

Length-Based Stock Assessment Of A Species Complex Caught In Deepwater Demersal Fisheries Targeting Snappers In Indonesia Fishery Management Area WPP 718

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1 Introduction

This report presents a length-based assessment of the multi-species deep slope fisheries targeting mostly snappers, groupers and emperors, at depths ranging from 50 to 500 meters, in fisheries management area (WPP) 718 in the Arafura Sea in Eastern Indonesia. Drop line and long line vessels fish in this area together with a number of gear types including bottom trawls that go under the name of "fish net". Bottom long line vessels fish on the shelf area as well as on the top of the slopes that drop to deeper waters. Drop liners fish those slopes also to greater depths into the Banda Sea and the Timor Trough. All gear types operate on both sides of the borders of WPP 718 and neighboring areas, where habitats are continuous, often within a single fishing trip.

Various fleets are operating in this region, including long liners and drop liners from Bali (often via Kupang), long liners from Probolinggo, Timika, Dobo, Tual, drop liners from Kema (North Sulawesi) and Ternate and trawlers from Sorong, Timika and other bases. Vessels from most of these fleets contributed data to the current assessment. Some vessels are based and operate entirely within the WPP 718 boundaries others like some of the medium scale drop liners from Kema and Ternate make trips to locations up to 1,000 kilometers away from their home ports. Various staging points and logistical hubs are used by the Arafura Sea fishing fleets, throughout Eastern Indonesia.

The drop line fishery is an active vertical hook and line fishery operating at depths from 50 to 500 meters, whereas long lines are set horizontally along the bottom at depths ranging from 50 to 150 meters. Trawlers work mostly over the shallower parts of the shelf area at depths overlapping mostly with the long line fisheries.

This report analyzes length frequencies of the 50 most abundant species of fish in the combined drop and long line catches in WPP 573. For a complete overview of the species composition please refer to the ID guide prepared for these fisheries¹. For further background on species life history characteristics, and data-poor length based assessment methods, as applied in this report, please refer to the assessment guide that was separately prepared for these fisheries².

Data in this report represent complete catches by small and medium scale vessels from the above described fleets. All fish captured were photographed on measuring boards by fishing crew participating in our Crew Operated Data Recording System or CODRS. Images were analyzed by project staff to generate the species specific length frequency distributions of the catches which served as the input for our length based assessment of this fishery.

¹http://72.14.187.103:8080/ifish/pub/TNC_FishID.pdf

²<http://72.14.187.103:8080/ifish/pub/DeepSlopeSpeciesAssessmentTool.pdf>

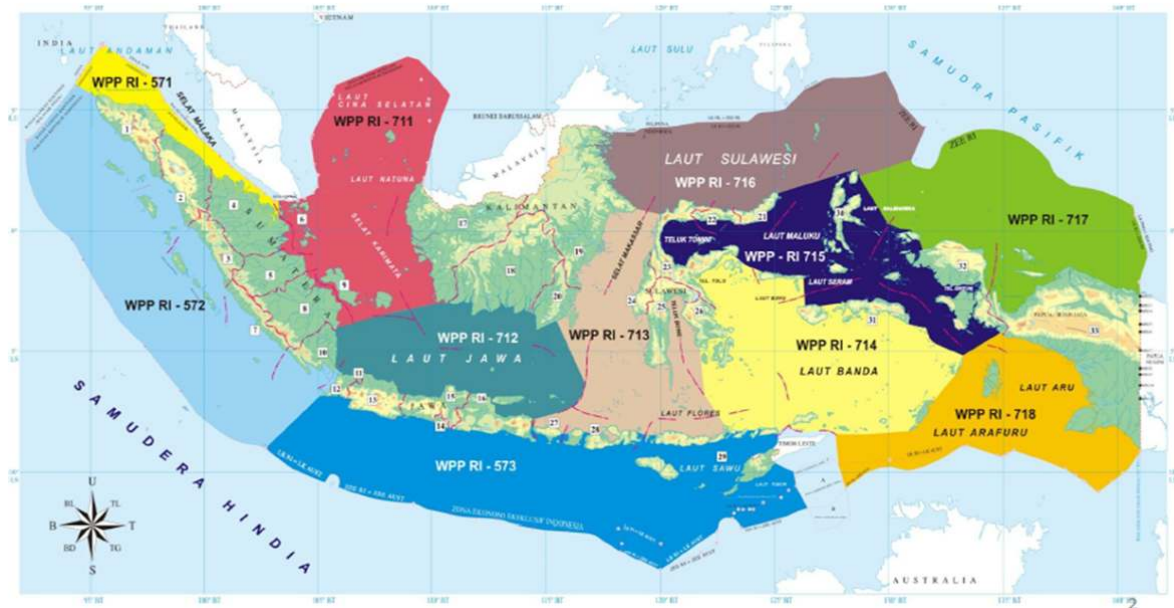


Figure 1.1: Fisheries Management Areas (WPP) in Indonesian marine waters.

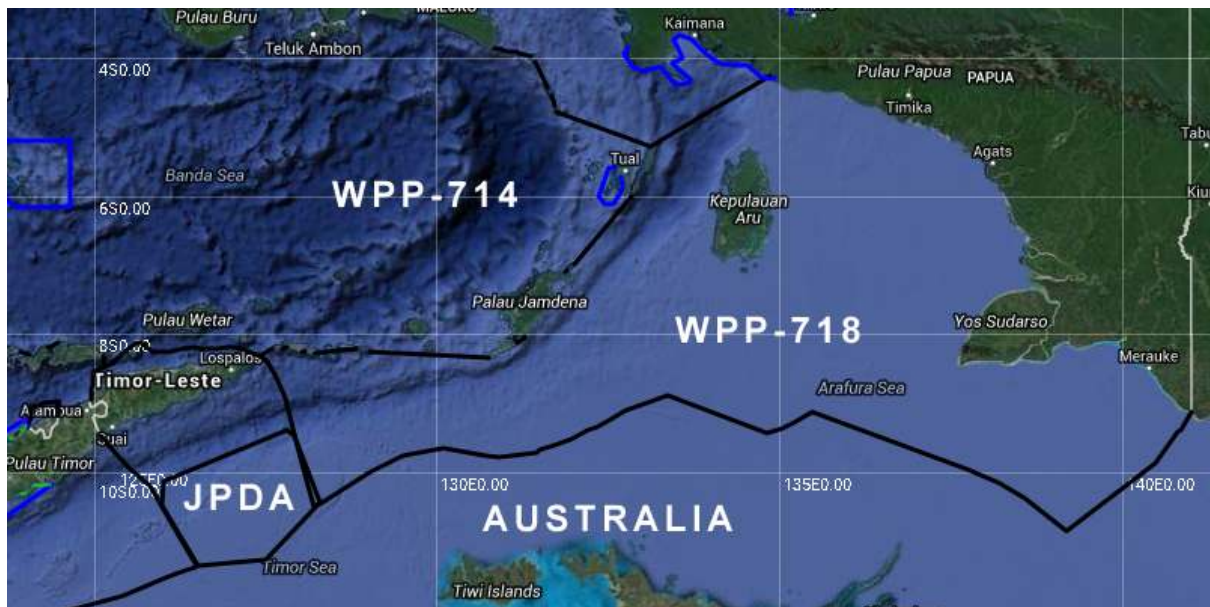


Figure 1.2: Bathymetric map of the Arafura Sea, WPP 718, with adjacent marine areas, in Eastern Indonesia. Black lines are WPP boundaries, blue lines are MPA boundaries.

Table 1.1: Length-weight relationships, trading limits and sample sizes in the most recent 365 days for the 50 most abundant species in deep water hook-and-line fisheries in WPP 718

#ID	Species	Reported	W = a L ^b		Length	Converted	Plotted	Sample Sizes
		Trade Limit Weight (g)	a	b	Type for a & b TL-FL-SL	Trade Limit L(cm)	Trade Limit TL(cm)	
1	<i>Aphareus rutilans</i>	1000	0.015	2.961	FL	42.20	49.61	319
2	<i>Aprion virescens</i>	1000	0.023	2.886	FL	40.49	45.90	82
4	<i>Etelis sp.</i>	500	0.022	2.950	FL	30.16	32.84	1000
5	<i>Etelis radius</i>	1000	0.056	2.689	FL	38.05	43.15	141
6	<i>Etelis coruscans</i>	500	0.041	2.758	FL	30.28	37.85	165
7	<i>Pristipomoides multidentis</i>	500	0.020	2.944	FL	31.18	34.92	7632
8	<i>Pristipomoides typus</i>	500	0.014	2.916	TL	36.16	36.16	1432
9	<i>Pristipomoides filamentosus</i>	500	0.038	2.796	FL	29.70	33.27	226
10	<i>Pristipomoides sieboldii</i>	300	0.022	2.942	FL	25.52	29.21	207
14	<i>Lutjanus bitaeniatus</i>	500	0.014	2.980	FL	33.61	34.18	80
15	<i>Lutjanus argentimaculatus</i>	500	0.034	2.792	FL	31.22	31.78	466
16	<i>Lutjanus bohar</i>	500	0.016	3.059	FL	29.70	31.31	149
17	<i>Lutjanus malabaricus</i>	500	0.009	3.137	FL	33.11	33.11	23340
18	<i>Lutjanus sebae</i>	500	0.009	3.208	FL	29.97	31.26	2370
19	<i>Lutjanus timorensis</i>	500	0.009	3.137	FL	33.11	33.34	273
20	<i>Lutjanus gibbus</i>	500	0.015	3.091	FL	28.87	31.09	92
21	<i>Lutjanus erythropterus</i>	500	0.024	2.870	FL	31.79	31.79	471
22	<i>Pinjalo lewisi</i>	300	0.014	2.970	FL	28.42	29.64	129
24	<i>Lutjanus johnii</i>	300	0.020	2.907	FL	27.28	28.49	566
25	<i>Lutjanus russelli</i>	300	0.020	2.907	FL	27.28	28.49	551
27	<i>Lutjanus vitta</i>	300	0.017	2.978	FL	26.72	27.64	272
34	<i>Paracaesio kusakarii</i>	500	0.011	3.135	FL	30.96	34.80	515
35	<i>Paracaesio stonei</i>	500	0.024	2.960	FL	28.78	32.35	104
39	<i>Cephalopholis sonnerati</i>	300	0.015	3.058	TL	25.78	25.78	73
41	<i>Epinephelus latifasciatus</i>	1500	0.010	3.088	TL	48.00	48.00	430
45	<i>Epinephelus areolatus</i>	300	0.011	3.048	FL	28.18	28.77	853
46	<i>Epinephelus bleekeri</i>	300	0.009	3.126	TL	28.09	28.09	242
50	<i>Epinephelus coioides</i>	1500	0.011	3.084	TL	46.94	46.94	334
53	<i>Epinephelus heniochus</i>	300	0.061	2.624	FL	25.59	25.59	70
54	<i>Epinephelus stictus</i>	300	0.027	3.000	SL	22.37	28.24	194
56	<i>Epinephelus multinotatus</i>	1500	0.017	2.964	TL	46.90	46.90	69
58	<i>Epinephelus amblycephalus</i>	1500	0.012	3.057	TL	45.99	45.99	304
64	<i>Lethrinus lentjan</i>	300	0.020	2.986	FL	25.16	26.35	670
65	<i>Lethrinus laticaudis</i>	300	0.020	2.986	FL	25.16	26.35	6656
66	<i>Lethrinus nebulosus</i>	500	0.019	2.996	FL	30.03	32.14	486
67	<i>Lethrinus olivaceus</i>	300	0.029	2.851	FL	25.49	27.50	226
70	<i>Wattsia mossambica</i>	500	0.040	2.824	FL	28.21	29.34	251
71	<i>Gymnocranius grandoculis</i>	500	0.032	2.885	FL	28.43	30.53	406
73	<i>Carangoides coeruleopinnatus</i>	1000	0.032	2.902	FL	35.35	40.12	187
76	<i>Carangoides chrysophrys</i>	1000	0.027	2.902	FL	37.68	42.12	291
78	<i>Caranx bucculentus</i>	2000	0.023	3.033	FL	42.51	49.83	459
81	<i>Caranx sexfasciatus</i>	2000	0.032	2.930	FL	43.43	49.51	104
82	<i>Caranx tille</i>	2000	0.032	2.930	FL	43.43	49.51	252
86	<i>Erythrocles schlegelii</i>	1500	0.011	3.040	FL	48.55	53.60	160
87	<i>Argyrops spinifer</i>	300	0.055	2.670	TL	25.11	27.87	132
89	<i>Glaucosoma buergeri</i>	500	0.045	2.725	TL	30.40	30.40	180
90	<i>Diagramma labiosum</i>	500	0.014	2.988	FL	33.08	36.71	682
92	<i>Pomadasys kaakan</i>	300	0.017	2.985	TL	26.57	26.57	454
99	<i>Rachycentron canadum</i>	1000	0.003	3.088	FL	60.67	67.28	93
100	<i>Protonibea diacanthus</i>	1000	0.013	2.940	TL	46.15	46.15	195

Table 1.2: Sample sizes over the period 2015 to 2023 for the 50 most abundant species in offshore demersal fisheries targeting snappers, groupers and emperors in WPP 718. Ranked by abundance in the most recent 365 days of catches

Rank	#ID	Species	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total	%	Cum %
1	17	<i>Lutjanus malabaricus</i>	26	12155	31895	1045	0	0	0	0	0	45121	33.58	33.58
2	7	<i>Pristipomoides multidens</i>	82	8678	8763	1419	0	0	0	0	0	18942	14.10	47.67
3	65	<i>Lethrinus laticaudis</i>	0	2435	9053	286	0	0	0	0	0	11774	8.76	56.43
4	18	<i>Lutjanus sebae</i>	43	1666	2918	178	0	0	0	0	0	4805	3.58	60.01
5	8	<i>Pristipomoides typus</i>	85	4323	1777	47	0	0	0	0	0	6232	4.64	64.65
6	4	<i>Etelis</i> sp.	0	1120	965	157	0	0	0	0	0	2242	1.67	66.31
7	45	<i>Epinephelus areolatus</i>	55	1771	835	139	0	0	0	0	0	2800	2.08	68.40
8	90	<i>Diagramma labiosum</i>	10	325	808	35	0	0	0	0	0	1178	0.88	69.27
9	64	<i>Lethrinus lentjan</i>	0	419	887	17	0	0	0	0	0	1323	0.98	70.26
10	24	<i>Lutjanus johnii</i>	0	379	1004	13	0	0	0	0	0	1396	1.04	71.30
11	25	<i>Lutjanus russelli</i>	0	204	590	66	0	0	0	0	0	860	0.64	71.94
12	34	<i>Paracaesio kusakarii</i>	0	1375	286	284	0	0	0	0	0	1945	1.45	73.38
13	66	<i>Lethrinus nebulosus</i>	0	10	522	1	0	0	0	0	0	533	0.40	73.78
14	21	<i>Lutjanus erythropterus</i>	0	965	690	2	0	0	0	0	0	1657	1.23	75.01
15	15	<i>Lutjanus argentimaculatus</i>	0	260	675	7	0	0	0	0	0	942	0.70	75.72
16	78	<i>Caranx bucculentus</i>	0	265	2470	282	0	0	0	0	0	3017	2.25	77.96
17	92	<i>Pomadasys kaakan</i>	0	2499	2023	5	0	0	0	0	0	4527	3.37	81.33
18	41	<i>Epinephelus latifasciatus</i>	0	74	265	226	0	0	0	0	0	565	0.42	81.75
19	71	<i>Gymnocranius grandoculis</i>	2	406	585	23	0	0	0	0	0	1016	0.76	82.51
20	50	<i>Epinephelus coioides</i>	0	453	474	36	0	0	0	0	0	963	0.72	83.22
21	1	<i>Aphareus rutilans</i>	0	1120	221	115	0	0	0	0	0	1456	1.08	84.31
22	58	<i>Epinephelus amblycephalus</i>	0	85	503	48	0	0	0	0	0	636	0.47	84.78
23	76	<i>Carangoides chrysophrys</i>	4	240	679	115	0	0	0	0	0	1038	0.77	85.55
24	19	<i>Lutjanus timorensis</i>	13	494	334	104	0	0	0	0	0	945	0.70	86.25
25	27	<i>Lutjanus vitta</i>	55	559	370	39	0	0	0	0	0	1023	0.76	87.02
26	82	<i>Caranx tille</i>	0	33	155	157	0	0	0	0	0	345	0.26	87.27
27	70	<i>Wattsia mossambica</i>	0	627	84	197	0	0	0	0	0	908	0.68	87.95
28	46	<i>Epinephelus bleekeri</i>	0	96	292	15	0	0	0	0	0	403	0.30	88.25
29	9	<i>Pristipomoides filamentosus</i>	1	1799	259	41	0	0	0	0	0	2100	1.56	89.81
30	67	<i>Lethrinus olivaceus</i>	0	62	229	2	0	0	0	0	0	293	0.22	90.03
31	10	<i>Pristipomoides sieboldii</i>	0	234	49	169	0	0	0	0	0	452	0.34	90.36
32	100	<i>Protonibea diacanthus</i>	0	369	1238	104	0	0	0	0	0	1711	1.27	91.64
33	54	<i>Epinephelus stictus</i>	0	144	6	192	0	0	0	0	0	342	0.25	91.89
34	73	<i>Carangoides coeruleopinnatus</i>	0	63	419	160	0	0	0	0	0	642	0.48	92.37
35	89	<i>Glaucosoma buergeri</i>	0	147	106	88	0	0	0	0	0	341	0.25	92.62
36	6	<i>Etelis coruscans</i>	0	445	228	25	0	0	0	0	0	698	0.52	93.14
37	86	<i>Erythrocles schlegelii</i>	0	435	111	93	0	0	0	0	0	639	0.48	93.62
38	16	<i>Lutjanus bohar</i>	8	185	153	1	0	0	0	0	0	347	0.26	93.88
39	5	<i>Etelis radius</i>	0	427	103	58	0	0	0	0	0	588	0.44	94.31
40	87	<i>Argyrops spinifer</i>	0	113	111	42	0	0	0	0	0	266	0.20	94.51
41	22	<i>Pinjalo lewisi</i>	0	177	123	35	0	0	0	0	0	335	0.25	94.76
42	35	<i>Paracaesio stonei</i>	0	486	124	15	0	0	0	0	0	625	0.47	95.23
43	81	<i>Caranx sexfasciatus</i>	0	52	173	8	0	0	0	0	0	233	0.17	95.40
44	99	<i>Rachycentron canadum</i>	0	81	132	49	0	0	0	0	0	262	0.19	95.60
45	20	<i>Lutjanus gibbus</i>	0	121	95	0	0	0	0	0	0	216	0.16	95.76
46	2	<i>Aprion virescens</i>	1	70	83	0	0	0	0	0	0	154	0.11	95.87
47	14	<i>Lutjanus bitaeniatus</i>	0	50	173	6	0	0	0	0	0	229	0.17	96.04
48	39	<i>Cephalopholis sonnerati</i>	2	142	84	0	0	0	0	0	0	228	0.17	96.21
49	53	<i>Epinephelus heniochus</i>	1	38	74	1	0	0	0	0	0	114	0.08	96.30
50	56	<i>Epinephelus multinotatus</i>	4	136	76	0	0	0	0	0	0	216	0.16	96.46

2 Materials and methods for data collection, analysis and reporting

2.1 SPOT Trace vessel tracking

Fishing grounds are determined by placing Spot Trace units on all fishing boats participating in this program (Figure 2.3). When in motion, Spot Trace units automatically report an hourly location, and when at rest for more than 24 hours, they relay daily status reports. Location and status report messages are automatically recorded in I-Fish Community, an online database running PostgreSQL with a user interface programmed in Java and analysis and reporting procedures in R and Latex.

2.2 Crew Operated Data Recording System

Data on species and size distributions of complete catches are needed for accurate length based stock assessments. Such data on individual fishing trips are collected via Crew Operated Data Recording Systems or CODRS. This catch data is geo-referenced as the CODRS works in tandem with the Spot Trace vessel tracking system. Crews of fishing vessels are contracted to take images on project-supplied digital cameras of all fish in the catch, positioned over measuring boards (Figure 2.1). This procedure takes place when batches of fish are taken from chiller boxes on deck, before they are packed on ice in the hold. The crew photographs all the fish in this manner and at the end of the trip hands in the storage chip from the camera to a project staff who analyzes the images back at the fisheries station. Analysis of the images includes ID of the species and reading of the length of the fish as displayed on the measuring board (Figure 2.2). Double checking with owner and trader data on total catches, and comparison with weights as calculated from fish lengths, ensures that we are capturing length frequencies of the total catch. It is essential to ensure that no species or size classes are missing before analysis. If estimated catch weight from CODRS data differs more than 30% from estimates based on boat owner data, the catch is not included in the length based assessment, to remove any chance of bias.

2.3 Catch per Unit of Effort from CODRS and SPOT Data

CODRS and SPOT data can be used to calculate Catch per Unit Effort (CpUE) as catch (100 target species) in KG per Gross Tonnage (GT) of fishing vessels on all active fishing days. The CODRS images from a specific fishing vessel for a specific fishing day represent the catch of that vessel on that day. The size frequency of the catch of each target species can be converted into weight by using the length weight relationship. This catch is divided by the total Gross Tonnage (GT) for the fishing vessel, and plotted as a CpUE value for the fishing date (Figure 2.4). Multiple values from multiple vessels can result on a single fishing day, where other days may be without any fishing activity. A linear regression of plotted CpUE values over time shows the trend and the current mean value for CpUE in the fishery. This can separately be looked at for different gear types, boat size categories and or fisheries management areas (using SPOT data to indicate fishing ground). CpUE averages by vessel category can be used to estimate catch, through multiplication with the GT of the fishing vessels in the fleet. With good information on fleet size this can then be used to estimate total catch per annum.



Figure 2.1: Fishing crew preparing fish on a measuring board.



Figure 2.2: Fish photographed by fishing crew on board as part of CODRS.

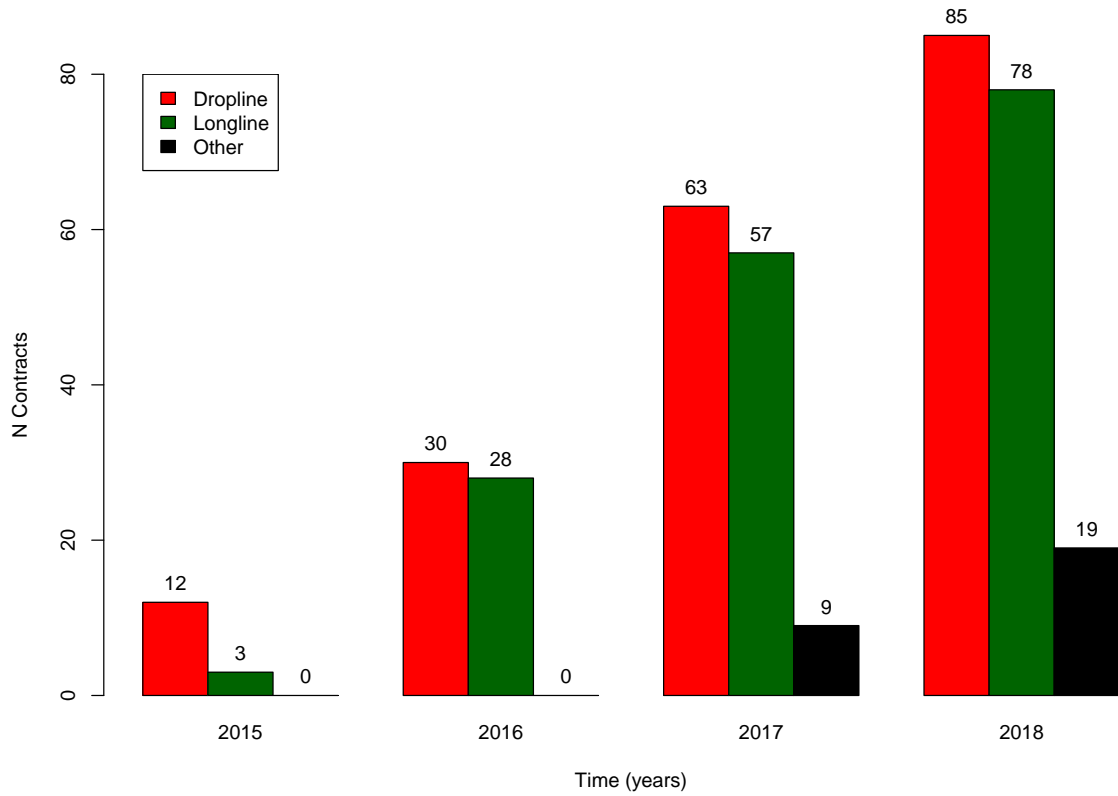


Figure 2.3: Number of CODRS contractors by gear type actively fishing in Indonesian waters.

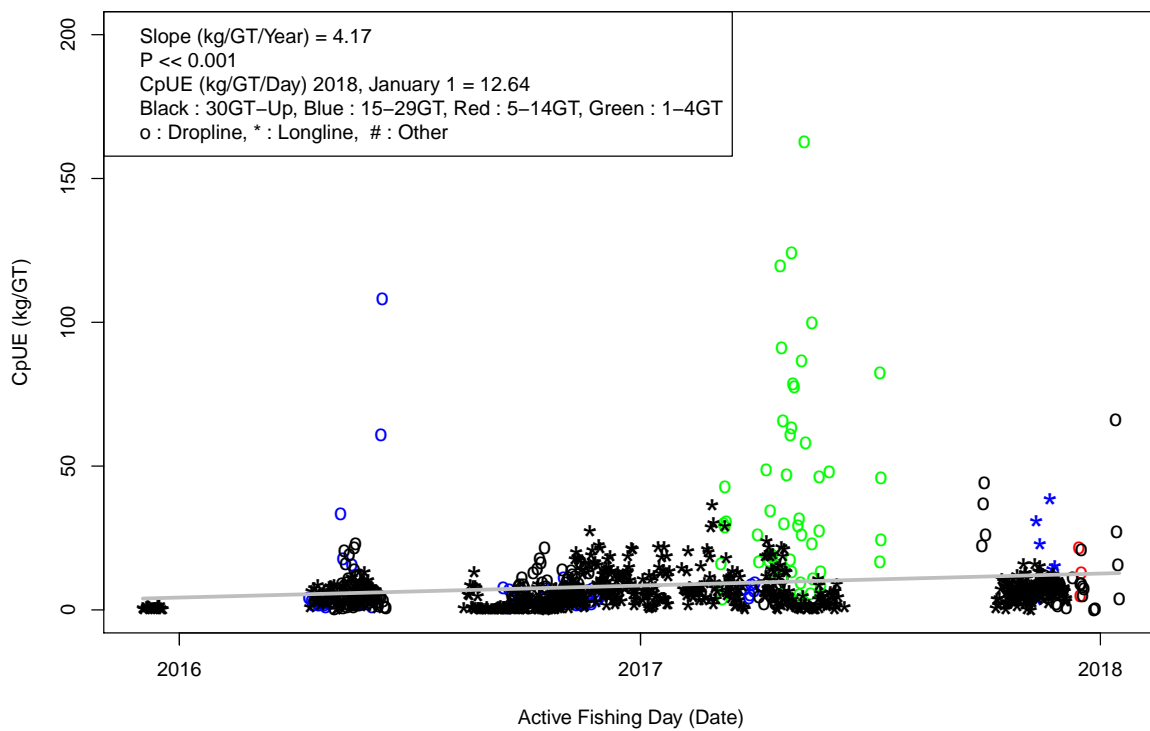


Figure 2.4: Catch per Unit of Effort in WPP 718.

2.4 I-Fish Community

I-Fish Community only stores data that are relevant to fisheries management, whereas data on processed volume and sales, from the Smart Weighing and Measuring System, remain on servers at processing companies. Access to the I-Fish Community database is controlled by user name and password. I-Fish Community has different layers of privacy, which is contingent on the user's role in the supply chain. For instance, boat owners may view exact location of their boats, but not of the boats of other owners.

I-Fish Community has an automatic length-frequency distribution reporting system for length-based assessment of the fishery by species. The database generates length frequency distribution graphs for each species, together with life history parameters including length at maturity (L_{mat}), optimum harvest size (L_{opt}), asymptotic length- (L_{inf}), and maximum total length (L_{max}), as well as size limits used in the trade. These "trade limit" lengths are derived from general buying behavior (minimal weight) of processing companies. The weights are converted into lengths by using species-specific length- weight relationships.

Each length frequency distribution is accompanied by an automated length-based assessment on current status of the fishery by species. Any I-Fish Community user can access these graphs and the conclusions from the assessments. The report produces an assessment for the 50 most abundant species in the fishery, based on complete catches from the most recent complete calendar year (to ensure full year data sets). The graphs show the position of the catch length frequency distributions relative to various life history parameter values and trading limits for each species. Relative abundance of specific size groups is plotted for all years for which data are available, to indicate trends in status by species.

Immature fish, small mature fish, large mature fish, and a subset of large mature fish, namely "mega-spawners", which are fish larger than 1.1 times the optimum harvest size (Froese 2004), make up the specific size groups used in our length based assessment. For all fish of each species in the catch, the percentage in each category is calculated for further use in the length based assessment. These percentages are calculated and presented as the first step in the length based assessment as follows: $W\%$ is immature (smaller than the length at maturity), $X\%$ is small matures (at or above size at maturity but smaller than the optimum harvest size), and $Y\%$ is large mature fish (at or above optimum harvest size). The percentage of mega-spawners is $Z\%$.

The automated assessment comprises of six elements from the catch length frequencies. These elements all work with length based indicators of various kinds to draw conclusions from species specific length frequencies in the catch.

1. Minimum size as traded compared to length and maturity.

We use a comparison between the trade limit (minimum size accepted by the trade) and the size at maturity as an indicator for incentives from the trade for either unsustainable targeting of juveniles or for more sustainable targeting of mature fish that have spawned at least once. We consider a trade limit at 10% below or above the length at maturity to be significantly different from the length at maturity and we consider trade limits to provide incentives for targeting of specific sizes of fish through price differentiation.

IF "TradeLimit" is lower than $0.9 * L\text{-mat}$ THEN:

"The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high."

ELSE, IF "TradeLimit" is greater than or equal to $0.9 * L\text{-mat}$ AND "TradeLimit" is lower than or equal to $1.1 * L\text{-mat}$ THEN:

"The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium."

ELSE, IF "TradeLimit" is greater than $1.1 * L\text{-mat}$ THEN:

"The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low."

2. Proportion of immature fish in the catch.

With 0% immature fish in the catch as an ideal target (Froese, 2004), a target of 10% or less is considered a reasonable indicator for sustainable (or safe) harvesting (Fujita et al., 2012; Vasilakopoulos et al., 2011). Zhang et al. (2009) consider 20% immature fish in the catch as an indicator for a fishery at risk, in their approach to an ecosystem based fisheries assessment. Results from meta-analysis over multiple fisheries showed stock status over a range of stocks to fall below precautionary limits at 30% or more immature fish in the catch (Vasilakopoulos et al., 2011). The fishery is considered highly at risk when more than 50% of the fish in the catch are immature (Froese et al, 2016).

IF "% immature" is lower than or equal to 10% THEN:

"At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low."

ELSE, IF "% immature" is greater than 10% AND "% immature" is lower than or equal to 20% THEN:

"Between 10% and 20% of the fish in the catch are juveniles that have not yet reproduced. There is no immediate concern in terms of overfishing through over harvesting of juveniles, but the fishery needs to be monitored closely for any further increase in this indicator and incentives need to be geared towards targeting larger fish. Risk level is medium."

ELSE, IF "% immature" is greater than 20% AND "% immature" is lower than or equal to 30% THEN:

"Between 20% and 30% of the fish in the catch are specimens that have not yet reproduced. This is reason for concern in terms of potential overfishing through overharvesting of juveniles, if fishing pressure is high and percentages immature fish would further rise. Targeting larger fish and avoiding small fish in the catch will promote a sustainable fishery. Risk level is medium."

ELSE, IF "% immature" is greater than 30% AND "% immature" is lower than or equal to 50% THEN:

"Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through

overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high."

ELSE, IF "% immature" is greater than 50% THEN:

"The majority of the fish in the catch have not had a chance to reproduce before capture. This fishery is most likely overfished already if fishing mortality is high for all size classes in the population. An immediate shift away from targeting juvenile fish and a reduction in overall fishing pressure is essential to prevent collapse of the stock. Risk level is high."

3. Current exploitation level.

We use the current exploitation level expressed as the percentage of fish in the catch below the optimum harvest size as an indicator for fisheries status. We consider a proportion of 65% of the fish (i.e. the vast majority in numbers) in the catch below the optimum harvest size as an indicator for growth overfishing. We also consider a majority in the catch around or above the optimum harvest size as an indicator for minimizing the impact of fishing (Froese et al., 2016). This indicator will be achieved when less than 50% of the fish in the catch are below the optimum harvest size.

IF "% immature + % small mature" is greater than or equal to 65% THEN:

"The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high."

ELSE, IF "% immature + % small mature" is lower than or equal to 50% THEN:

"The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low."

ELSE, IF "% immature + % small mature" is greater than 50% AND "% immature + % small mature" is lower than 65% THEN:

"The bulk of the catch includes age groups that have just matured and are about to achieve their full growth potential. This indicates that the fishery is probably at least being fully exploited. Risk level is medium."

4. Proportion of mega spawners in the catch.

Mega spawners are fish larger than 1.1 times the optimum harvest size. We consider a proportion of 30% or more mega spawners in the catch to be a sign of a healthy population (Froese, 2004), whereas lower proportions are increasingly leading to concerns, with proportions below 20% indicating great risk to the fishery.

IF "% mega spawners" is greater than 30% THEN:

"More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low."

ELSE, IF "% mega spawners" is greater than 20% AND "% mega spawners" is lower than or equal to 30% THEN:

"The percentage of mega spawners is between 20 and 30%. There is no immediate reason for concern, though fishing pressure may be significantly reducing the percentage of mega-spawners, which may negatively affect the reproductive output of this population. Risk level is medium."

ELSE, IF "% mega spawners" is lower than or equal to 20%, THEN:

"Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high."

5. *Spawning Potential Ratio.*

As an indicator for Spawning Potential Ratio (SPR, Quinn and Deriso, 1999), we used the estimated spawning stock biomass divided by the spawning stock biomass of that population if it would have been pristine (see, for example, Meester et al 2001). We calculated SPR on a per-recruit basis from life-history parameters Z , F , K (von Bertalanffy), and L_{inf} . We estimated Z and F as explained above and K from L_{opt} , using the method presented in Froese and Binohlan 2000.

In a perfect world, fishery biologists would know what the appropriate SPR should be for every harvested stock based on the biology of that stock. Generally, however, not enough is known about managed stocks to be so precise. However, studies show that some stocks (depending on the species of fish) can maintain themselves if the spawning stock biomass per recruit can be kept at 20 to 35% (or more) of what it was in the un-fished stock. Lower values of SPR may lead to severe stock declines (Wallace and Fletcher, 2001). Froese et al. (2016) considered a total population biomass B of half the pristine population biomass B_0 to be the lower limit reference point for stock size, minimizing the impact of fishing. Using SPR and B/B_0 estimates from our own data set, this Froese et al. (2016) lower limit reference point correlates with an SPR of about 40%, not far from but slightly more conservative than the Wallace and Fletcher (2001) reference point. We chose an SPR of 40% as our reference point for low risk and after similar comparisons we consider and SPR between 25% and 40% to represent a medium risk situation.

IF "SPR" is lower than 25% THEN:

"SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high."

ELSE, IF "SPR" is greater than or equal to 25% AND "SPR" is lower than 40% THEN:

"SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium."

ELSE, IF "SPR" is greater than or equal to 40% THEN:

"SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low."

3 Fishing grounds and traceability

The Spot Trace data from the Timor Sea and Arafura Sea fisheries illustrate a classic “fishing the line” phenomenon. Many vessels fish right at the Indonesia - Australia border, on the edge of better managed fishing grounds on the Australian side, where fish densities are expected to be higher. Several drop line fishers were observed to operate illegally in Australian waters and some of these have been arrested by Australian patrol boats in 2015 (Figure 3.2). Some drop long line vessels have also been observed to illegally fish in Timor Leste waters (Figure 3.3). There is apparently little or no enforcement of fisheries regulations in Timor Leste waters and especially the Joint Petroleum Development Area or JPDA (an area in Timor Leste waters where a resource sharing agreement for seabed resources is in place with Australia) is frequently targeted illegally by Indonesian vessels.

The Spot Trace data from WPP 718 and surrounding areas show great mobility of the medium-scale snapper fishing boats, making trips to fishing grounds that are up to 1,000 kilometers away from home ports. Not only are these fleets highly mobile in terms of their trips from home port, they are also flexible in changing their base of operations from one port to another, changing from landing at home port to offloading on transport vessels in remote ports or offloading for air cargo at yet other places. Decision making on movements by boat owners can be based on fisheries technical issues such as catch rates or weather, but also on administrative issues like licensing or enforcement of rules against under-marking in Gross Tonnage. Most recently we are observing movement of staging ports but also of processing capacity to remote areas in the east such as the island of Penambulai, East of the Aru Islands. Fish is landed there and moved onto transport vessels bound for processing plants elsewhere in the country.

Therefore the fish that is processed in major processing centers like Probolinggo comes from a number of different fleets that operate throughout the waters of Eastern Indonesian, including also WPP 718. For the purpose of this report, all fishing trips, recorded (from SPOT data) within WPP 718, mostly from long line and drop line operations, were included in the analysis for this WPP. This includes fishing trips originating from outside the WPP, for example from Probolinggo, Bali or Kema.

Potential IUU issues include the operation by various fleets outside Indonesian waters in the East Timorese - Australian JPDA as well as in strictly Australian waters. Additional issues include the under marking of medium scale vessels to below 30GT, the licensing of the various fleets for various WPP and the operation of fleets from remote ports inside Marine Protected Areas throughout Eastern Indonesia. All this needs to be discussed with fishing boat captains and boat owners to prevent issues of supply line “pollution” with IUU fish from thee protected areas.

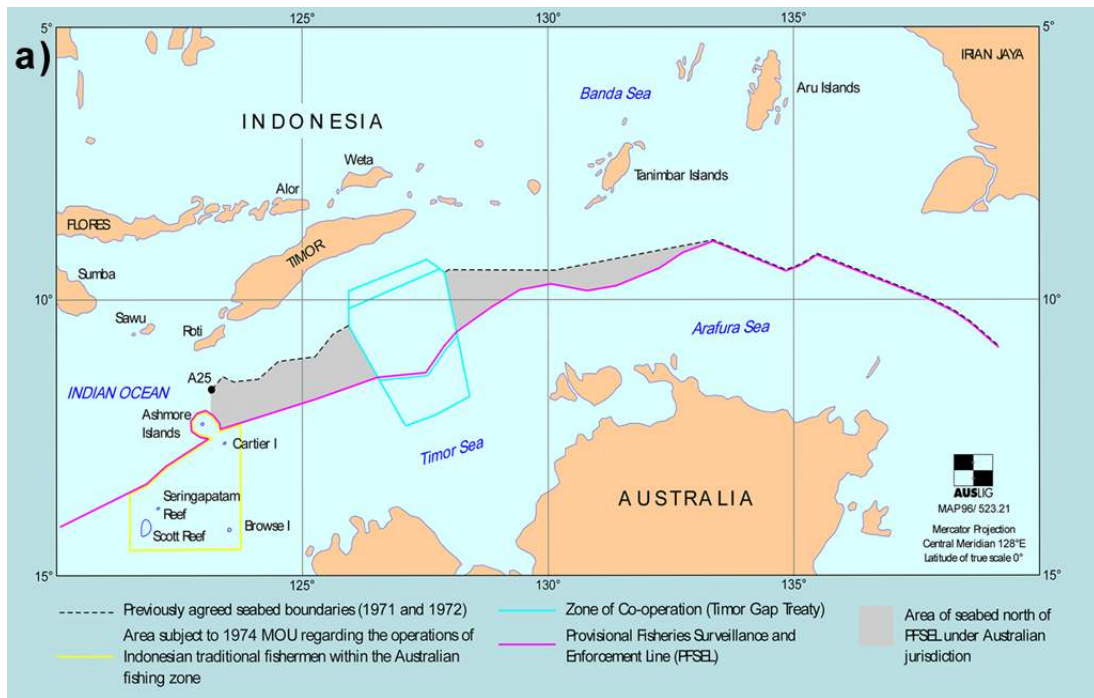
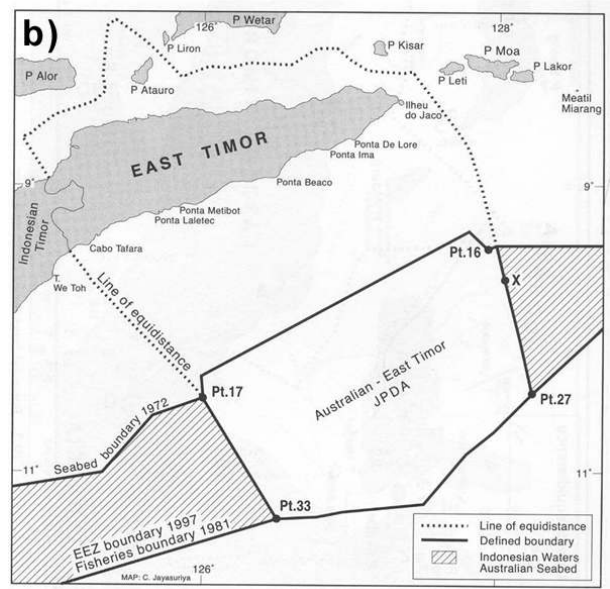


Figure 3.1: Timor Sea and Arafura Sea fishing grounds with current boundaries between Indonesia, East Timor and Australia.

a) The dotted line is the Australia - Indonesia Seabed Boundary. The pink line (PFSEL) is the Australia - Indonesia Fisheries Boundary. Indonesian vessels are allowed to fish in the grey area between the pink line and the dotted line, but not below the PFSEL. The light blue line is the boundary of the East Timor - Australia Zone of Cooperation which covers East Timorese fishing grounds where Indonesian fishing vessels are not allowed to fish. Australia does not enforce fisheries regulations here.

b) The shaded area between the Seabed Boundary and the Fisheries Boundary is Australian seabed, where fishers from Indonesia are allowed to fish. The Australian - East Timor zone of cooperation or Joint Petroleum Development Area (JPDA) is not open to fishers from Indonesia. East Timor is responsible for fishery surveillance within the JPDA.



[h]

Source: Australian Surveying & Land Information Group (AUSLIG) Commonwealth Department of Industry Science and Resources. MAP 96/523.21.1.

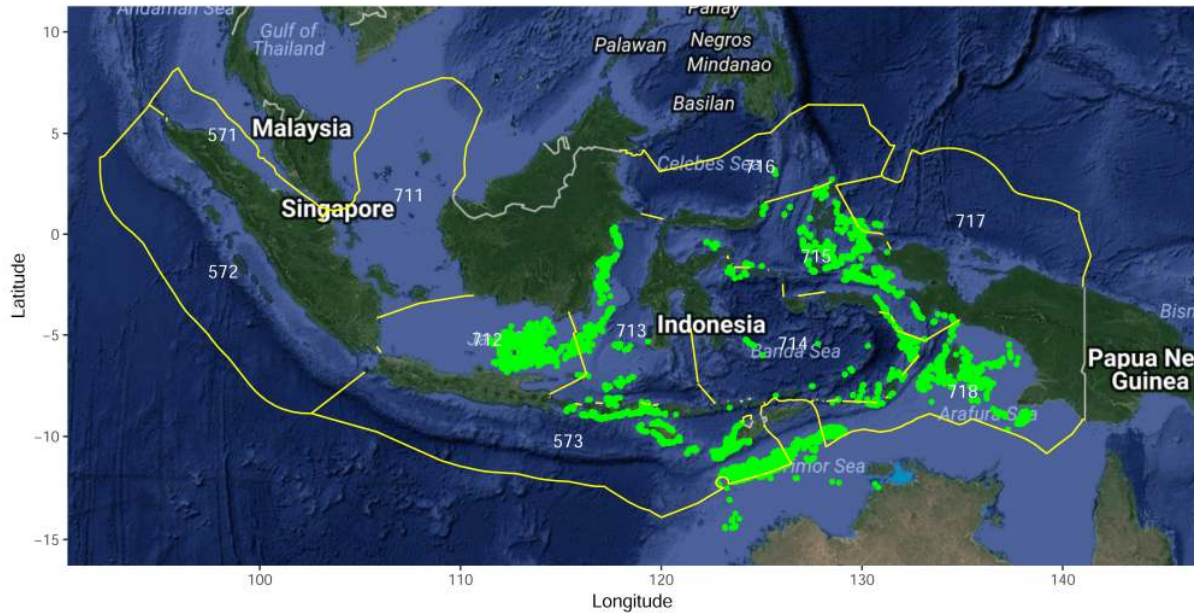


Figure 3.2: Fishing positions of dropliners participating in the CODRS program over the years 2014 - 2018, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

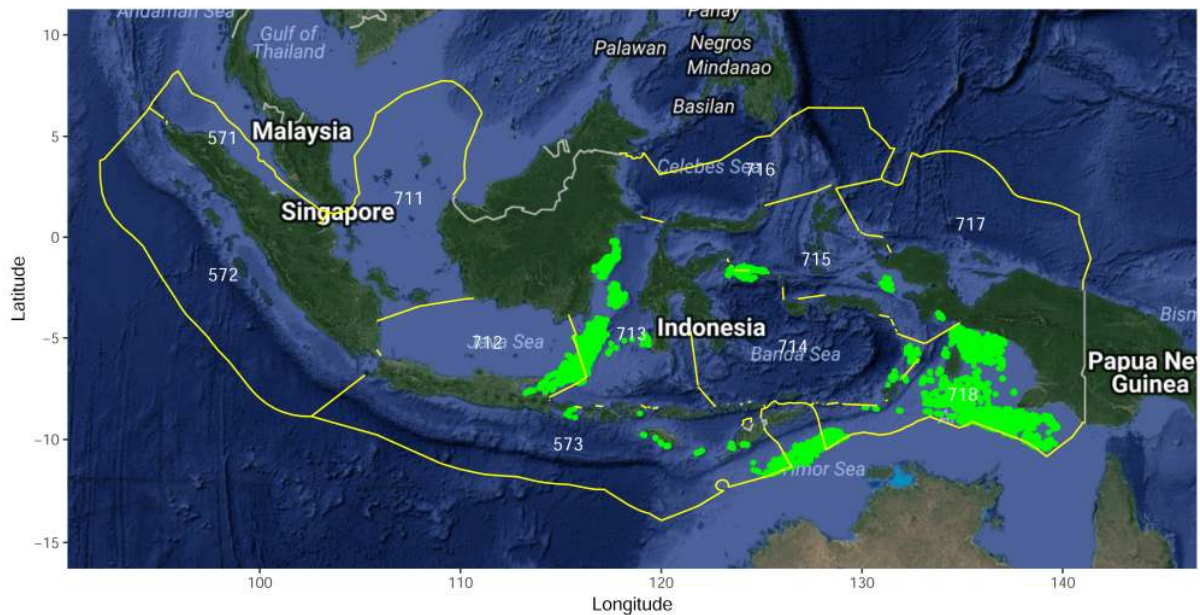


Figure 3.3: Fishing positions of longliners participating in the CODRS program over the years 2014 - 2018, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

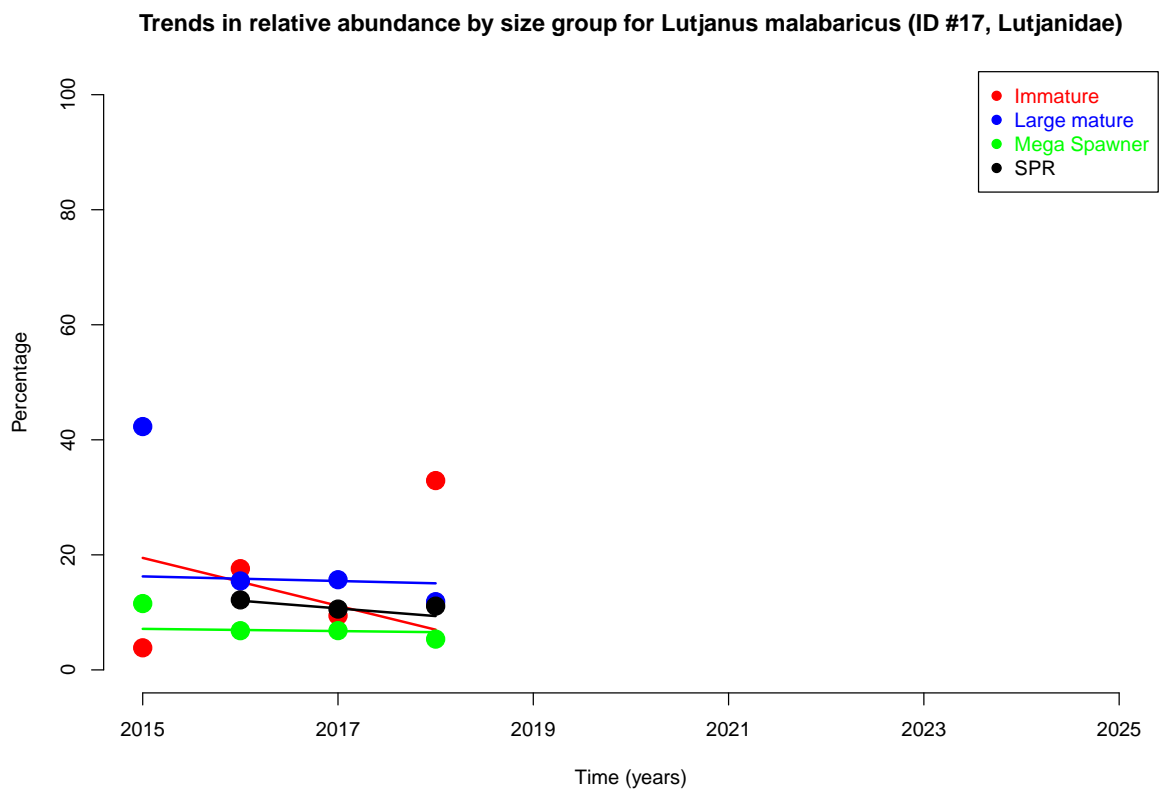
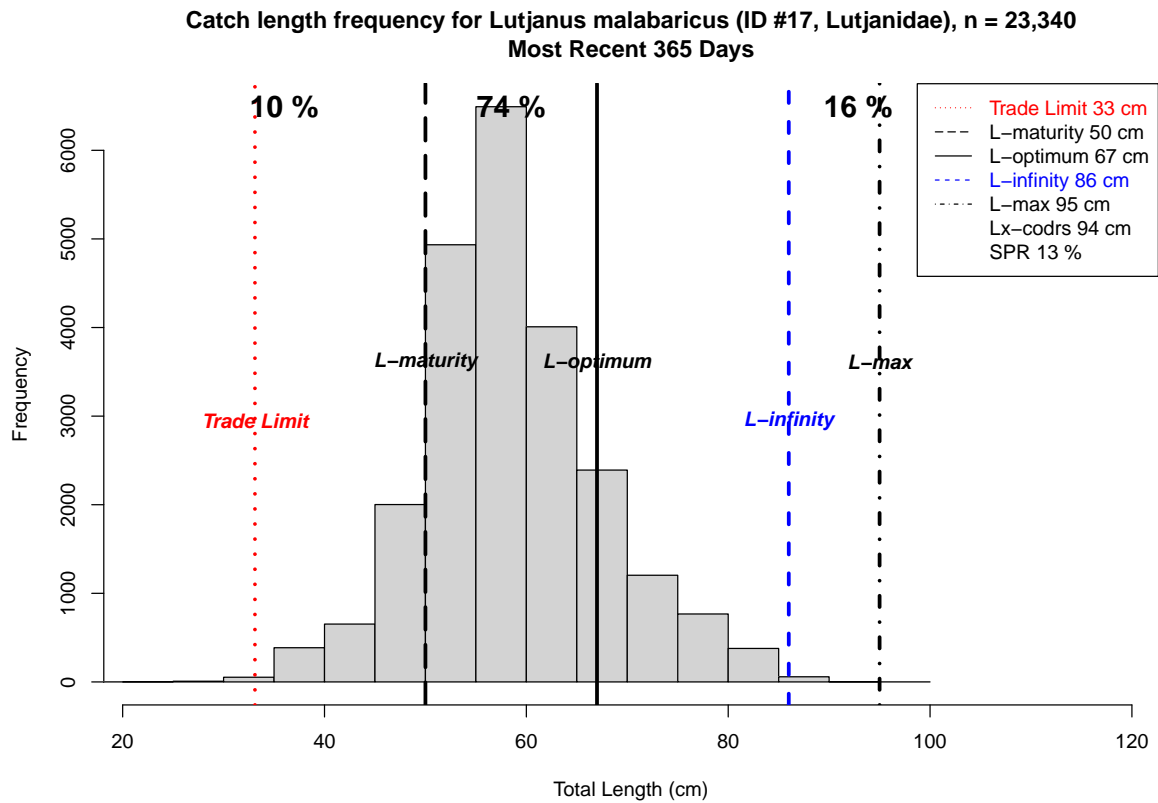


Figure 3.4: A typical snapper fishing boat from Probolinggo, Jawa Timur, operating in the Arafura Seas (WPP 718) and on nearby fishing grounds.



Figure 3.5: A typical snapper fishing boat from Dobo, Kepulauan Aru, Maluku, operating in the Arafura Seas (WPP 718) and on nearby fishing grounds.

4 Length-based assessments of Top 50 species in the most recent 365 days of Catches



The percentages of *Lutjanus malabaricus* (ID #17, Lutjanidae) in most recent 365 days, n=23,340
Immature (< 50cm): 10%
Small mature (\geq 50cm, < 67cm): 74%
Large mature (\geq 67cm): 16%
Mega spawner (\geq 73.7cm): 7% (subset of large mature fish)
Spawning Potential Ratio: 13 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

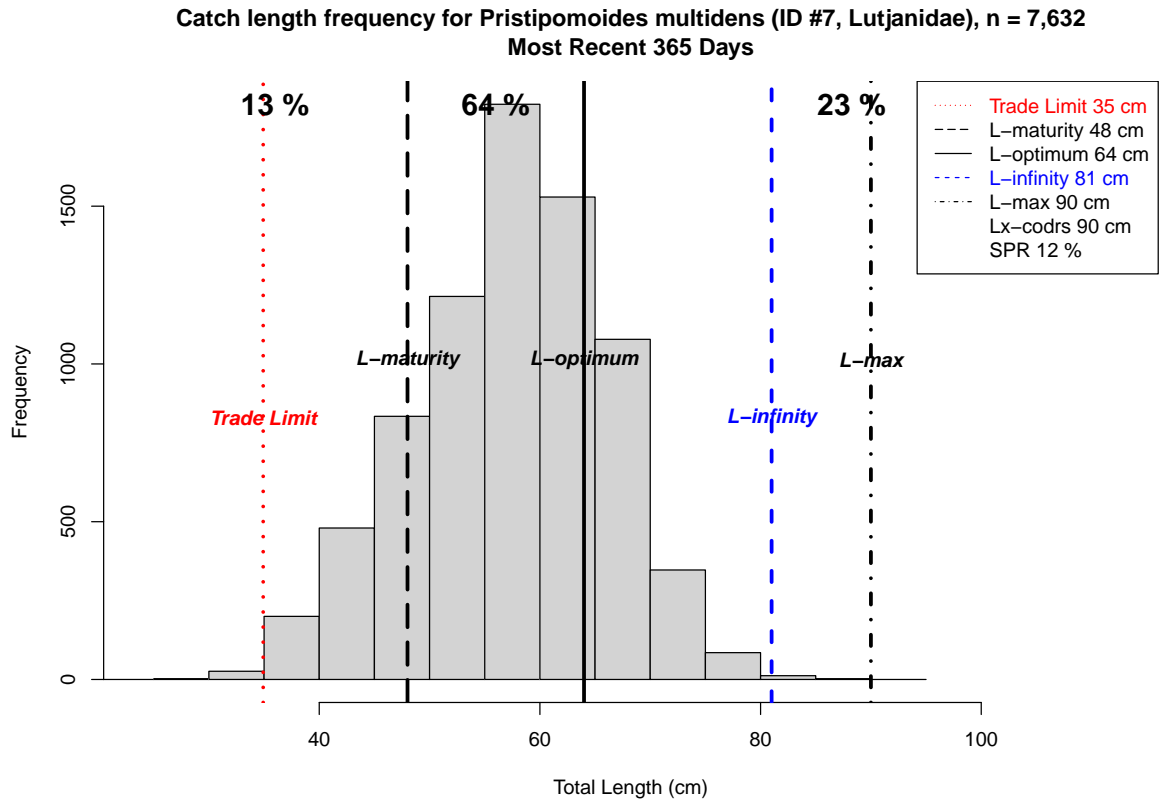
Trends in relative abundance by size group for *Lutjanus malabaricus* (ID #17, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.583

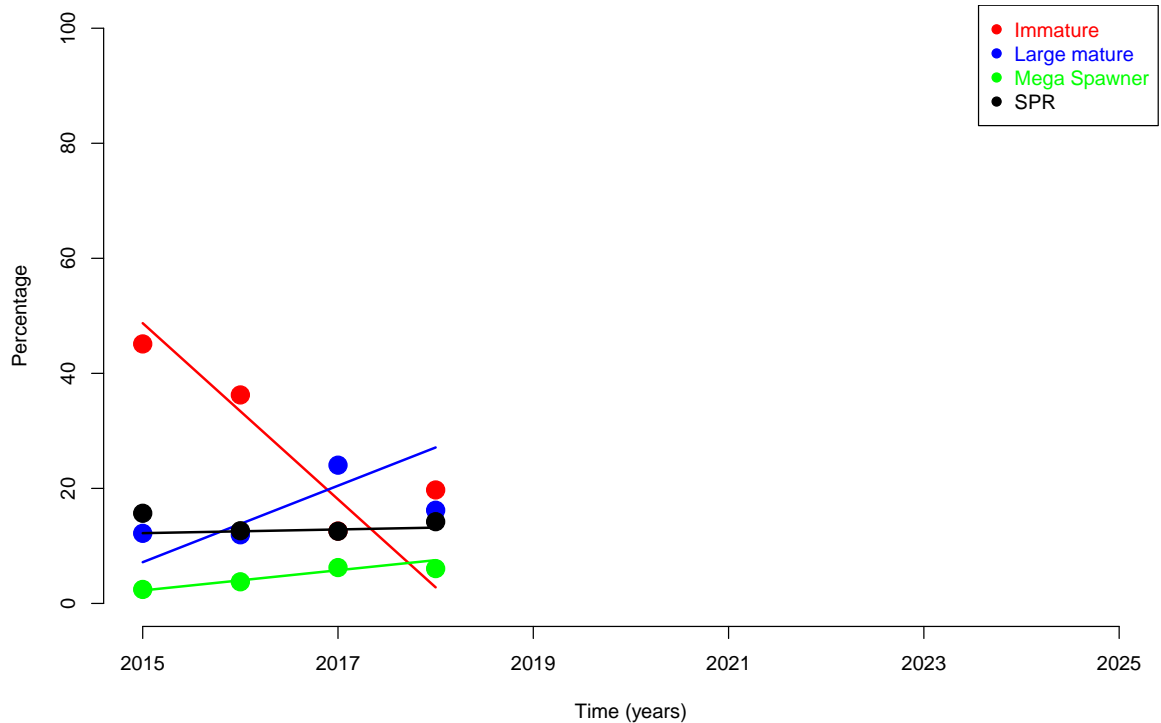
% Large Mature falling over recent years, situation deteriorating. P: 0.776

% Mega Spawner falling over recent years, situation deteriorating. P: 0.626

% SPR falling over recent years, situation deteriorating. P: 0.271



Trends in relative abundance by size group for *Pristipomoides multidens* (ID #7, Lutjanidae)



The percentages of *Pristipomoides multidens* (ID #7, Lutjanidae) in most recent 365 days, n=7,632
Immature (< 48cm): 13%
Small mature (\geq 48cm, < 64cm): 64%
Large mature (\geq 64cm): 23%
Mega spawner (\geq 70.4cm): 6% (subset of large mature fish)
Spawning Potential Ratio: 12 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 10% and 20% of the fish in the catch are juveniles that have not yet reproduced. There is no immediate concern in terms of overfishing through over harvesting of juveniles, but the fishery needs to be monitored closely for any further increase in this indicator and incentives need to be geared towards targeting larger fish. Risk level is medium.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

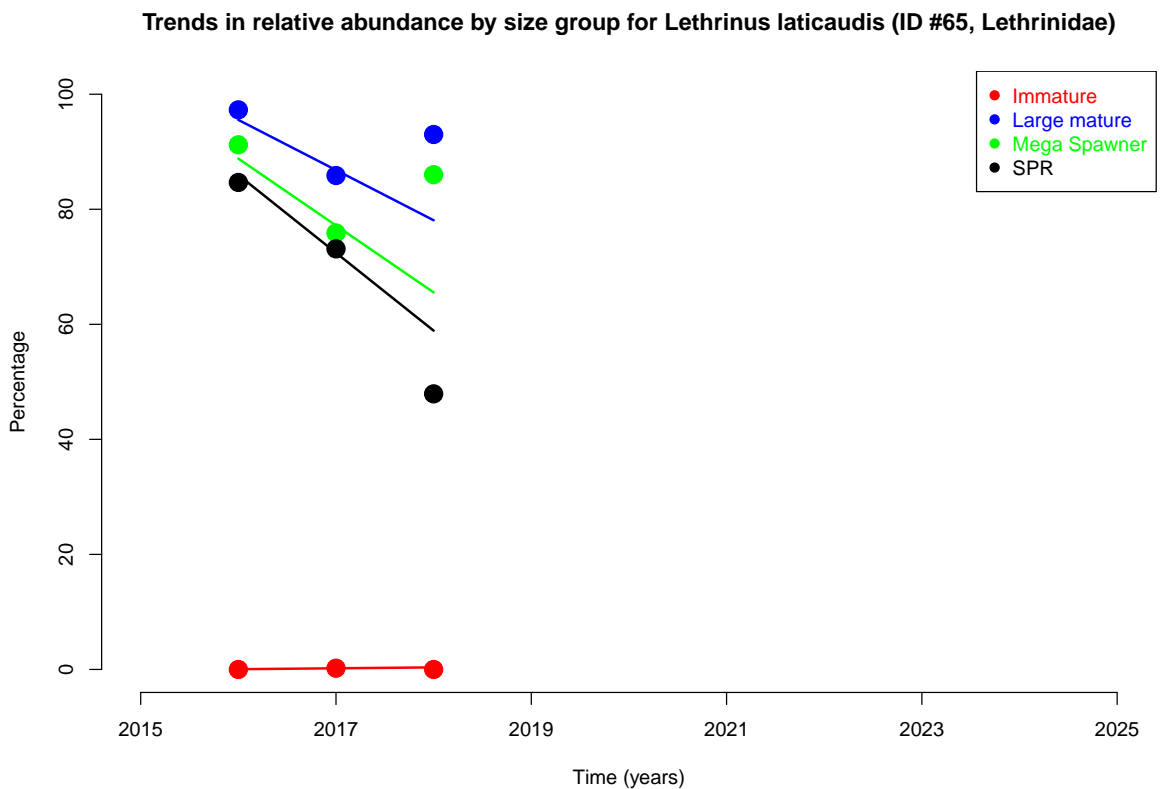
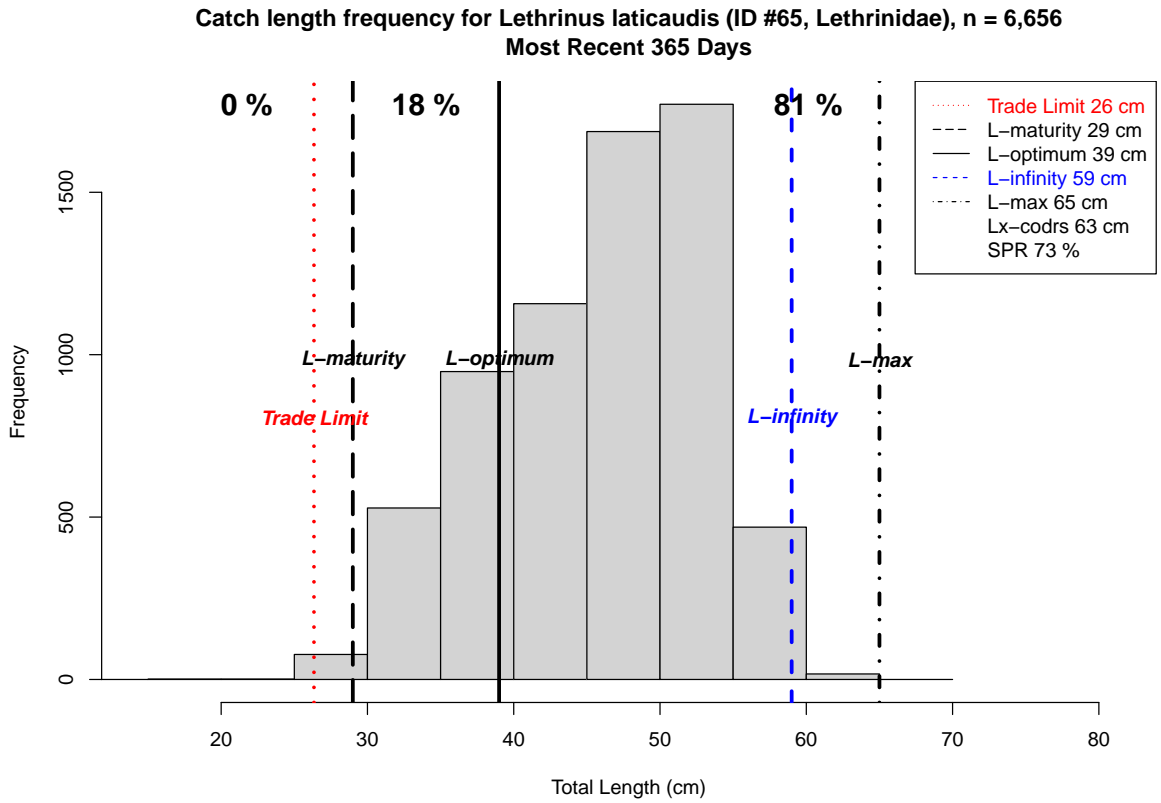
Trends in relative abundance by size group for *Pristipomoides multidens* (ID #7, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.162

% Large Mature rising over recent years, situation improving. P: 0.283

% Mega Spawner rising over recent years, situation improving. P: 0.101

% SPR rising over recent years, situation improving. P: 0.569



The percentages of *Lethrinus laticaudis* (ID #65, Lethrinidae) in most recent 365 days, n=6,656
Immature (< 29cm): 0%
Small mature (\geq 29cm, < 39cm): 18%
Large mature (\geq 39cm): 81%
Mega spawner (\geq 42.9cm): 70% (subset of large mature fish)
Spawning Potential Ratio: 73 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

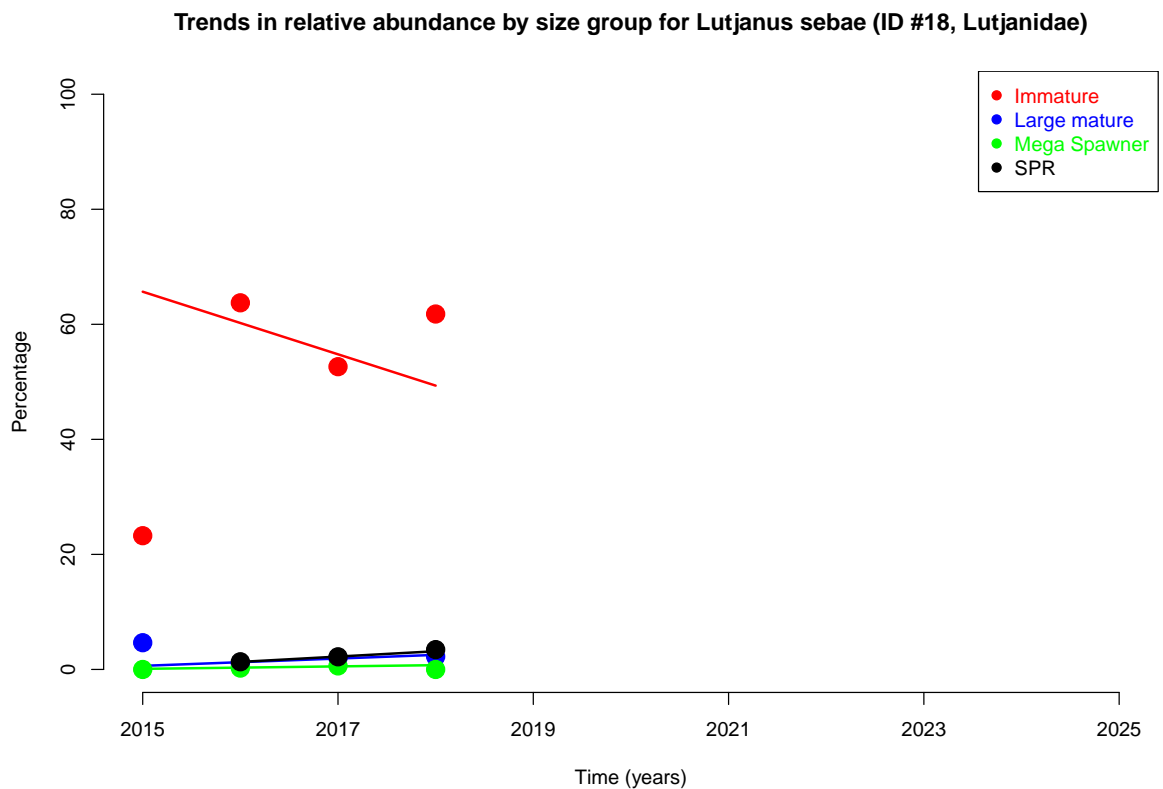
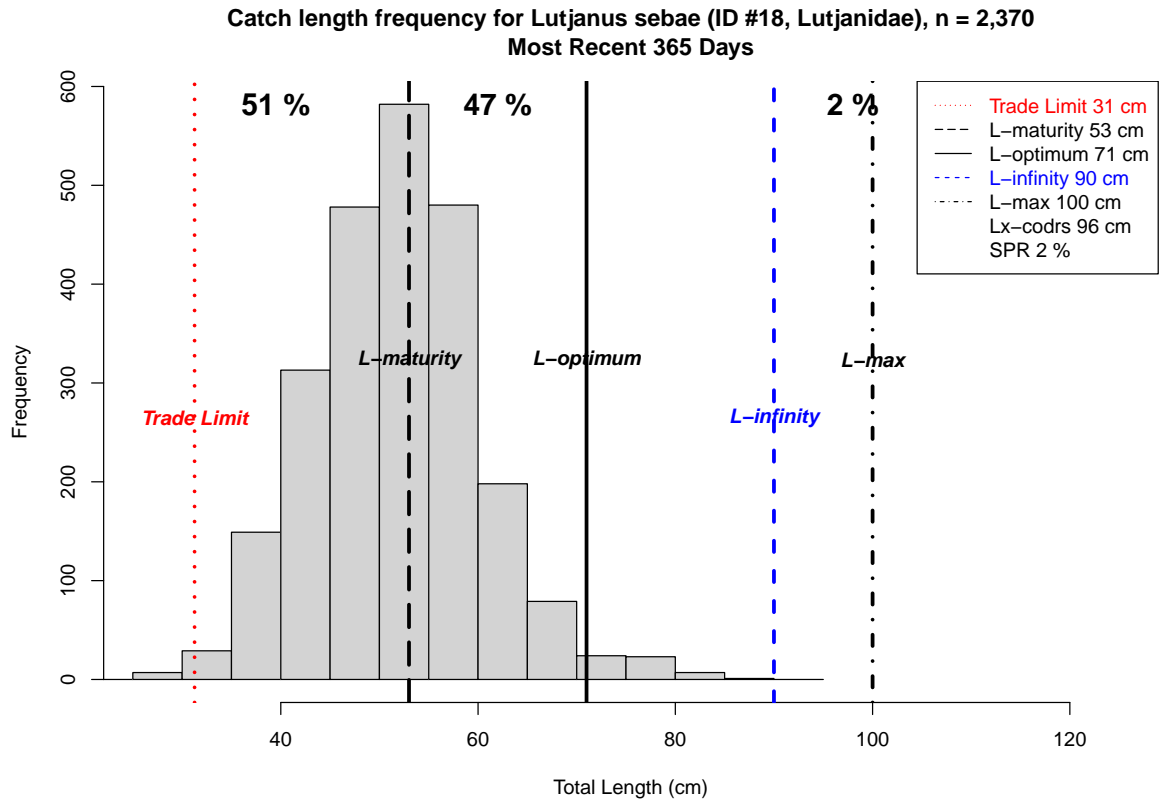
Trends in relative abundance by size group for *Lethrinus laticaudis* (ID #65, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.461

% Large Mature falling over recent years, situation deteriorating. P: 0.375

% Mega Spawner falling over recent years, situation deteriorating. P: 0.384

% SPR falling over recent years, situation deteriorating. P: 0.196



The percentages of *Lutjanus sebae* (ID #18, Lutjanidae) in most recent 365 days, n=2,370
Immature (< 53cm): 51%
Small mature (\geq 53cm, < 71cm): 47%
Large mature (\geq 71cm): 2%
Mega spawner (\geq 78.1cm): 1% (subset of large mature fish)
Spawning Potential Ratio: 2 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

The majority of the fish in the catch have not had a chance to reproduce before capture. This fishery is most likely overfished already if fishing mortality is high for all size classes in the population. An immediate shift away from targeting juvenile fish and a reduction in overall fishing pressure is essential to prevent collapse of the stock. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

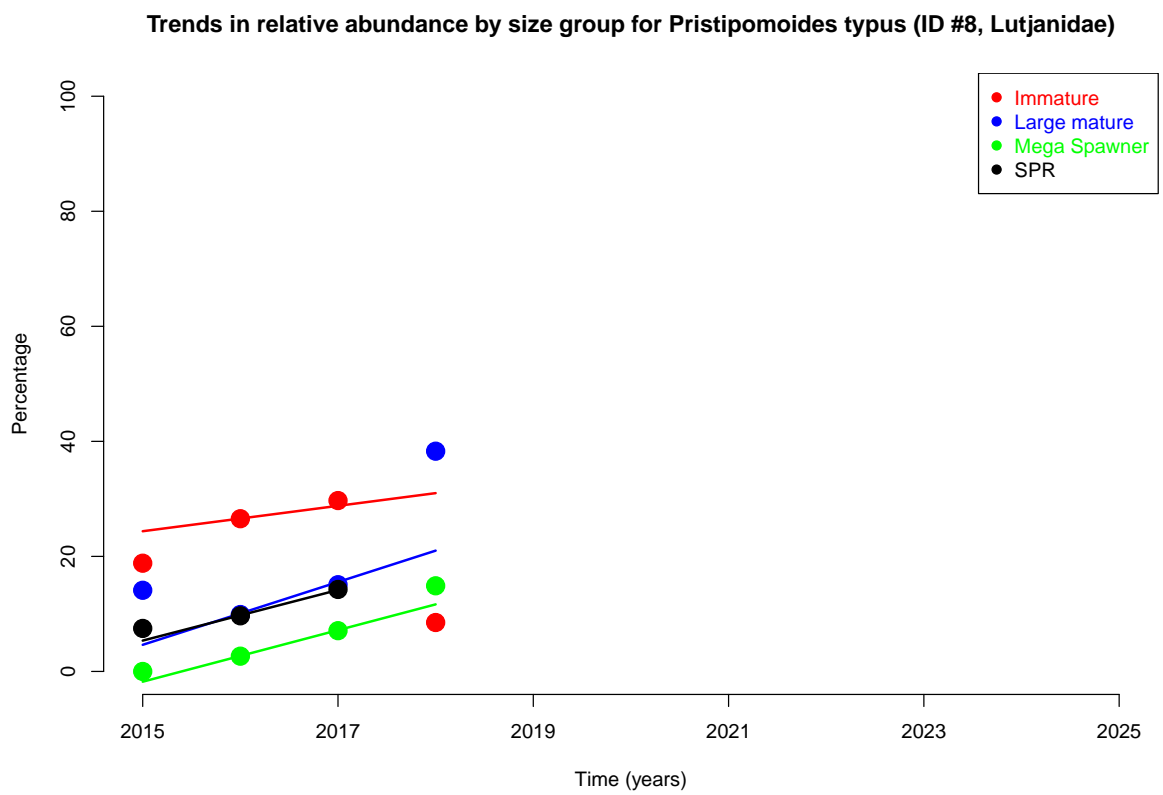
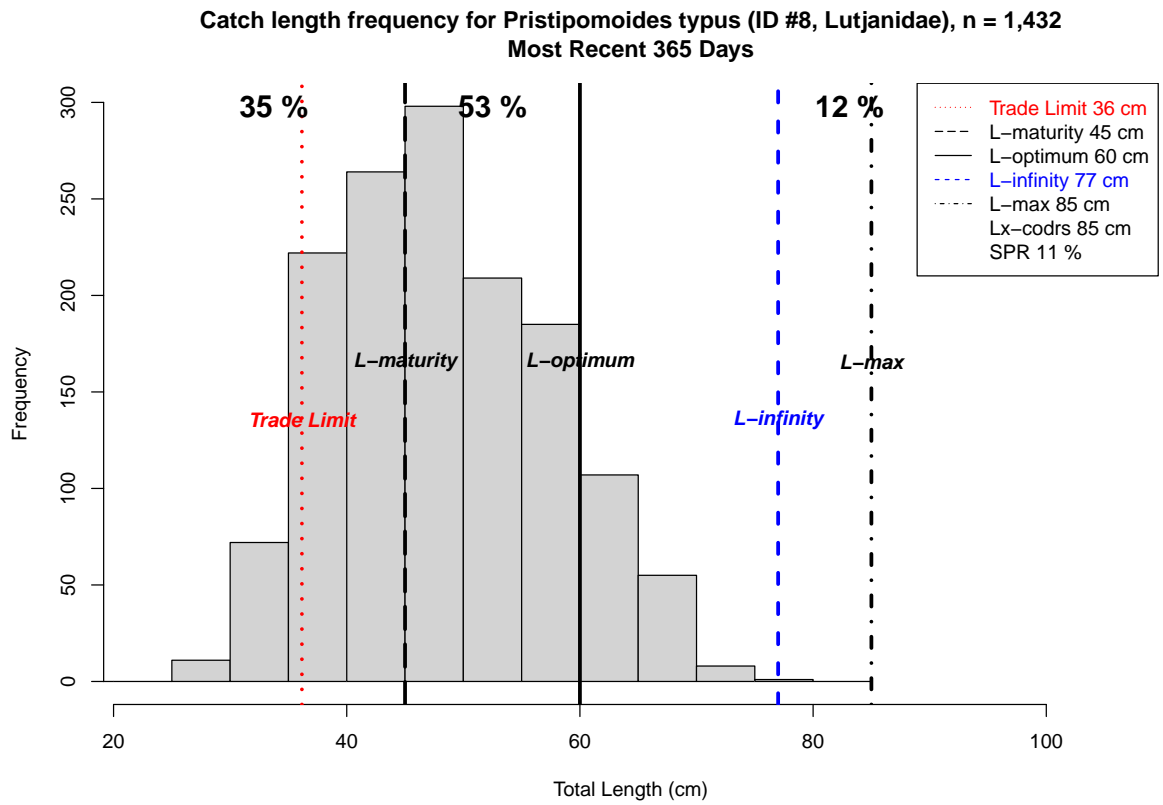
Trends in relative abundance by size group for *Lutjanus sebae* (ID #18, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.508

% Large Mature rising over recent years, situation improving. P: 0.351

% Mega Spawner rising over recent years, situation improving. P: 0.413

% SPR rising over recent years, situation improving. P: 0.082



The percentages of *Pristipomoides typus* (ID #8, Lutjanidae) in most recent 365 days, n=1,432
Immature (< 45cm): 35%
Small mature ($\geq 45\text{cm}$, < 60cm): 53%
Large mature ($\geq 60\text{cm}$): 12%
Mega spawner ($\geq 66\text{cm}$): 4% (subset of large mature fish)
Spawning Potential Ratio: 11 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

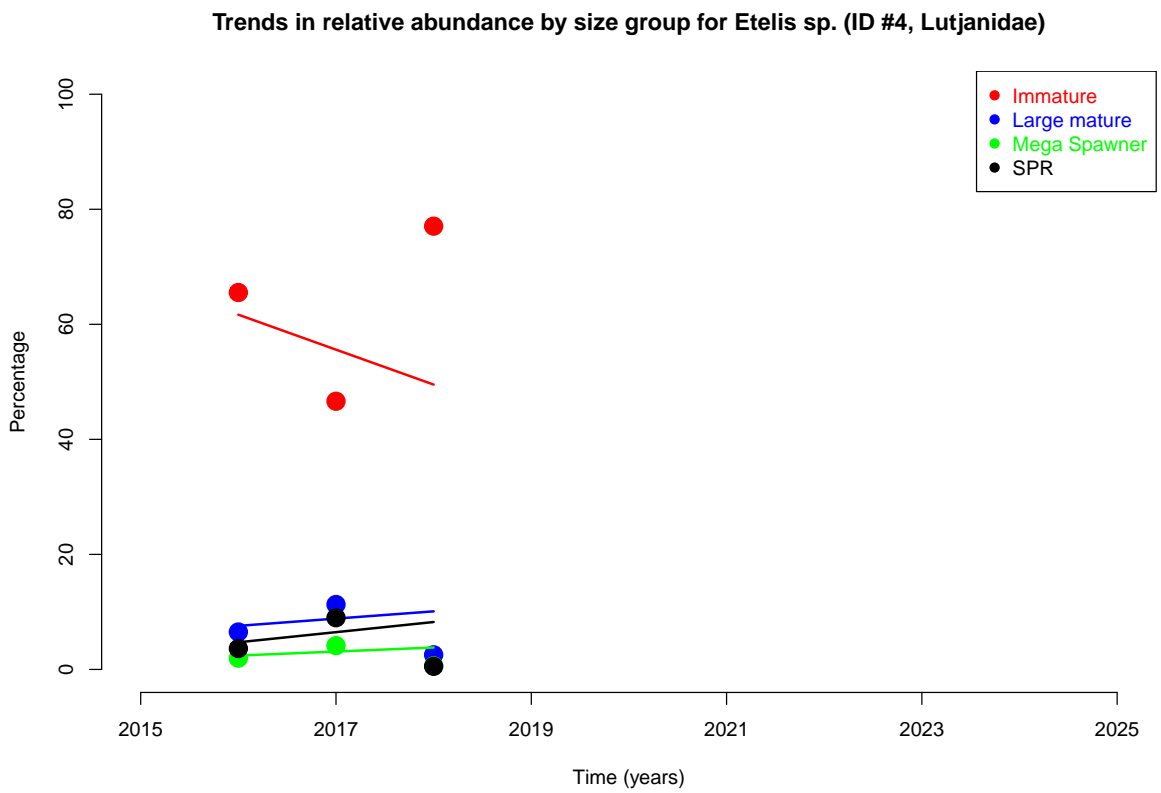
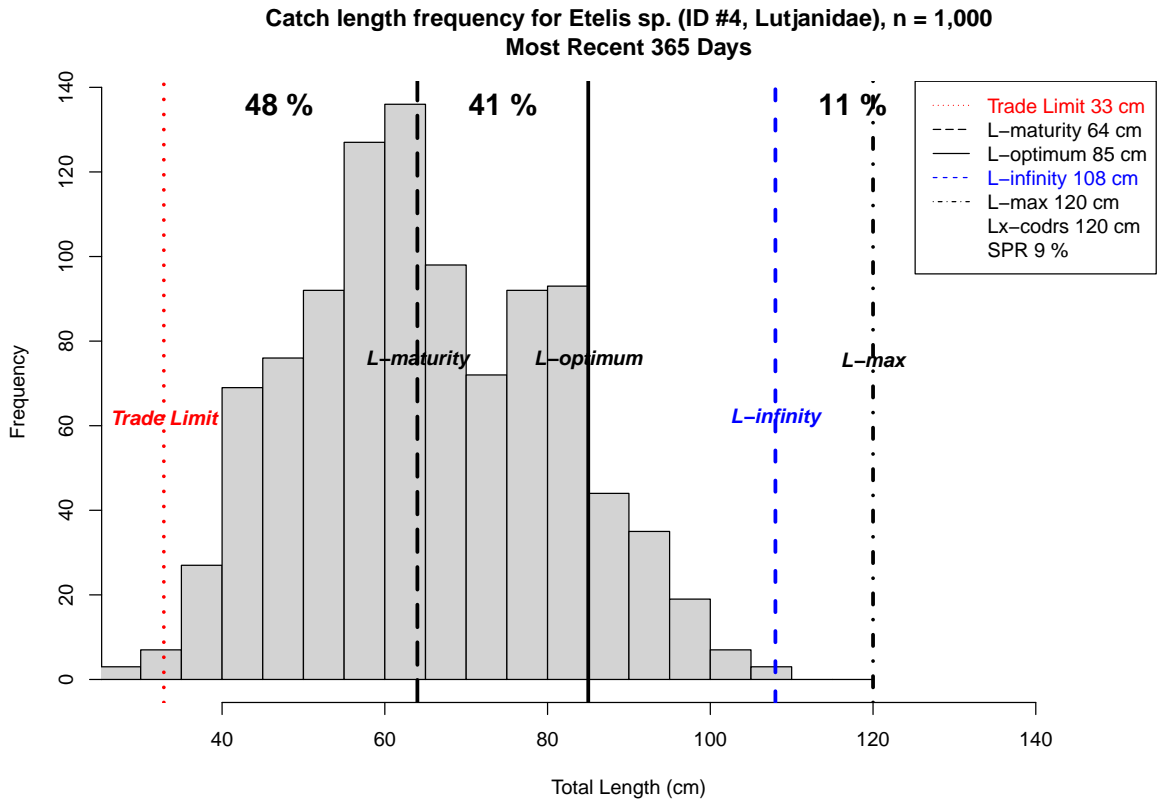
Trends in relative abundance by size group for *Pristipomoides typus* (ID #8, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.540

% Large Mature rising over recent years, situation improving. P: 0.180

% Mega Spawner rising over recent years, situation improving. P: 0.012

% SPR rising over recent years, situation improving. P: 0.080



The percentages of *Etelis* sp. (ID #4, Lutjanidae) in most recent 365 days, n=1,000
Immature (< 64cm): 48%
Small mature (>= 64cm, < 85cm): 41%
Large mature (>= 85cm): 11%
Mega spawner (>= 93.5cm): 4% (subset of large mature fish)
Spawning Potential Ratio: 9 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

Trends in relative abundance by size group for *Etelis* sp. (ID #4, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

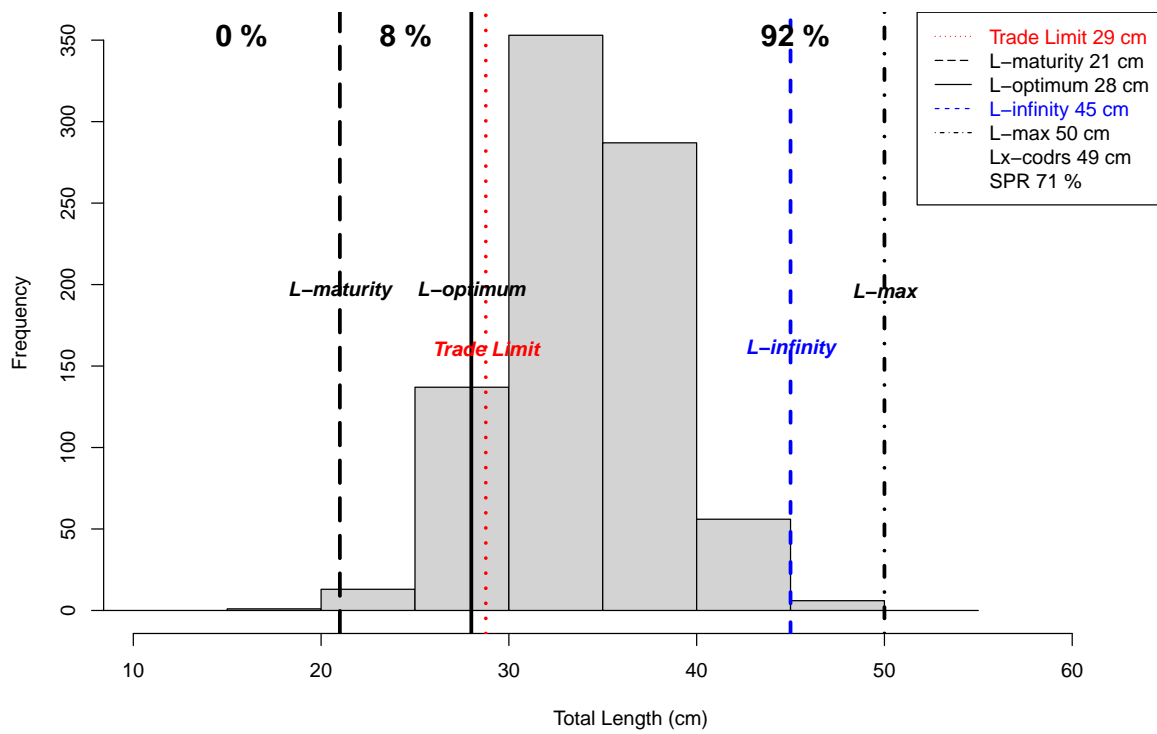
% Immature falling over recent years, situation improving. P: 0.765

% Large Mature rising over recent years, situation improving. P: 0.819

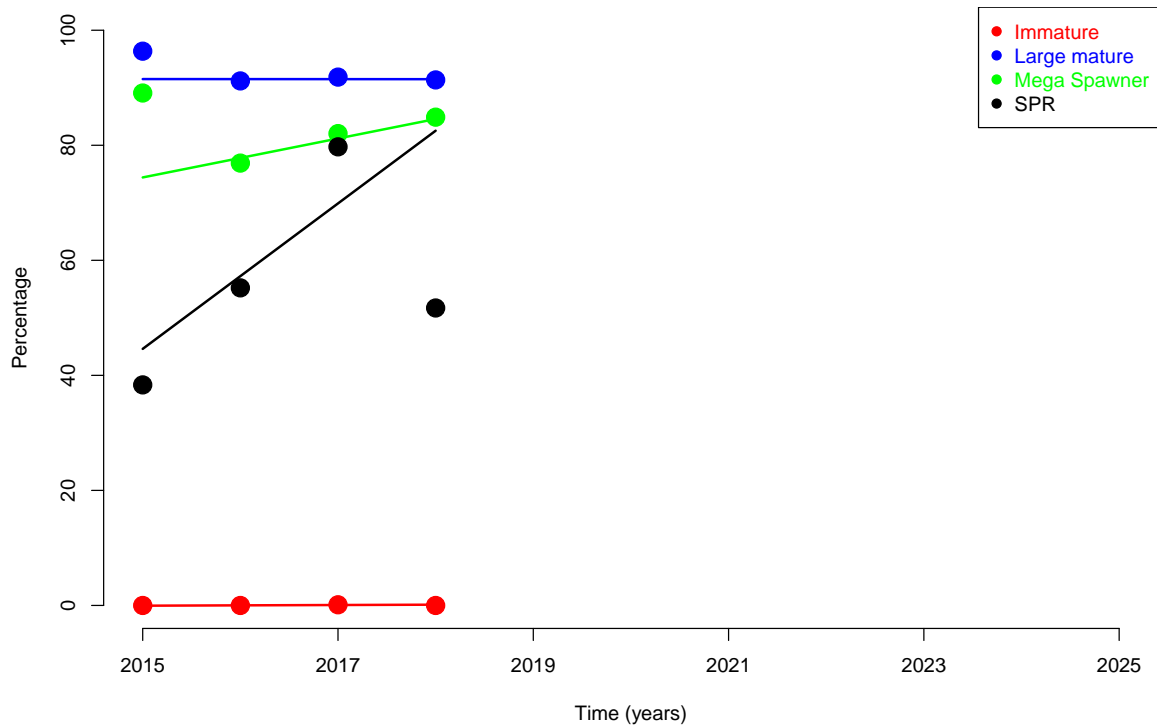
% Mega Spawner rising over recent years, situation improving. P: 0.765

% SPR rising over recent years, situation improving. P: 0.757

Catch length frequency for *Epinephelus areolatus* (ID #45, Epinephelidae), n = 853
 Most Recent 365 Days



Trends in relative abundance by size group for *Epinephelus areolatus* (ID #45, Epinephelidae)



The percentages of *Epinephelus areolatus* (ID #45, Epinephelidae) in most recent 365 days, n=853
Immature (< 21cm): 0%
Small mature (\geq 21cm, < 28cm): 8%
Large mature (\geq 28cm): 92%
Mega spawner (\geq 30.8cm): 82% (subset of large mature fish)
Spawning Potential Ratio: 71 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

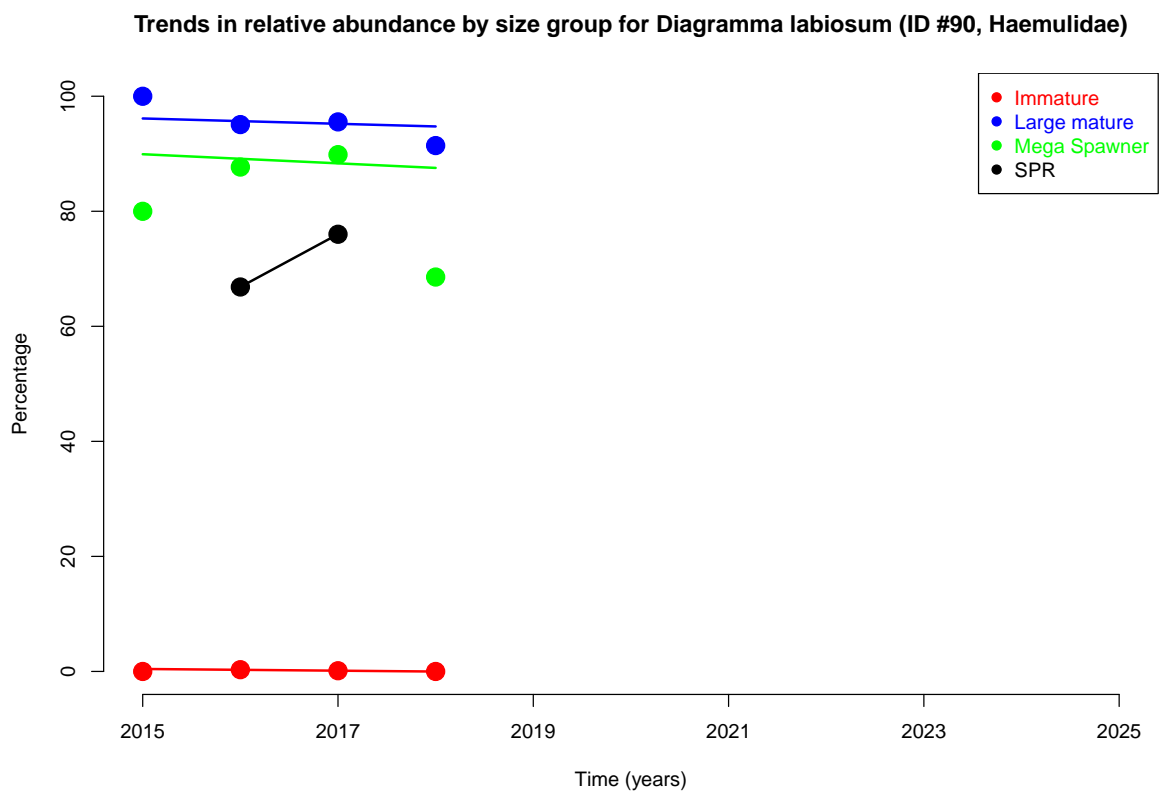
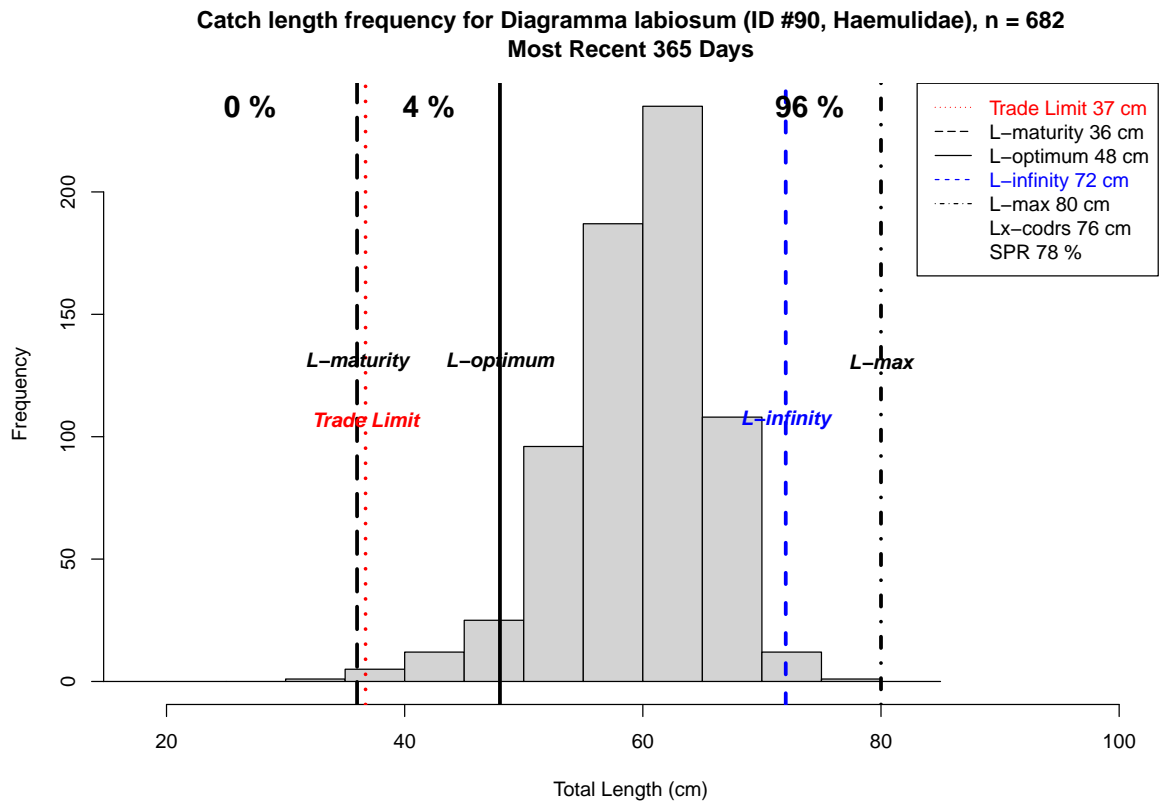
Trends in relative abundance by size group for *Epinephelus areolatus* (ID #45, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: 0.337

% Large Mature no trend over recent years, situation stable. P: 0.995

% Mega Spawner rising over recent years, situation improving. P: 0.319

% SPR rising over recent years, situation improving. P: 0.345



The percentages of *Diagramma labiosum* (ID #90, Haemulidae) in most recent 365 days, n=682
Immature (< 36cm): 0%
Small mature (\geq 36cm, < 48cm): 4%
Large mature (\geq 48cm): 96%
Mega spawner (\geq 52.8cm): 89% (subset of large mature fish)
Spawning Potential Ratio: 78 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

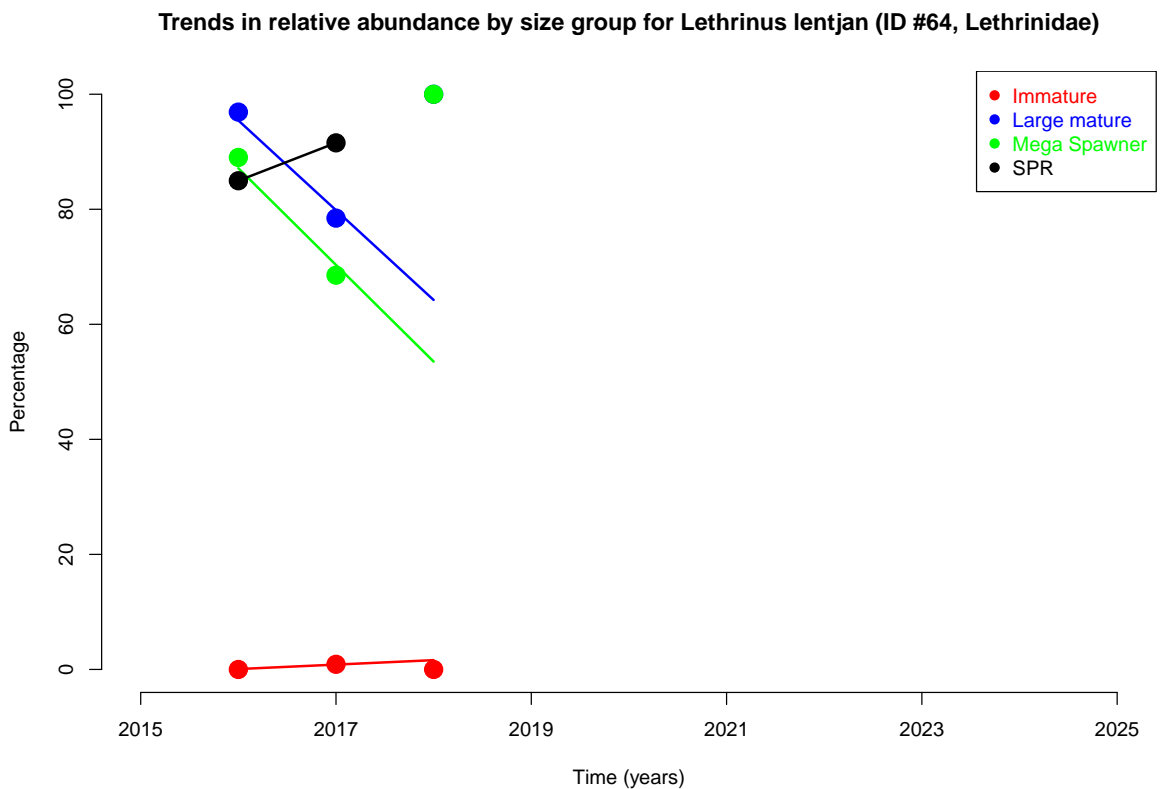
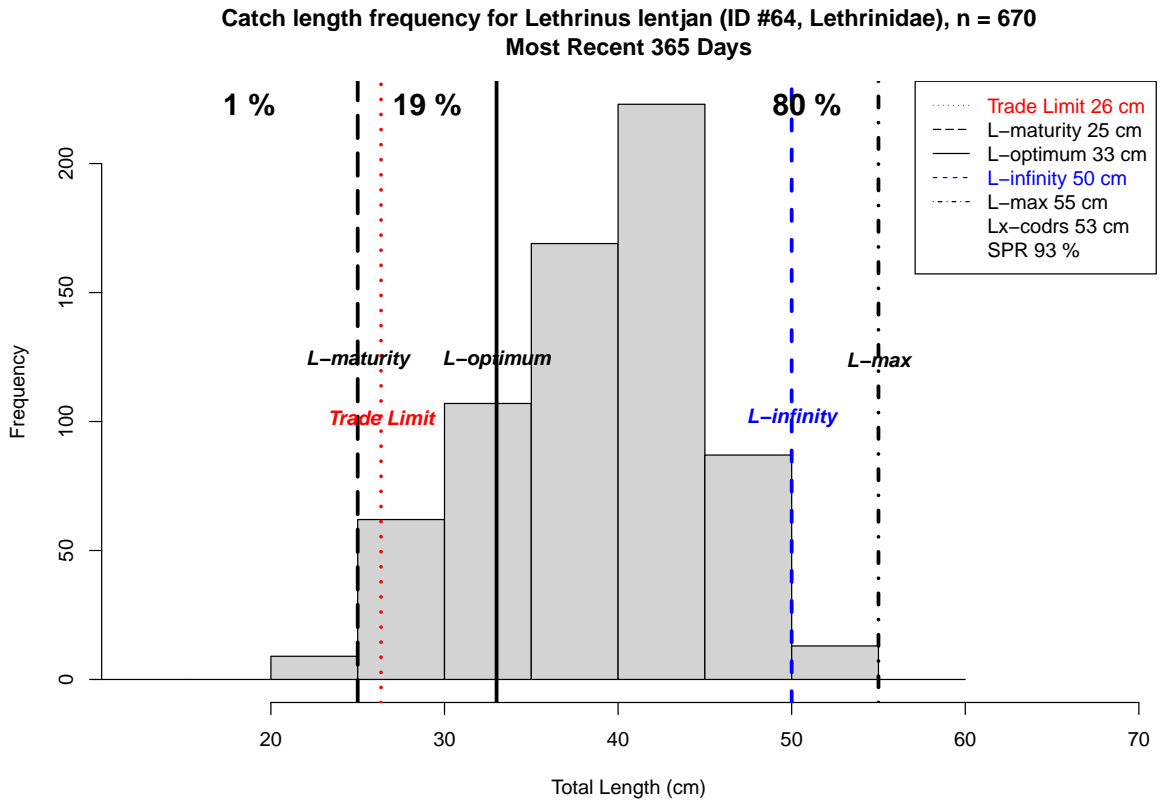
Trends in relative abundance by size group for *Diagramma labiosum* (ID #90, Haemulidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.124

% Large Mature falling over recent years, situation deteriorating. P: 0.710

% Mega Spawner falling over recent years, situation deteriorating. P: 0.889

% SPR rising over recent years, situation improving. P: not available



The percentages of *Lethrinus lentjan* (ID #64, Lethrinidae) in most recent 365 days, n=670
Immature (< 25cm): 1%
Small mature ($\geq 25\text{cm}$, < 33cm): 19%
Large mature ($\geq 33\text{cm}$): 80%
Mega spawner ($\geq 36.3\text{cm}$): 69% (subset of large mature fish)
Spawning Potential Ratio: 93 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

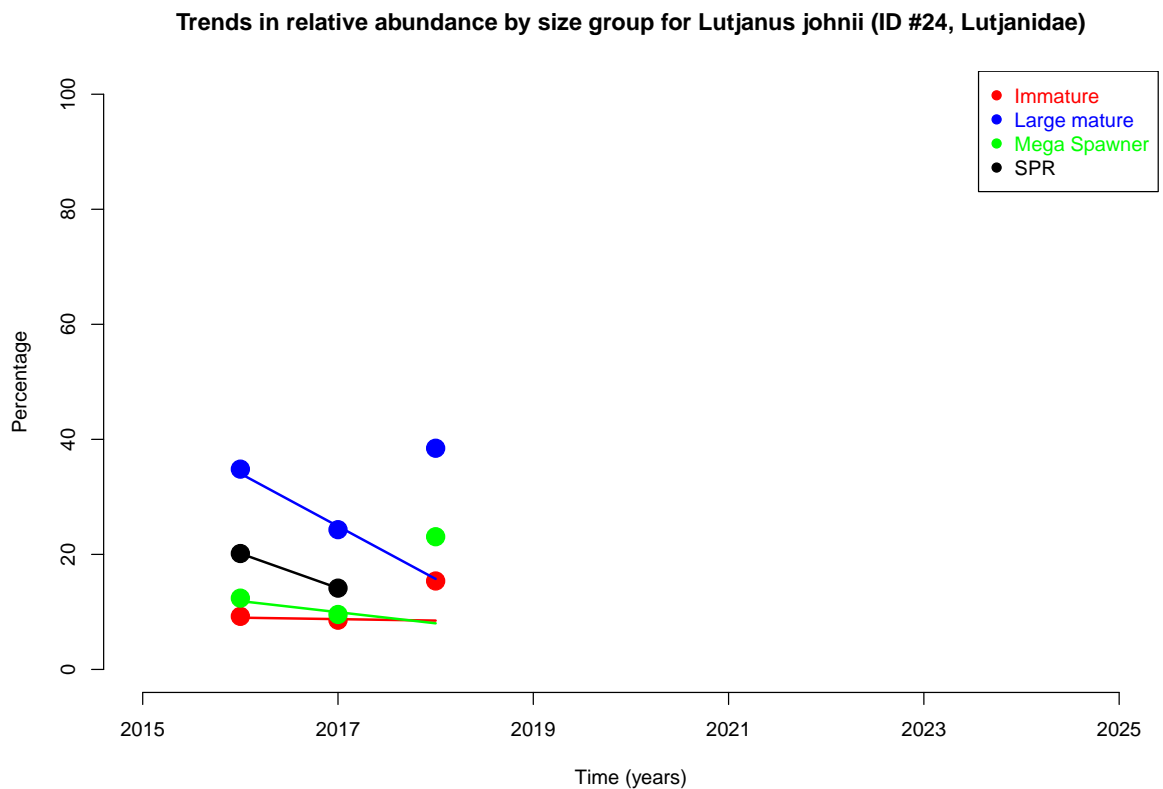
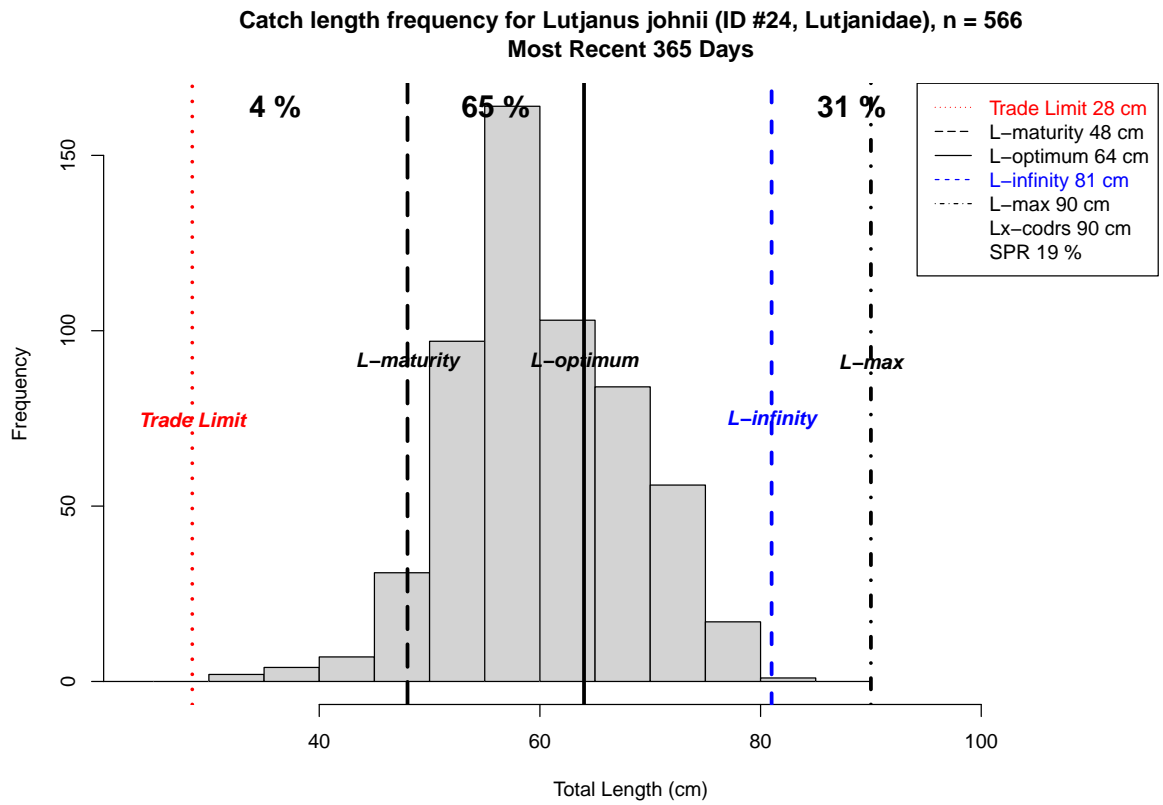
Trends in relative abundance by size group for *Lethrinus lentjan* (ID #64, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.302

% Large Mature falling over recent years, situation deteriorating. P: 0.327

% Mega Spawner falling over recent years, situation deteriorating. P: 0.380

% SPR rising over recent years, situation improving. P: not available



The percentages of *Lutjanus johnii* (ID #24, Lutjanidae) in most recent 365 days, n=566
Immature (< 48cm): 4%
Small mature (\geq 48cm, < 64cm): 65%
Large mature (\geq 64cm): 31%
Mega spawner (\geq 70.4cm): 13% (subset of large mature fish)
Spawning Potential Ratio: 19 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

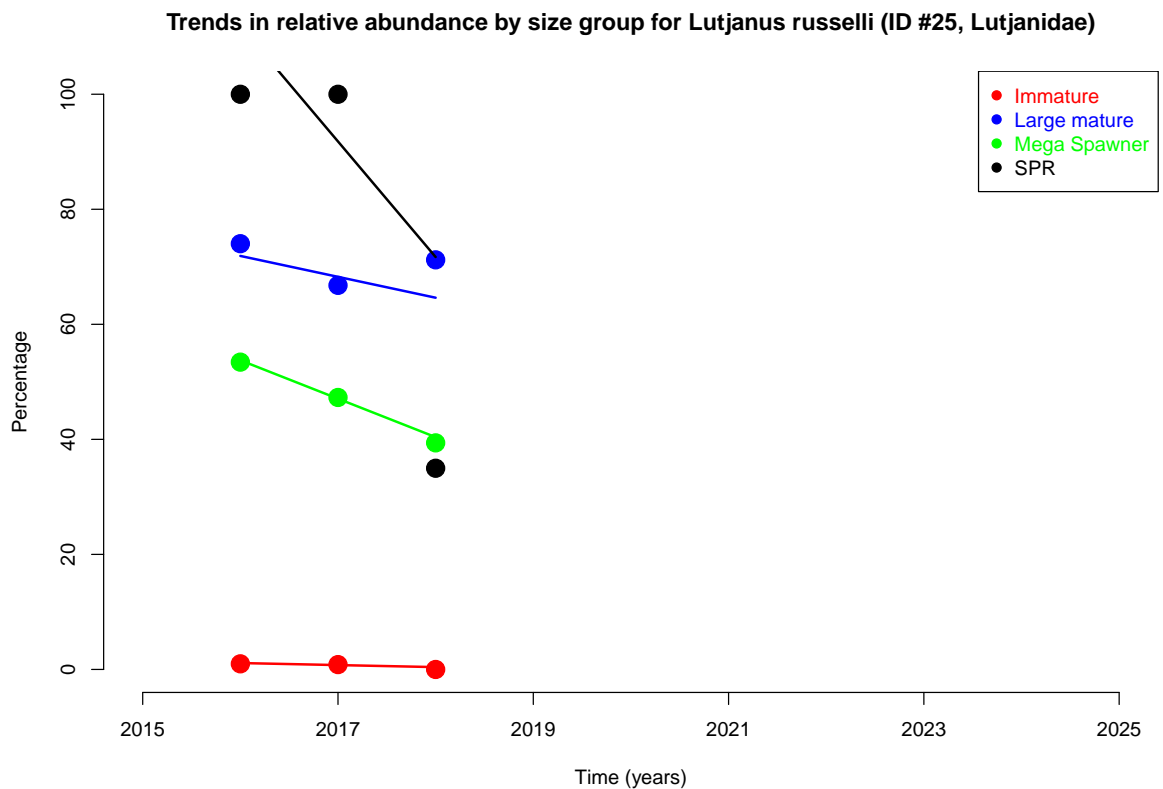
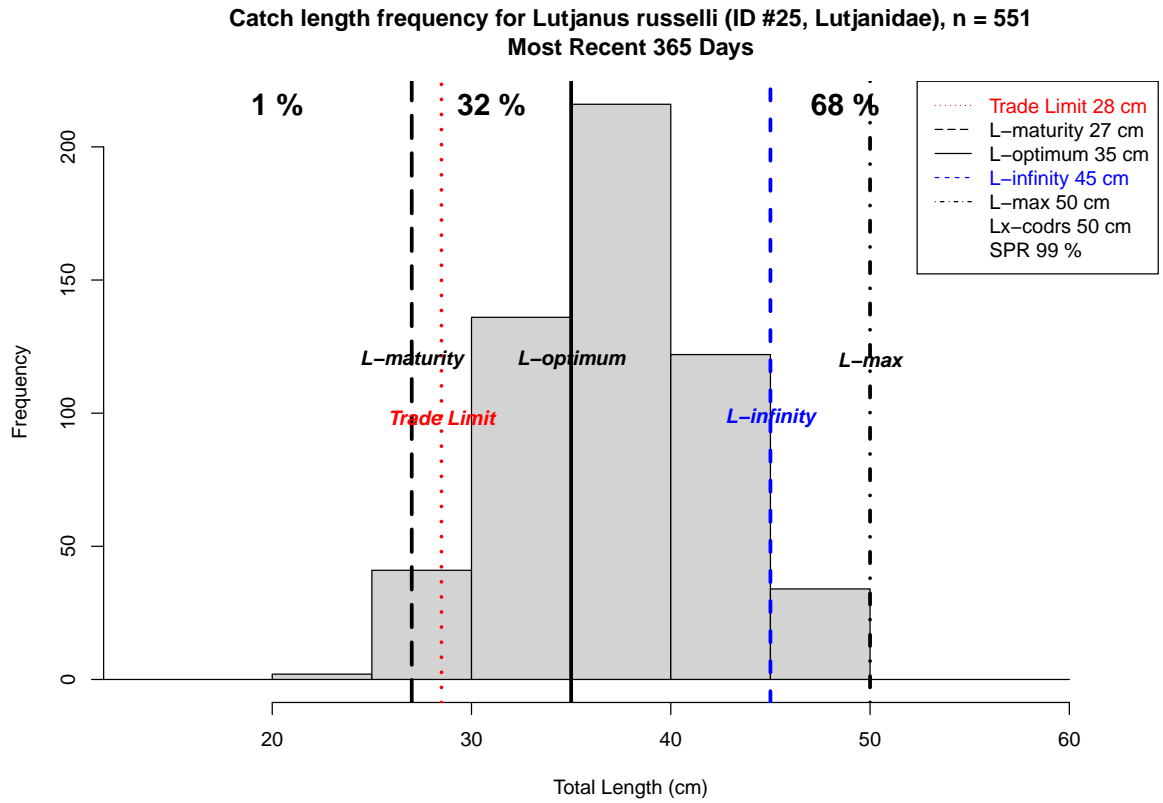
Trends in relative abundance by size group for *Lutjanus johnii* (ID #24, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.894

% Large Mature falling over recent years, situation deteriorating. P: 0.316

% Mega Spawner falling over recent years, situation deteriorating. P: 0.662

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Lutjanus russelli* (ID #25, Lutjanidae) in most recent 365 days, n=551
Immature (< 27cm): 1%
Small mature (\geq 27cm, < 35cm): 32%
Large mature (\geq 35cm): 68%
Mega spawner (\geq 38.5cm): 46% (subset of large mature fish)
Spawning Potential Ratio: 99 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

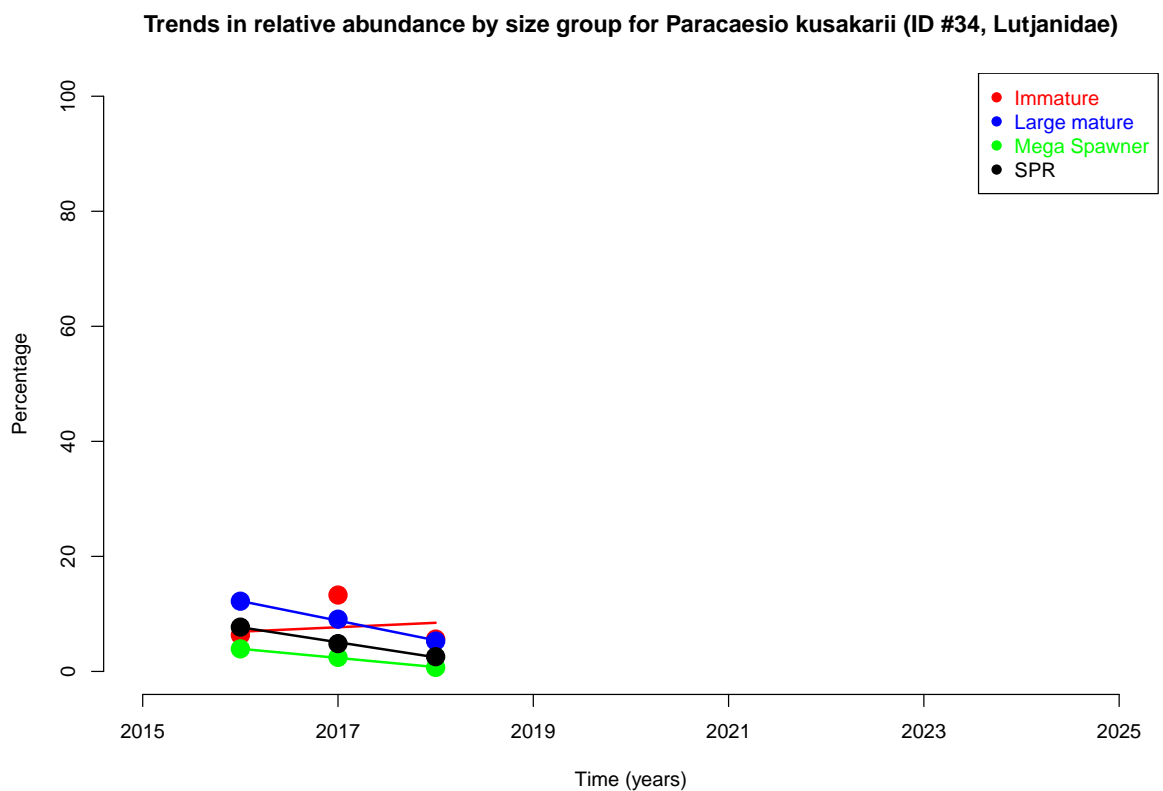
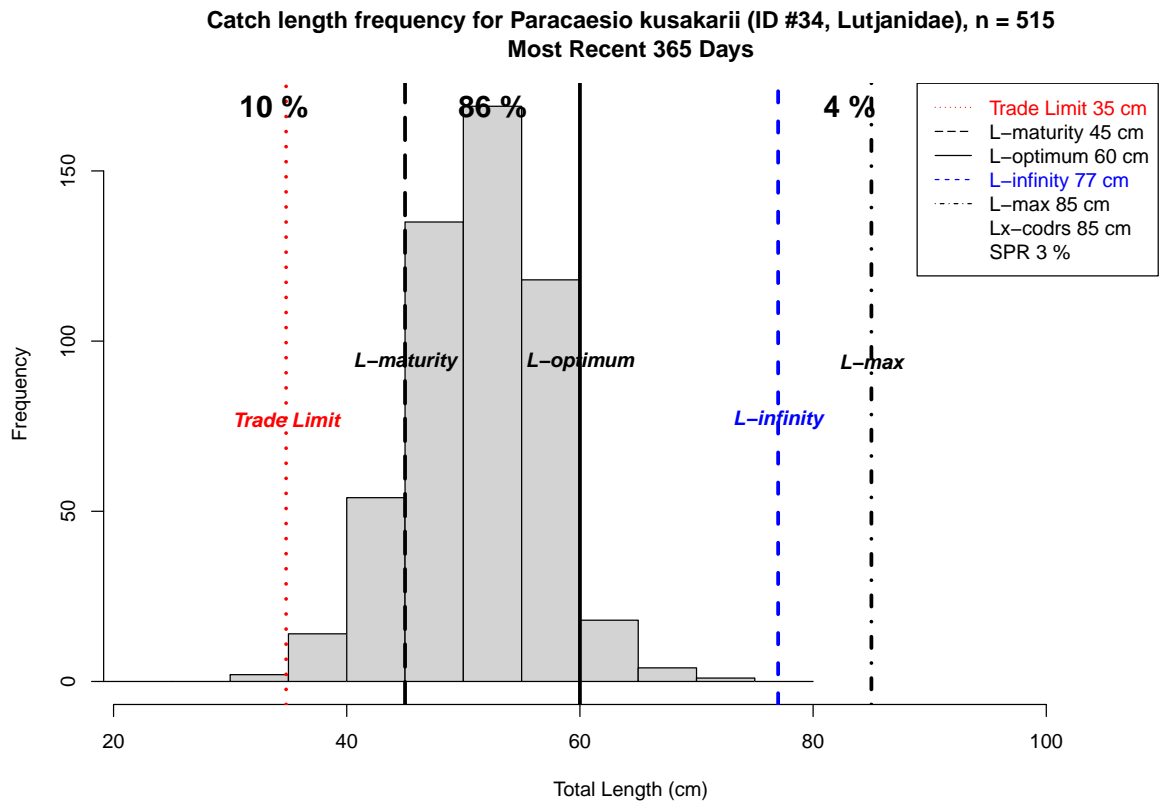
Trends in relative abundance by size group for *Lutjanus russelli* (ID #25, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.423

% Large Mature falling over recent years, situation deteriorating. P: 0.569

% Mega Spawner falling over recent years, situation deteriorating. P: 0.064

% SPR falling over recent years, situation deteriorating. P: 0.572



The percentages of *Paracaesio kusakarii* (ID #34, Lutjanidae) in most recent 365 days, n=515
Immature (< 45cm): 10%
Small mature ($\geq 45\text{cm}$, < 60cm): 86%
Large mature ($\geq 60\text{cm}$): 4%
Mega spawner ($\geq 66\text{cm}$): 1% (subset of large mature fish)
Spawning Potential Ratio: 3 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

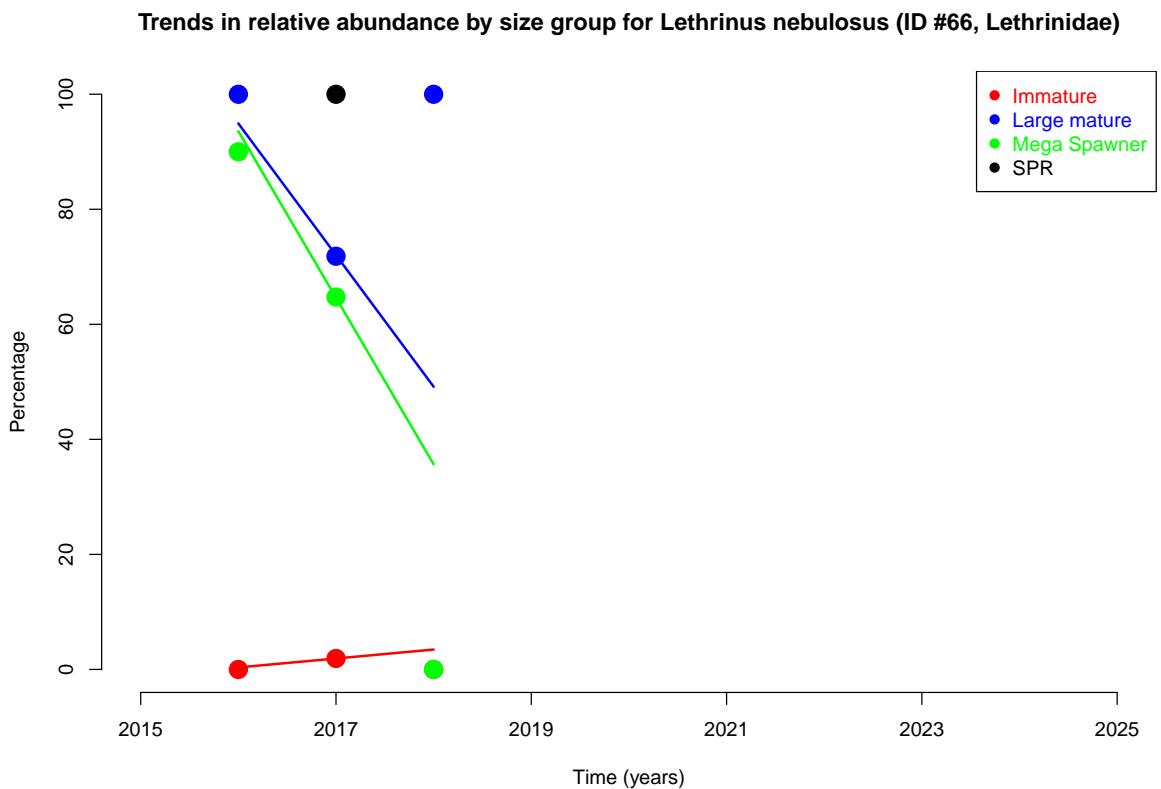
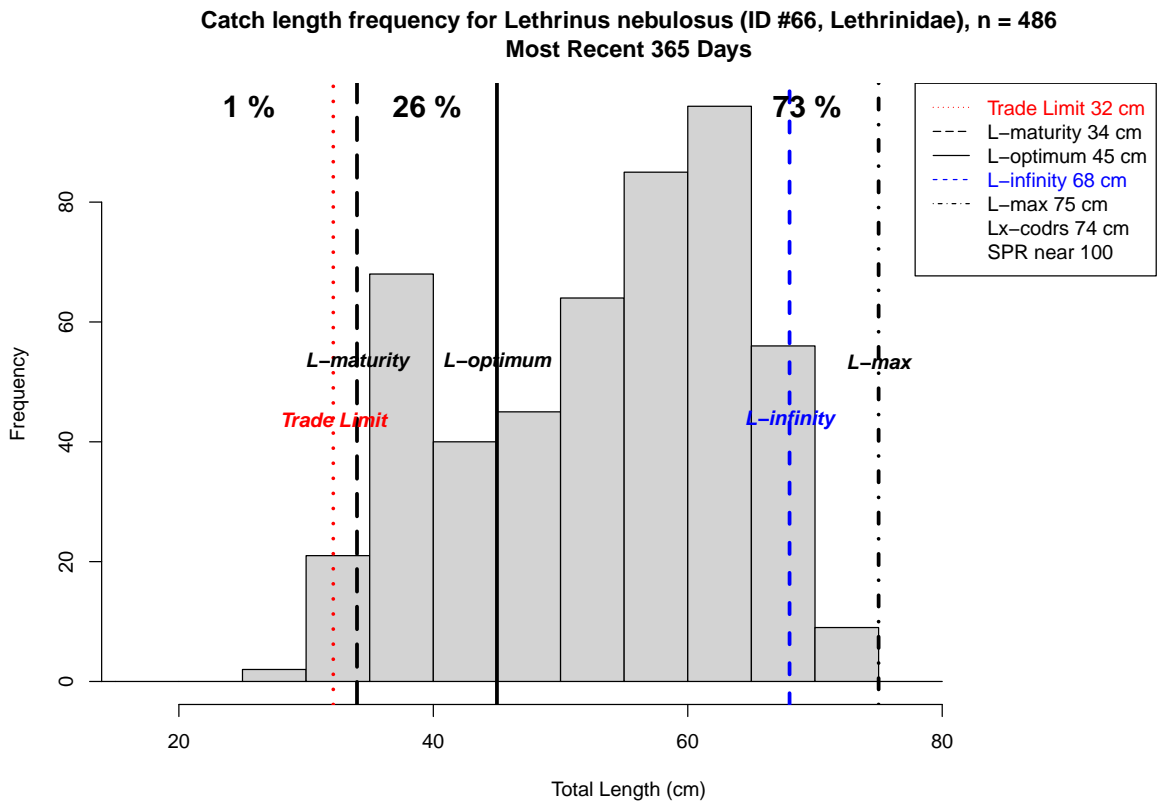
Trends in relative abundance by size group for *Paracaesio kusakarii* (ID #34, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.855

% Large Mature falling over recent years, situation deteriorating. P: 0.029

% Mega Spawner falling over recent years, situation deteriorating. P: 0.024

% SPR falling over recent years, situation deteriorating. P: 0.033



The percentages of *Lethrinus nebulosus* (ID #66, Lethrinidae) in most recent 365 days, n=486
Immature (< 34cm): 1%
Small mature (\geq 34cm, < 45cm): 26%
Large mature (\geq 45cm): 73%
Mega spawner (\geq 49.5cm): 66% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Lethrinus nebulosus* (ID #66, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

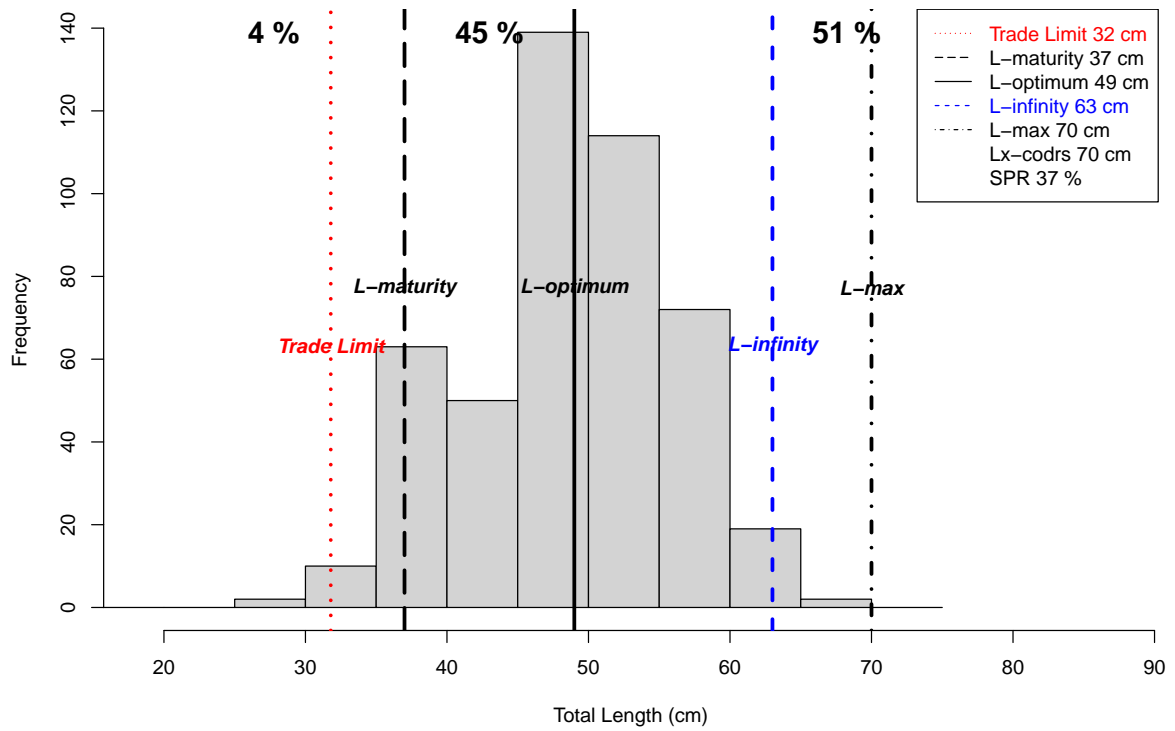
% Immature rising over recent years, situation deteriorating. P: 0.393

% Large Mature falling over recent years, situation deteriorating. P: 0.393

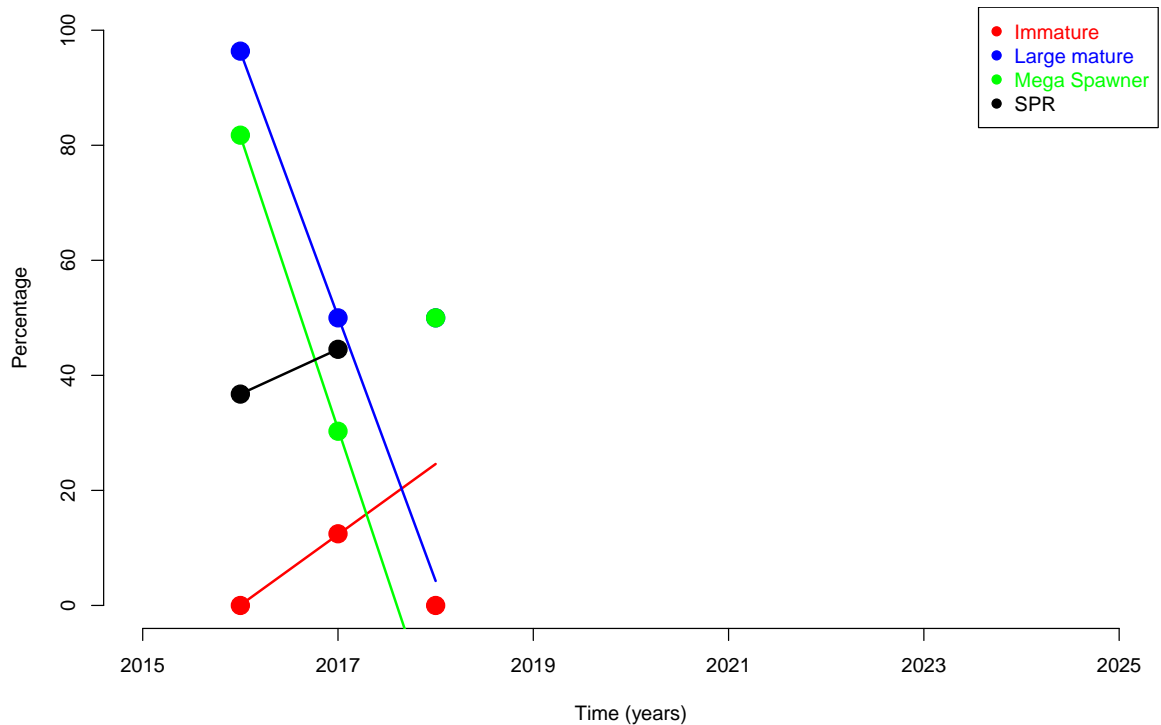
% Mega Spawner falling over recent years, situation deteriorating. P: 0.239

% SPR no trend over recent years, situation stable. P: not available

Catch length frequency for *Lutjanus erythropterus* (ID #21, Lutjanidae), n = 471
 Most Recent 365 Days



Trends in relative abundance by size group for *Lutjanus erythropterus* (ID #21, Lutjanidae)



The percentages of *Lutjanus erythropterus* (ID #21, Lutjanidae) in most recent 365 days, n=471
Immature (< 37cm): 4%
Small mature (\geq 37cm, < 49cm): 45%
Large mature (\geq 49cm): 51%
Mega spawner (\geq 53.9cm): 28% (subset of large mature fish)
Spawning Potential Ratio: 37 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

The percentage of mega spawners is between 20 and 30%. There is no immediate reason for concern, though fishing pressure may be significantly reducing the percentage of mega-spawners, which may negatively affect the reproductive output of this population. Risk level is medium.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

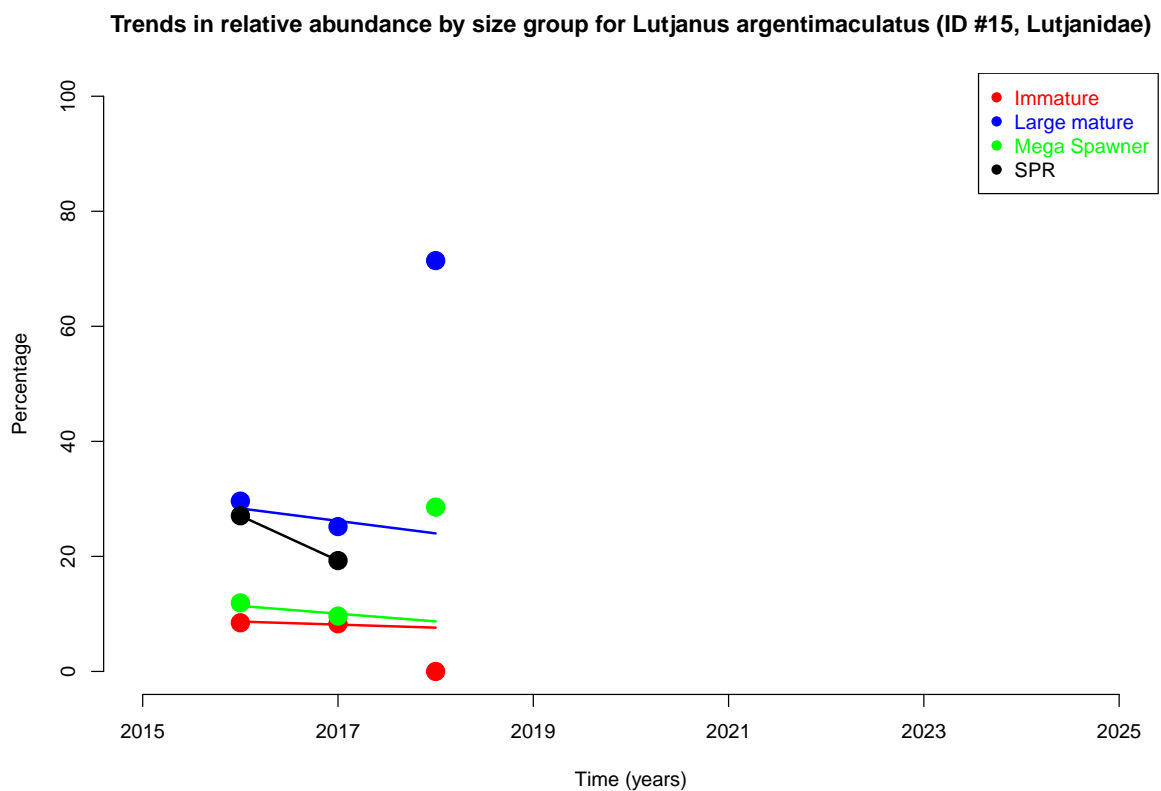
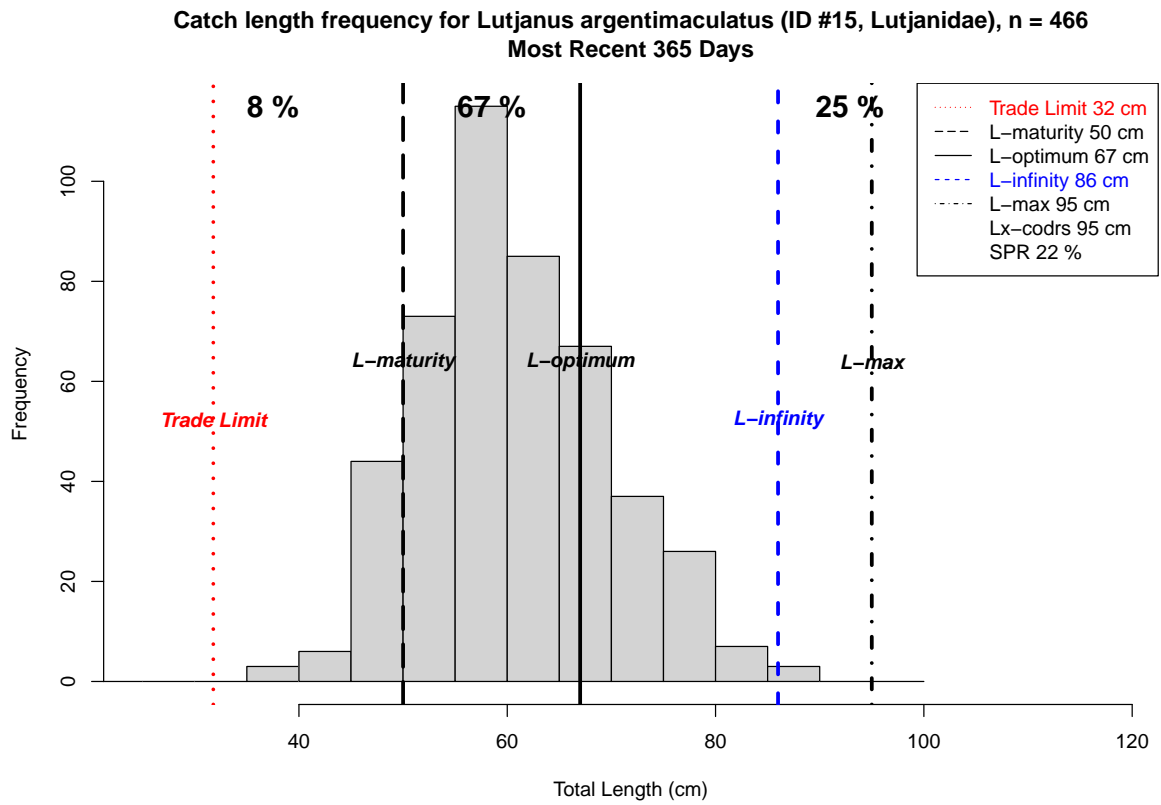
Trends in relative abundance by size group for *Lutjanus erythropterus* (ID #21, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.089

% Large Mature falling over recent years, situation deteriorating. P: 0.045

% Mega Spawner falling over recent years, situation deteriorating. P: 0.062

% SPR rising over recent years, situation improving. P: not available



The percentages of *Lutjanus argentimaculatus* (ID #15, Lutjanidae) in most recent 365 days, n=466
Immature (< 50cm): 8%
Small mature ($\geq 50\text{cm}$, < 67cm): 67%
Large mature ($\geq 67\text{cm}$): 25%
Mega spawner ($\geq 73.7\text{cm}$): 10% (subset of large mature fish)
Spawning Potential Ratio: 22 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

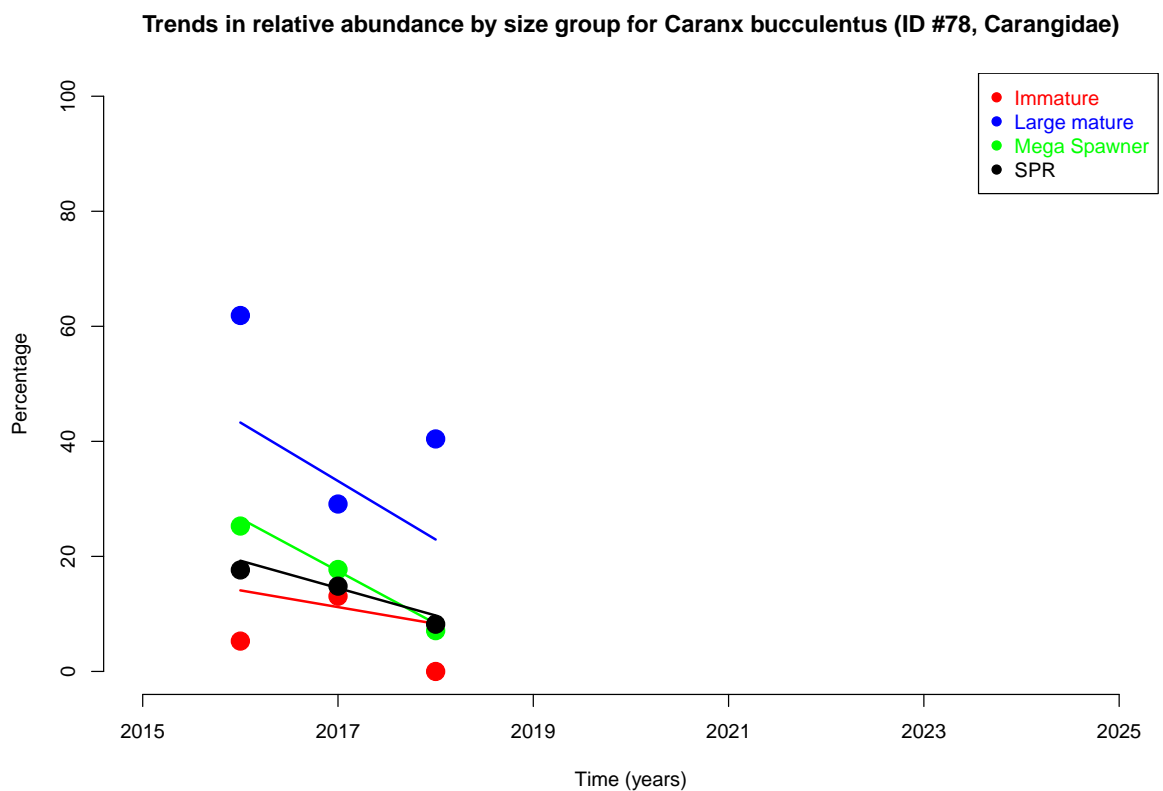
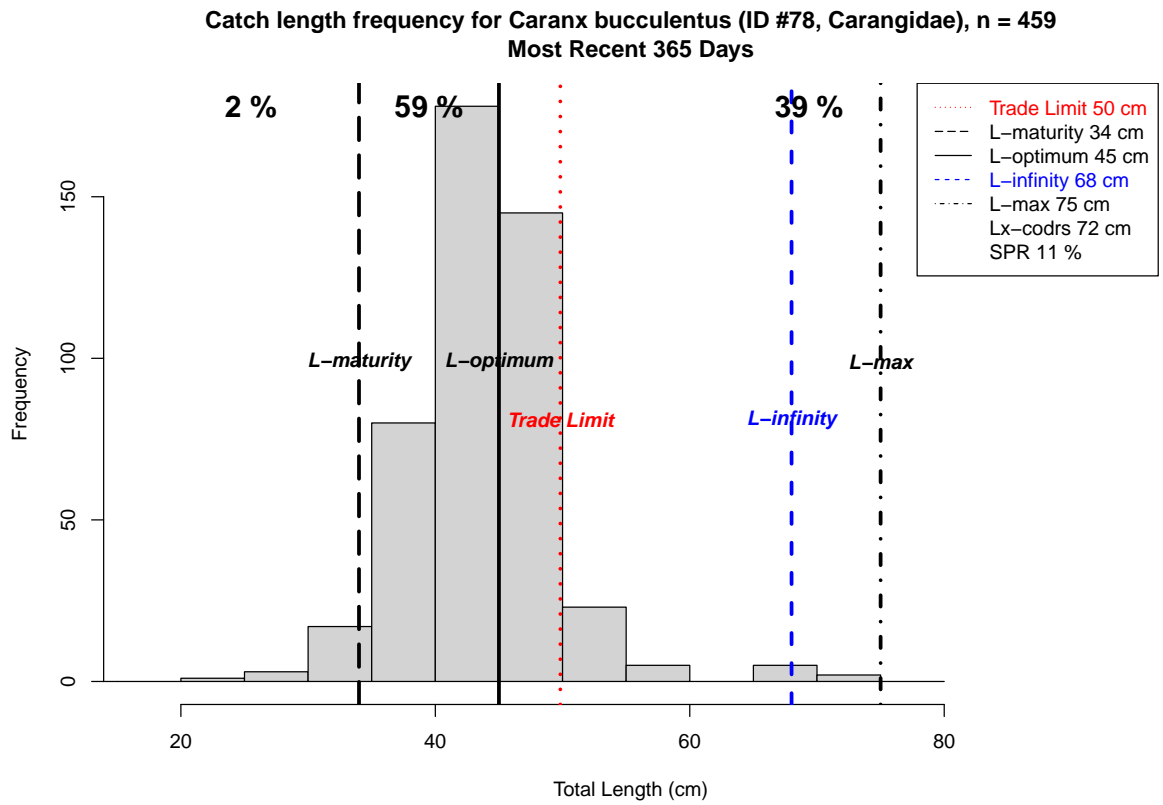
Trends in relative abundance by size group for *Lutjanus argentimaculatus* (ID #15, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.781

% Large Mature falling over recent years, situation deteriorating. P: 0.852

% Mega Spawner falling over recent years, situation deteriorating. P: 0.786

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Caranx bucculentus* (ID #78, Carangidae) in most recent 365 days, n=459
Immature (< 34cm): 2%
Small mature (\geq 34cm, < 45cm): 59%
Large mature (\geq 45cm): 39%
Mega spawner (\geq 49.5cm): 10% (subset of large mature fish)
Spawning Potential Ratio: 11 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The bulk of the catch includes age groups that have just matured and are about to achieve their full growth potential. This indicates that the fishery is probably at least being fully exploited. Risk level is medium.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

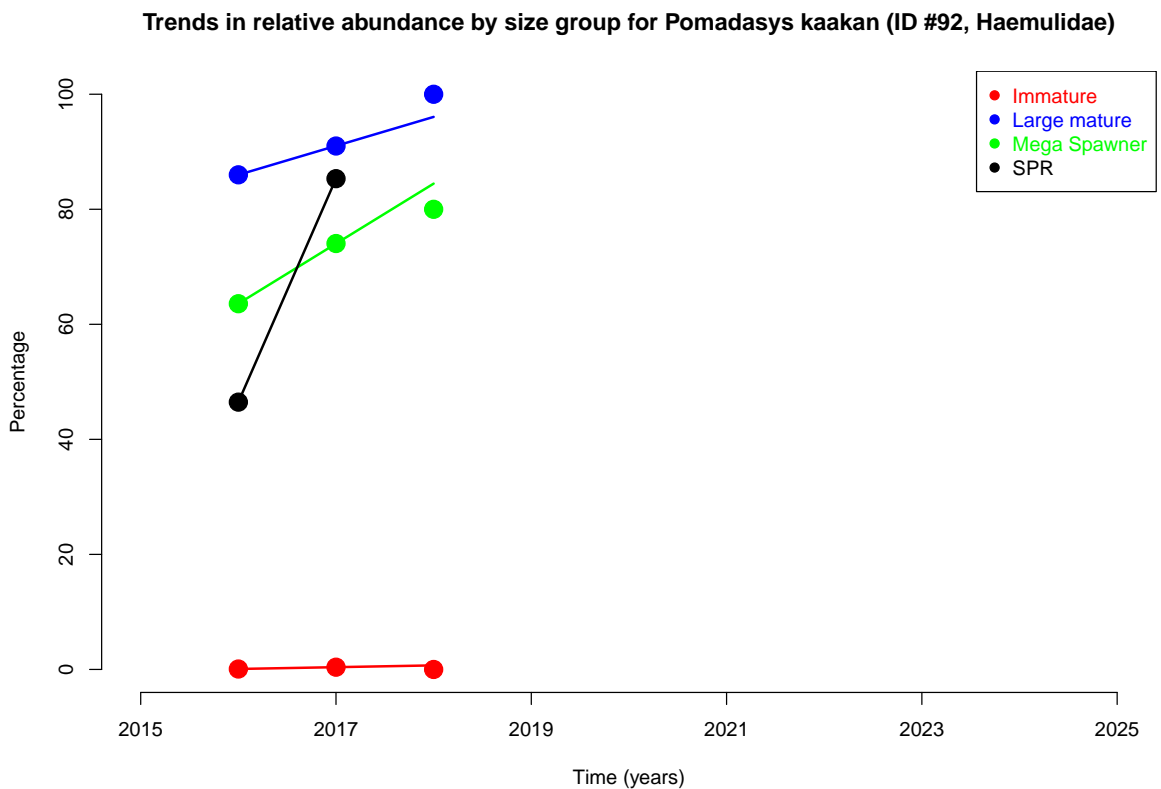
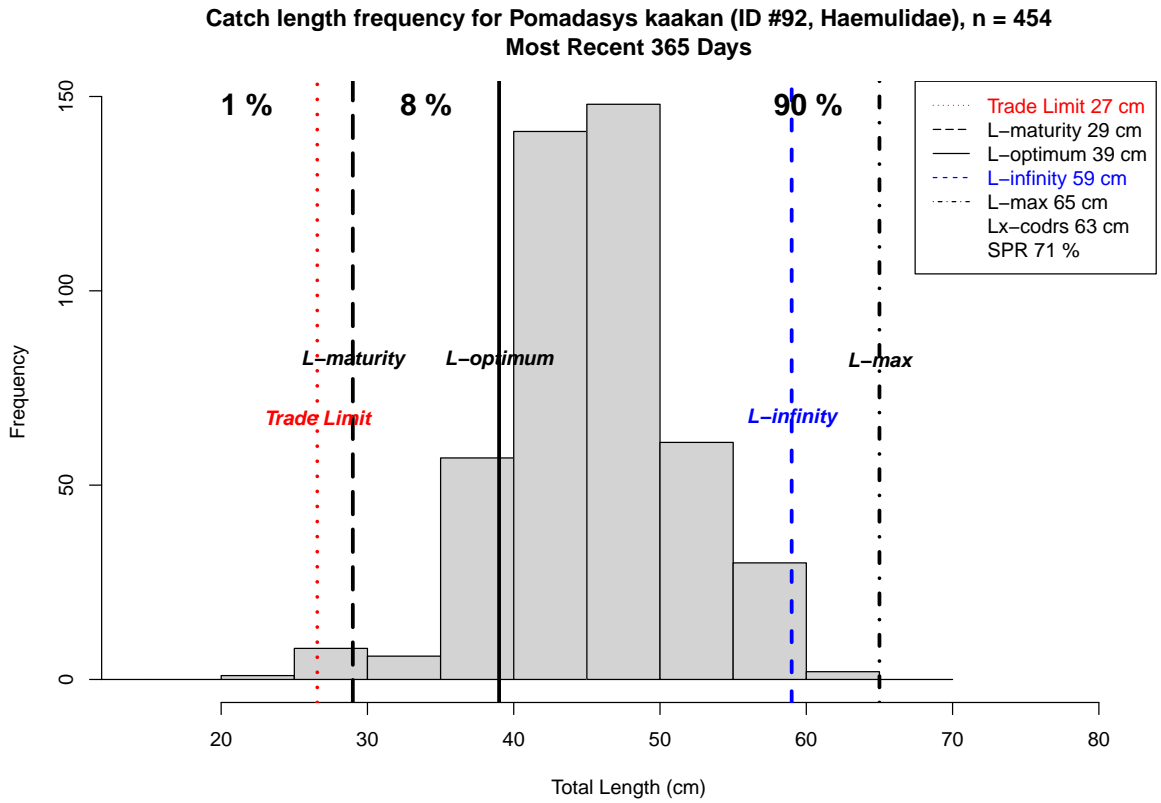
Trends in relative abundance by size group for *Caranx bucculentus* (ID #78, Carangidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.810

% Large Mature falling over recent years, situation deteriorating. P: 0.700

% Mega Spawner falling over recent years, situation deteriorating. P: 0.097

% SPR falling over recent years, situation deteriorating. P: 0.220



The percentages of *Pomadasys kaakan* (ID #92, Haemulidae) in most recent 365 days, n=454
Immature (< 29cm): 1%
Small mature (\geq 29cm, < 39cm): 8%
Large mature (\geq 39cm): 90%
Mega spawner (\geq 42.9cm): 74% (subset of large mature fish)
Spawning Potential Ratio: 71 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Pomadasys kaakan* (ID #92, Haemulidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

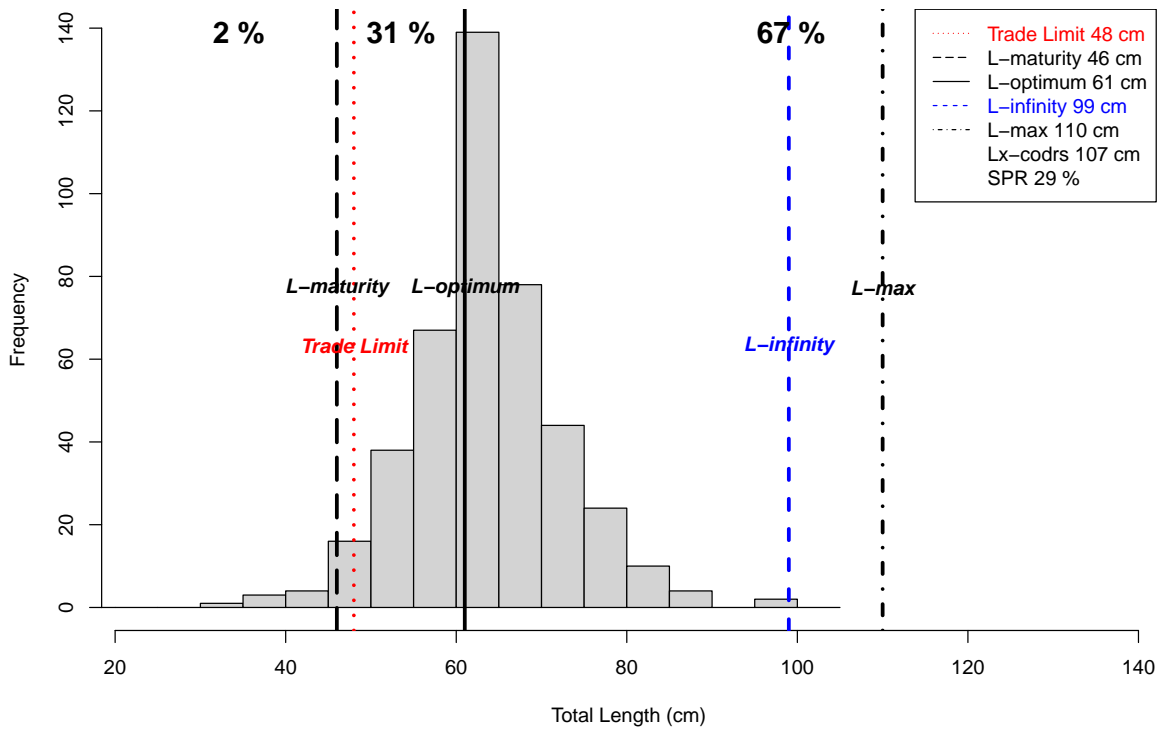
% Immature rising over recent years, situation deteriorating. P: 0.096

% Large Mature rising over recent years, situation improving. P: 0.033

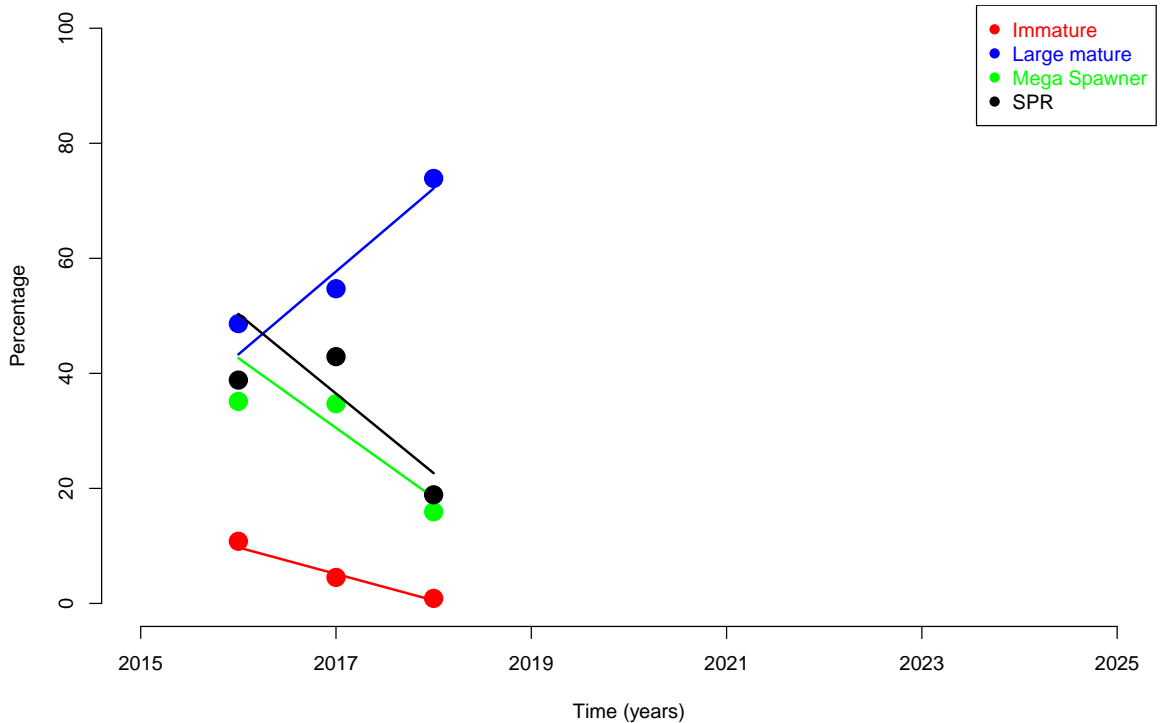
% Mega Spawner rising over recent years, situation improving. P: 0.018

% SPR rising over recent years, situation improving. P: not available

Catch length frequency for *Epinephelus latifasciatus* (ID #41, Epinephelidae), n = 430
 Most Recent 365 Days



Trends in relative abundance by size group for *Epinephelus latifasciatus* (ID #41, Epinephelidae)



The percentages of *Epinephelus latifasciatus* (ID #41, Epinephelidae) in most recent 365 days, n=430
Immature (< 46cm): 2%
Small mature ($\geq 46\text{cm}$, < 61cm): 31%
Large mature ($\geq 61\text{cm}$): 67%
Mega spawner ($\geq 67.1\text{cm}$): 29% (subset of large mature fish)
Spawning Potential Ratio: 29 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

The percentage of mega spawners is between 20 and 30%. There is no immediate reason for concern, though fishing pressure may be significantly reducing the percentage of mega-spawners, which may negatively affect the reproductive output of this population. Risk level is medium.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

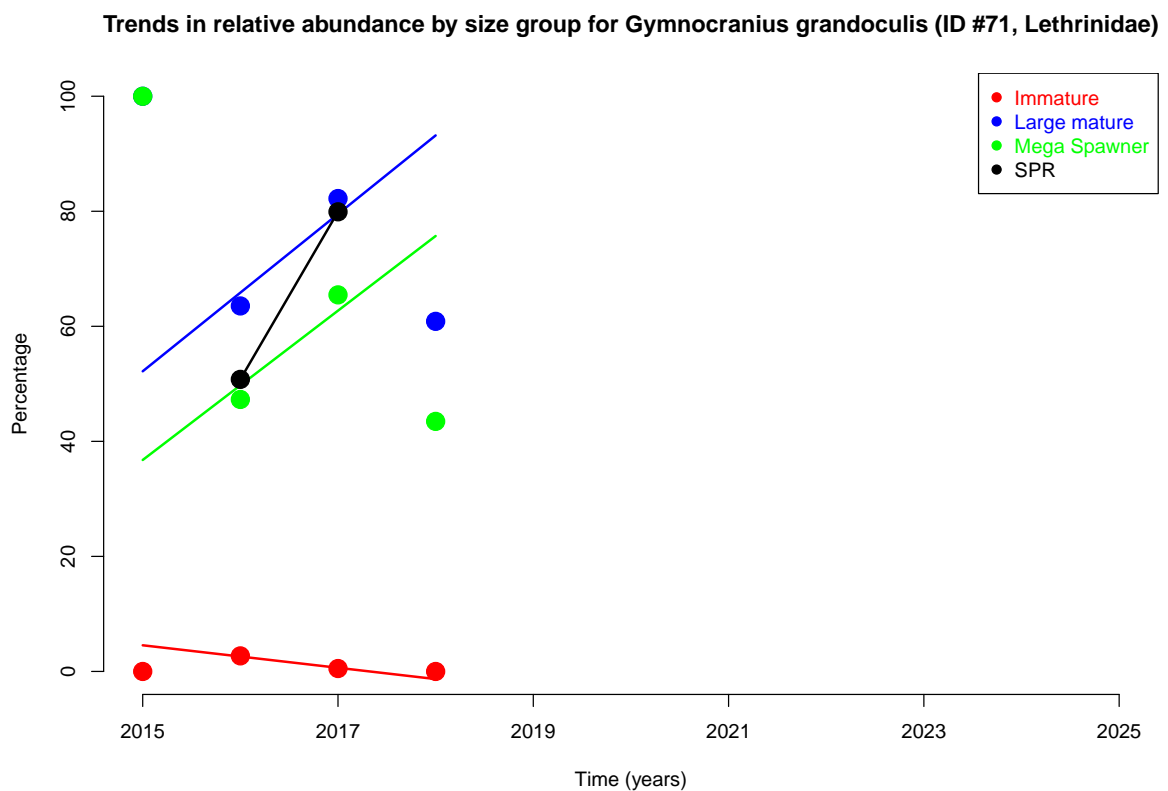
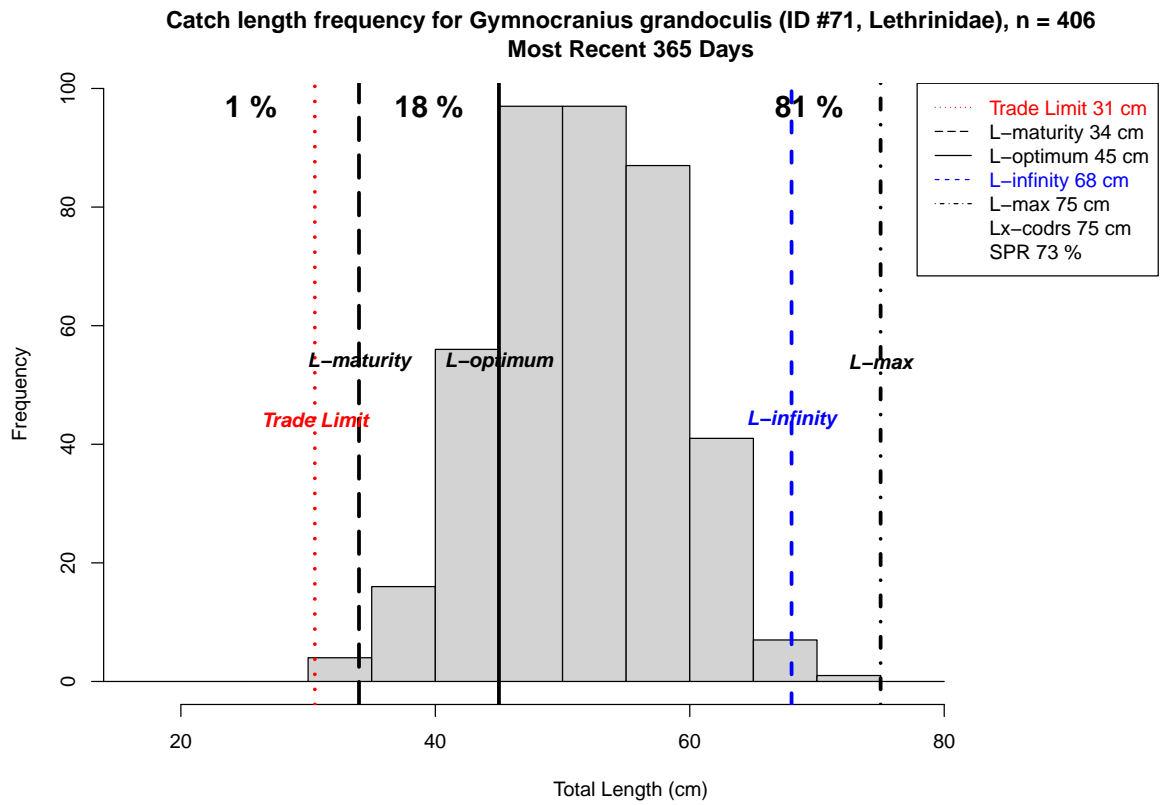
Trends in relative abundance by size group for *Epinephelus latifasciatus* (ID #41, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.123

% Large Mature rising over recent years, situation improving. P: 0.192

% Mega Spawner falling over recent years, situation deteriorating. P: 0.304

% SPR falling over recent years, situation deteriorating. P: 0.386



The percentages of *Gymnocranius grandoculis* (ID #71, Lethrinidae) in most recent 365 days, n=406
Immature (< 34cm): 1%
Small mature (\geq 34cm, < 45cm): 18%
Large mature (\geq 45cm): 81%
Mega spawner (\geq 49.5cm): 64% (subset of large mature fish)
Spawning Potential Ratio: 73 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Gymnocranius grandoculis* (ID #71, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

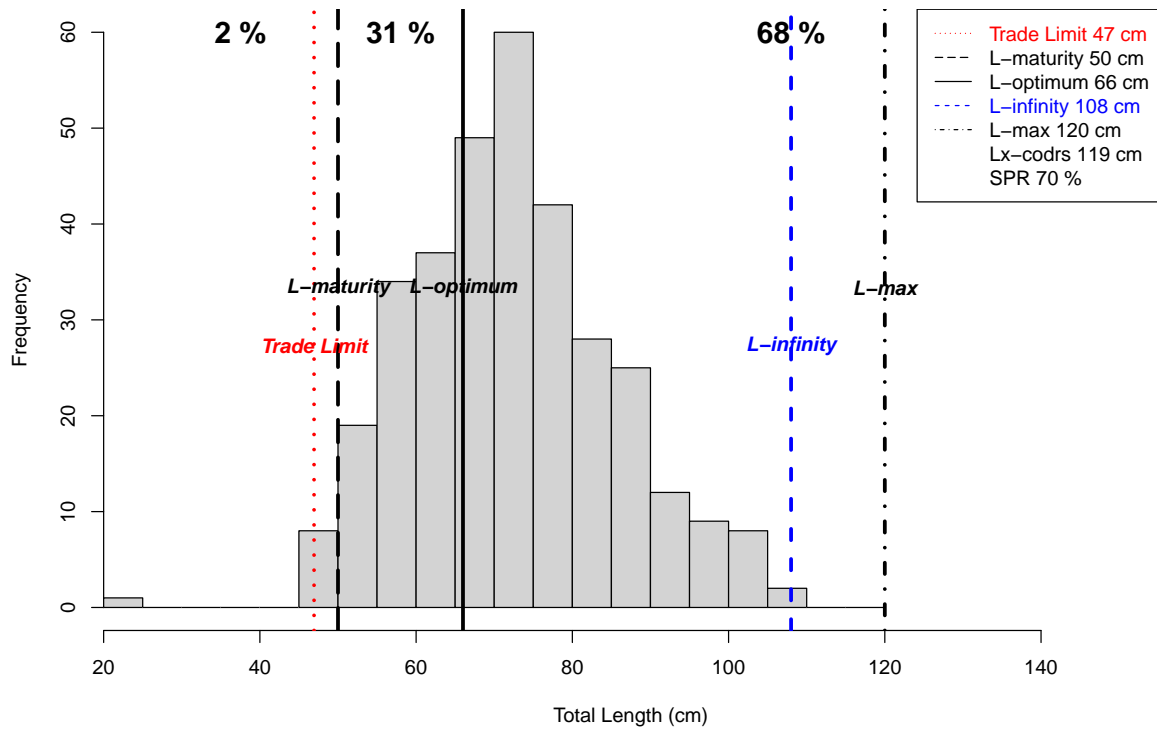
% Immature falling over recent years, situation improving. P: 0.041

% Large Mature rising over recent years, situation improving. P: 0.221

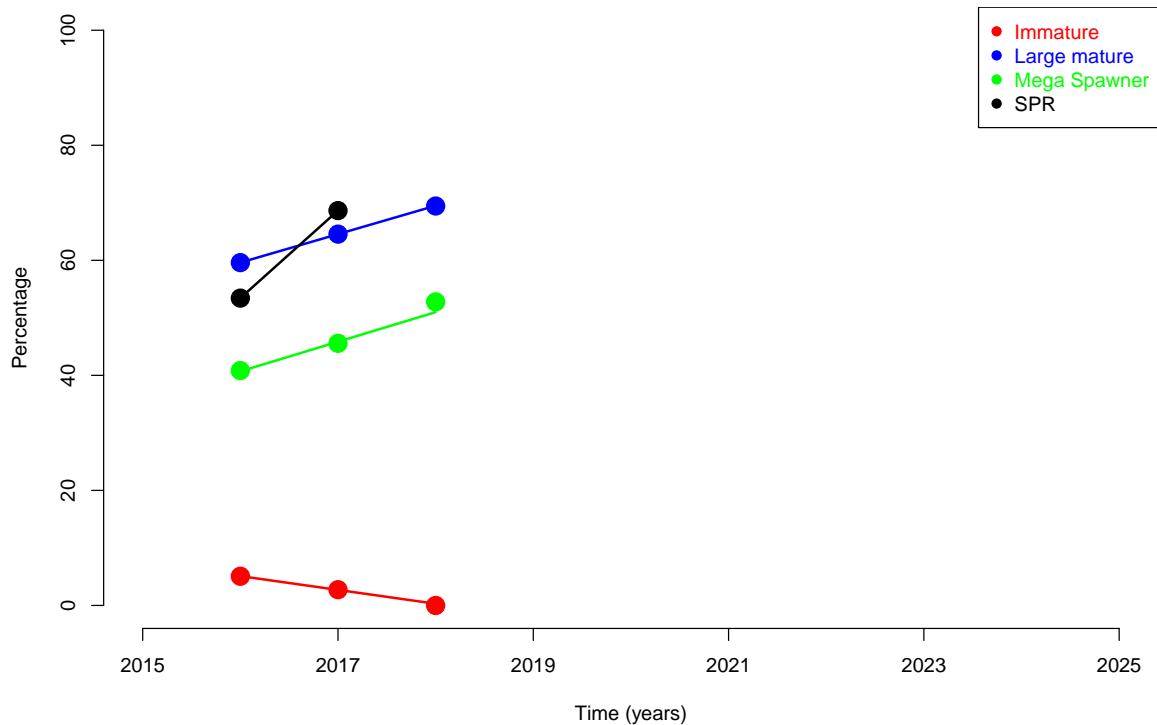
% Mega Spawner rising over recent years, situation improving. P: 0.253

% SPR rising over recent years, situation improving. P: not available

Catch length frequency for *Epinephelus coioides* (ID #50, Epinephelidae), n = 334
 Most Recent 365 Days



Trends in relative abundance by size group for *Epinephelus coioides* (ID #50, Epinephelidae)



The percentages of *Epinephelus coioides* (ID #50, Epinephelidae) in most recent 365 days, n=334
Immature (< 50cm): 2%
Small mature (\geq 50cm, < 66cm): 31%
Large mature (\geq 66cm): 68%
Mega spawner (\geq 72.6cm): 50% (subset of large mature fish)
Spawning Potential Ratio: 70 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

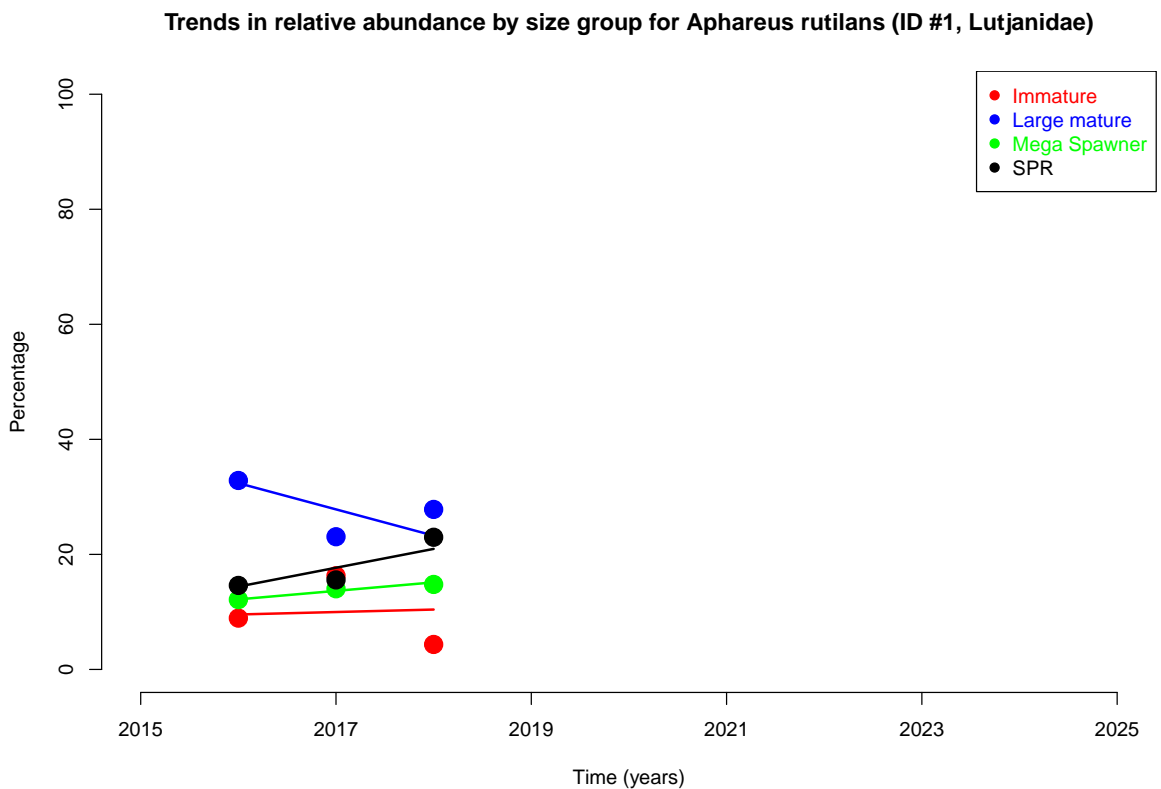
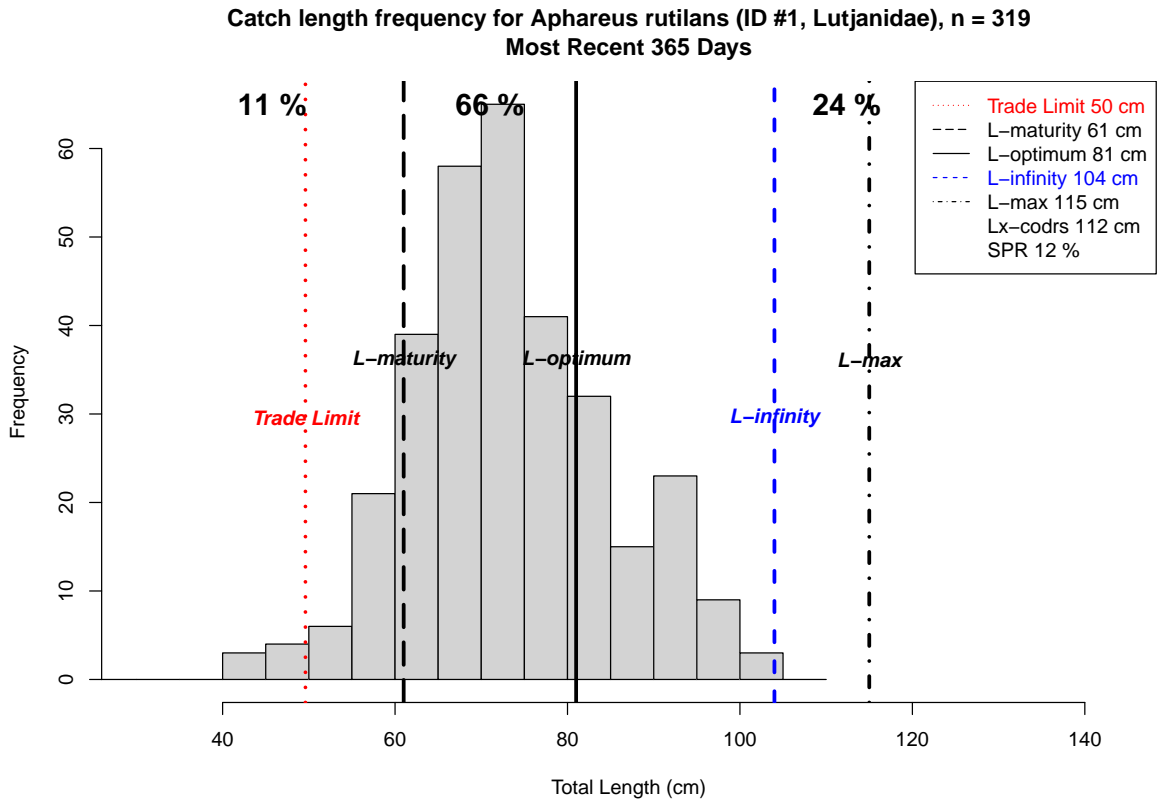
Trends in relative abundance by size group for *Epinephelus coioides* (ID #50, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.031

% Large Mature rising over recent years, situation improving. P: 0.003

% Mega Spawner rising over recent years, situation improving. P: 0.088

% SPR rising over recent years, situation improving. P: not available



The percentages of *Aphareus rutilans* (ID #1, Lutjanidae) in most recent 365 days, n=319
Immature (< 61cm): 11%
Small mature (\geq 61cm, < 81cm): 66%
Large mature (\geq 81cm): 24%
Mega spawner (\geq 89.1cm): 13% (subset of large mature fish)
Spawning Potential Ratio: 12 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 10% and 20% of the fish in the catch are juveniles that have not yet reproduced. There is no immediate concern in terms of overfishing through over harvesting of juveniles, but the fishery needs to be monitored closely for any further increase in this indicator and incentives need to be geared towards targeting larger fish. Risk level is medium.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

Trends in relative abundance by size group for *Aphareus rutilans* (ID #1, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

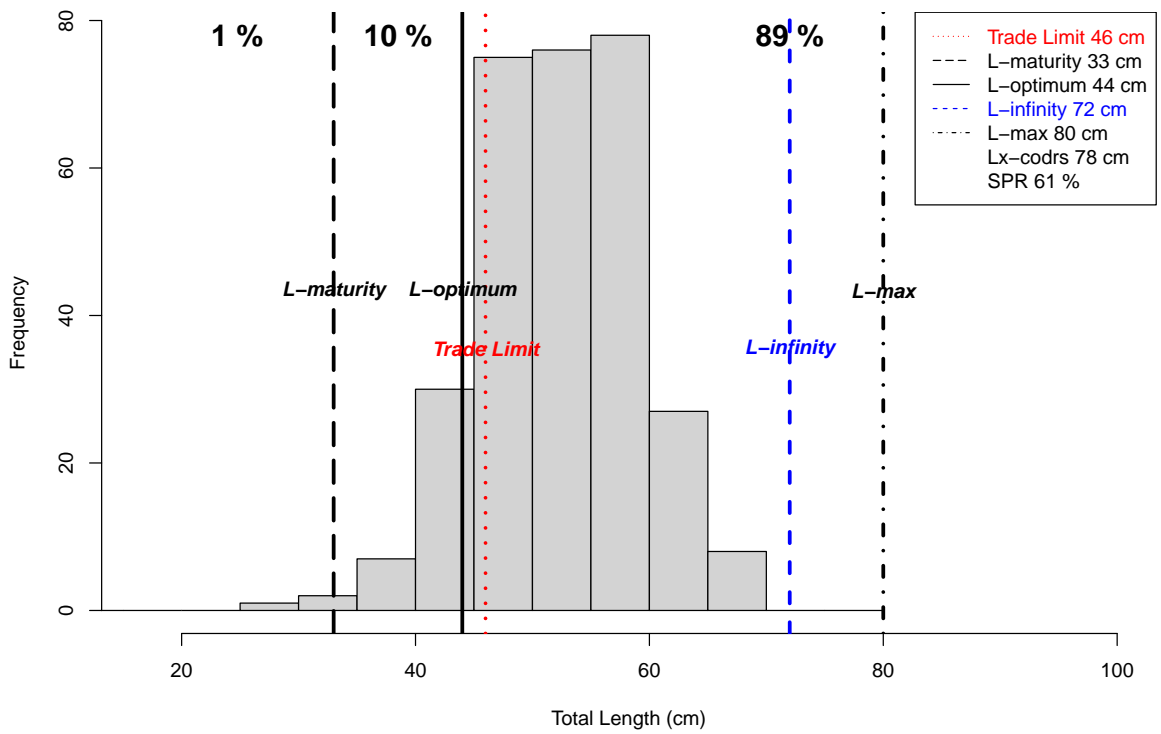
% Immature rising over recent years, situation deteriorating. P: 0.945

% Large Mature falling over recent years, situation deteriorating. P: 0.438

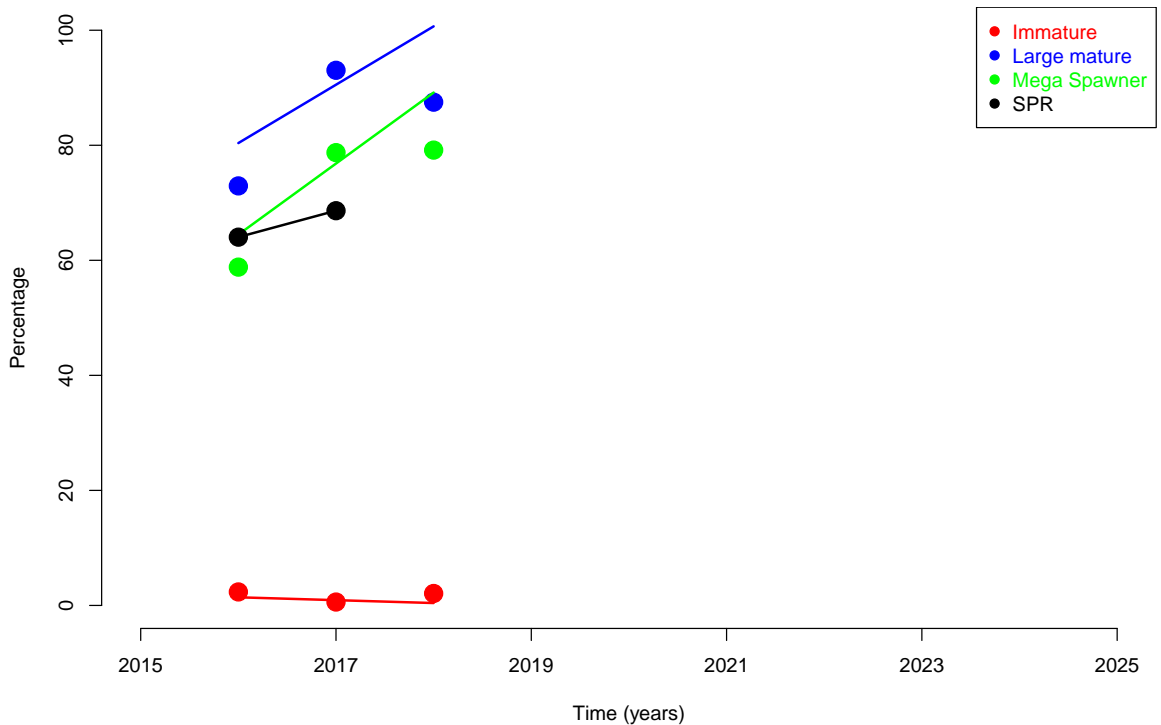
% Mega Spawner rising over recent years, situation improving. P: 0.124

% SPR rising over recent years, situation improving. P: 0.300

Catch length frequency for *Epinephelus amblycephalus* (ID #58, Epinephelidae), n = 304
 Most Recent 365 Days



Trends in relative abundance by size group for *Epinephelus amblycephalus* (ID #58, Epinephelidae)



The percentages of *Epinephelus amblycephalus* (ID #58, Epinephelidae) in most recent 365 days, n=304

Immature (< 33cm): 1%

Small mature (>= 33cm, < 44cm): 10%

Large mature (>= 44cm): 89%

Mega spawner (>= 48.4cm): 74% (subset of large mature fish)

Spawning Potential Ratio: 61 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

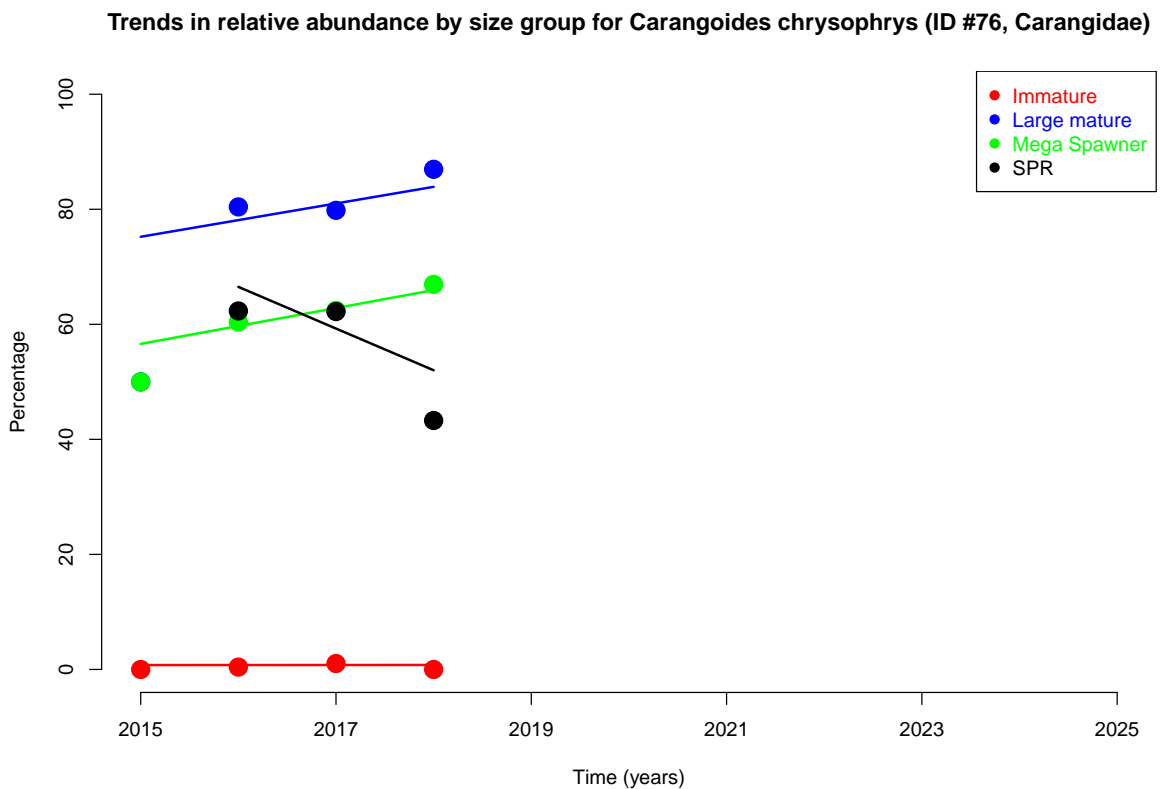
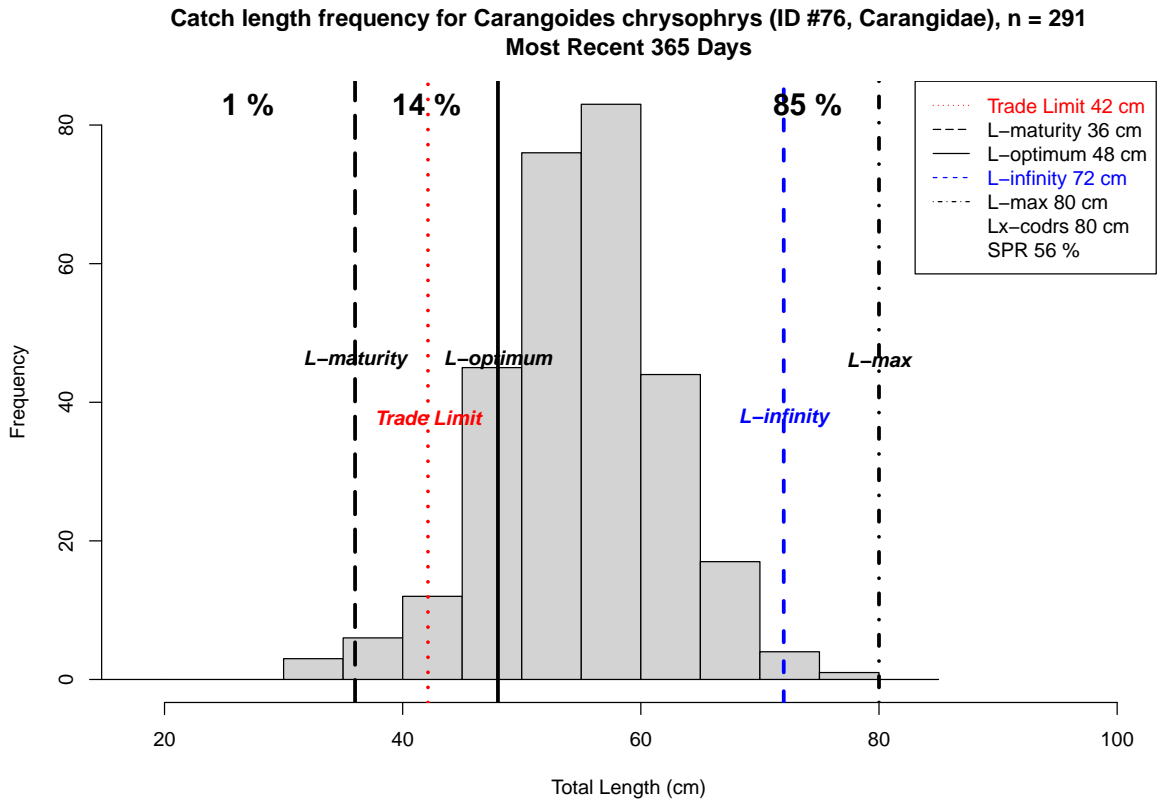
Trends in relative abundance by size group for *Epinephelus amblycephalus* (ID #58, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.784

% Large Mature rising over recent years, situation improving. P: 0.529

% Mega Spawner rising over recent years, situation improving. P: 0.382

% SPR rising over recent years, situation improving. P: not available



The percentages of *Carangoides chrysophrys* (ID #76, Carangidae) in most recent 365 days, n=291
Immature (< 36cm): 1%
Small mature (\geq 36cm, < 48cm): 14%
Large mature (\geq 48cm): 85%
Mega spawner (\geq 52.8cm): 67% (subset of large mature fish)
Spawning Potential Ratio: 56 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Carangoides chrysophrys* (ID #76, Carangidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

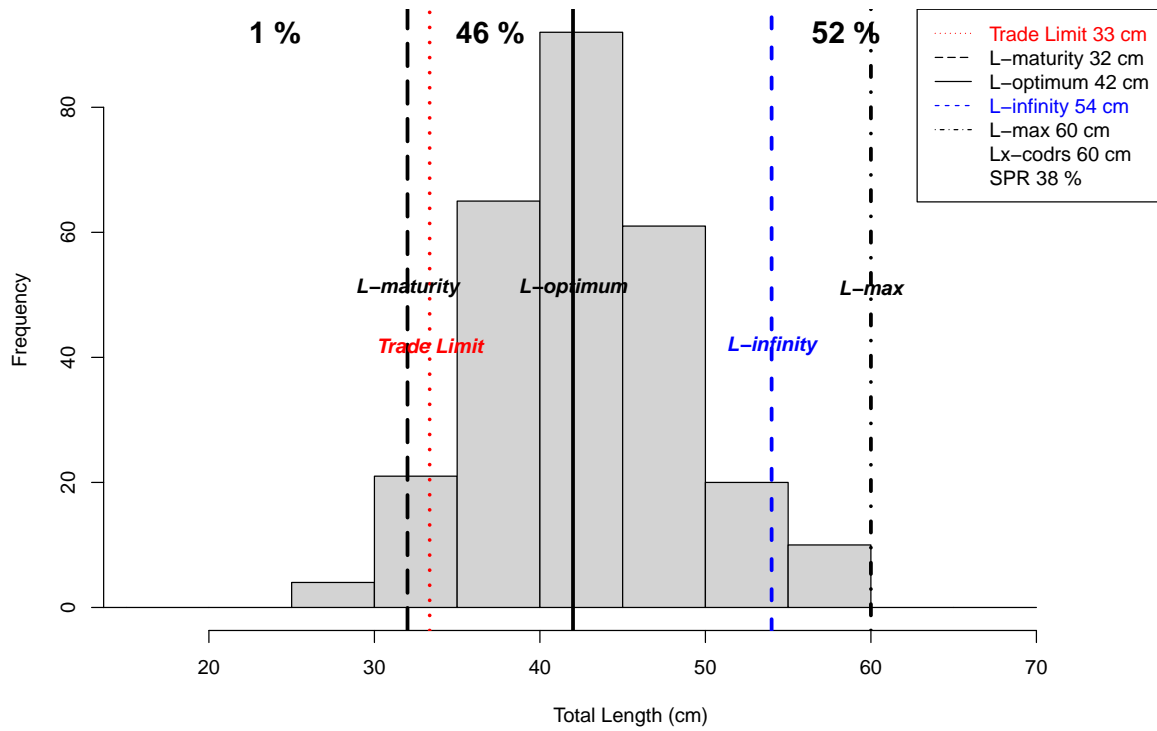
% Immature no trend over recent years, situation stable. P: 0.989

% Large Mature rising over recent years, situation improving. P: 0.420

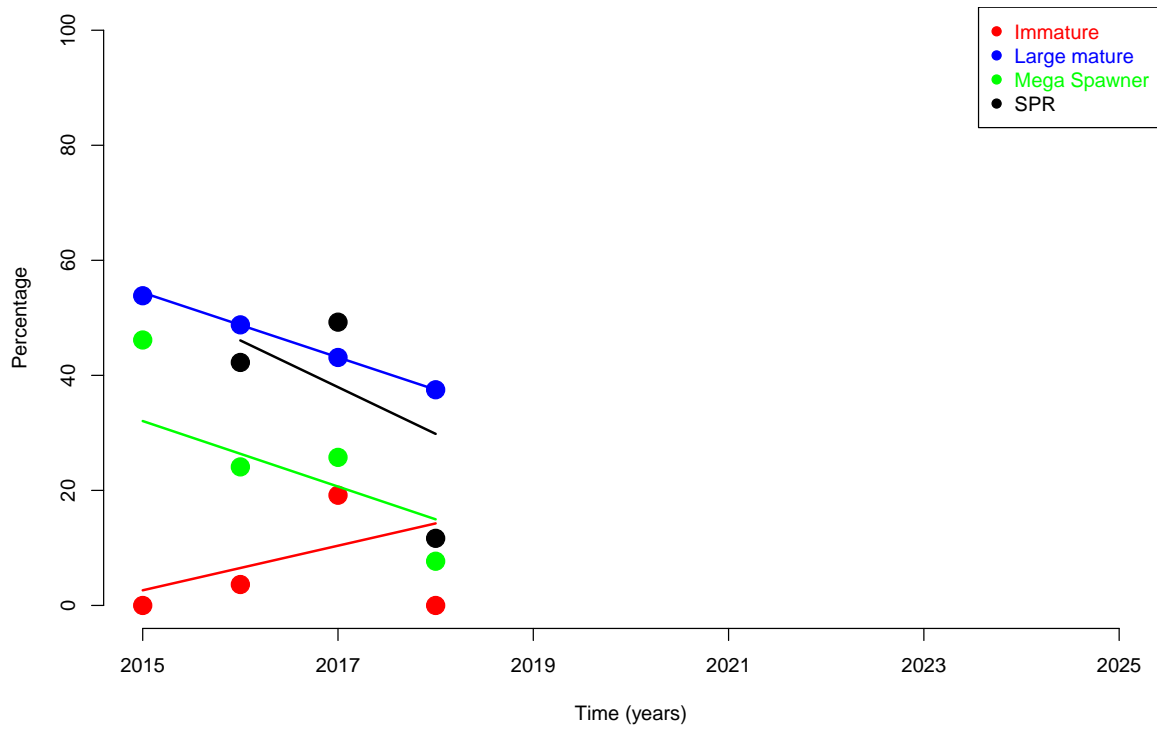
% Mega Spawner rising over recent years, situation improving. P: 0.067

% SPR falling over recent years, situation deteriorating. P: 0.509

Catch length frequency for *Lutjanus timorensis* (ID #19, Lutjanidae), n = 273
 Most Recent 365 Days



Trends in relative abundance by size group for *Lutjanus timorensis* (ID #19, Lutjanidae)



The percentages of *Lutjanus timorensis* (ID #19, Lutjanidae) in most recent 365 days, n=273
Immature (< 32cm): 1%
Small mature (\geq 32cm, < 42cm): 46%
Large mature (\geq 42cm): 52%
Mega spawner (\geq 46.2cm): 27% (subset of large mature fish)
Spawning Potential Ratio: 38 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

The percentage of mega spawners is between 20 and 30%. There is no immediate reason for concern, though fishing pressure may be significantly reducing the percentage of mega-spawners, which may negatively affect the reproductive output of this population. Risk level is medium.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

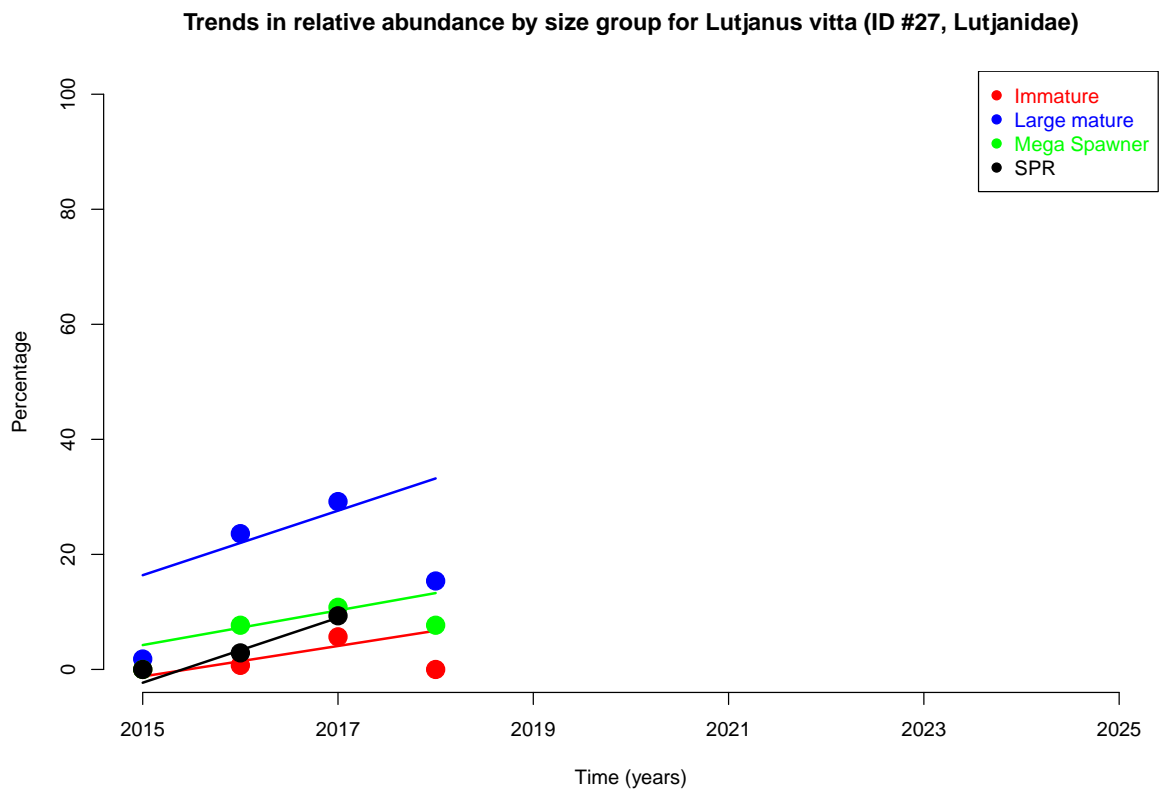
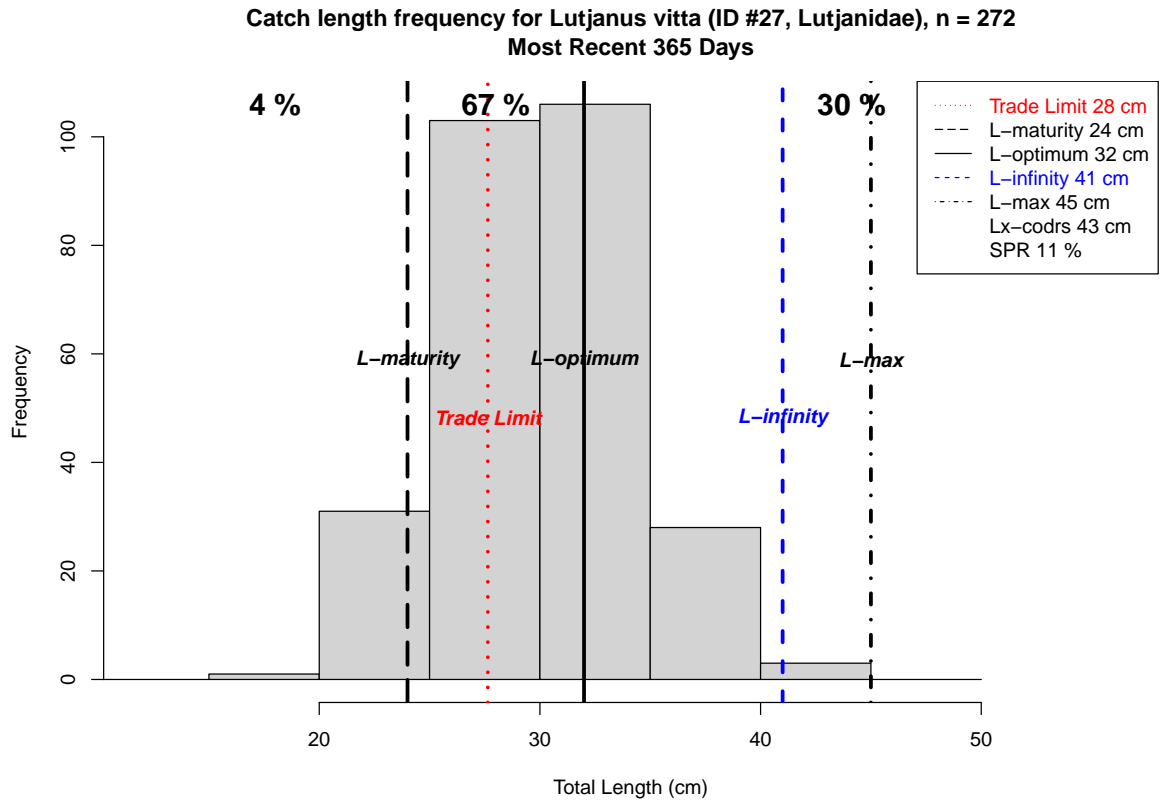
Trends in relative abundance by size group for *Lutjanus timorensis* (ID #19, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.652

% Large Mature falling over recent years, situation deteriorating. P: 0.000

% Mega Spawner falling over recent years, situation deteriorating. P: 0.337

% SPR falling over recent years, situation deteriorating. P: 0.664



The percentages of *Lutjanus vitta* (ID #27, Lutjanidae) in most recent 365 days, n=272
Immature (< 24cm): 4%
Small mature (\geq 24cm, < 32cm): 67%
Large mature (\geq 32cm): 30%
Mega spawner (\geq 35.2cm): 11% (subset of large mature fish)
Spawning Potential Ratio: 11 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

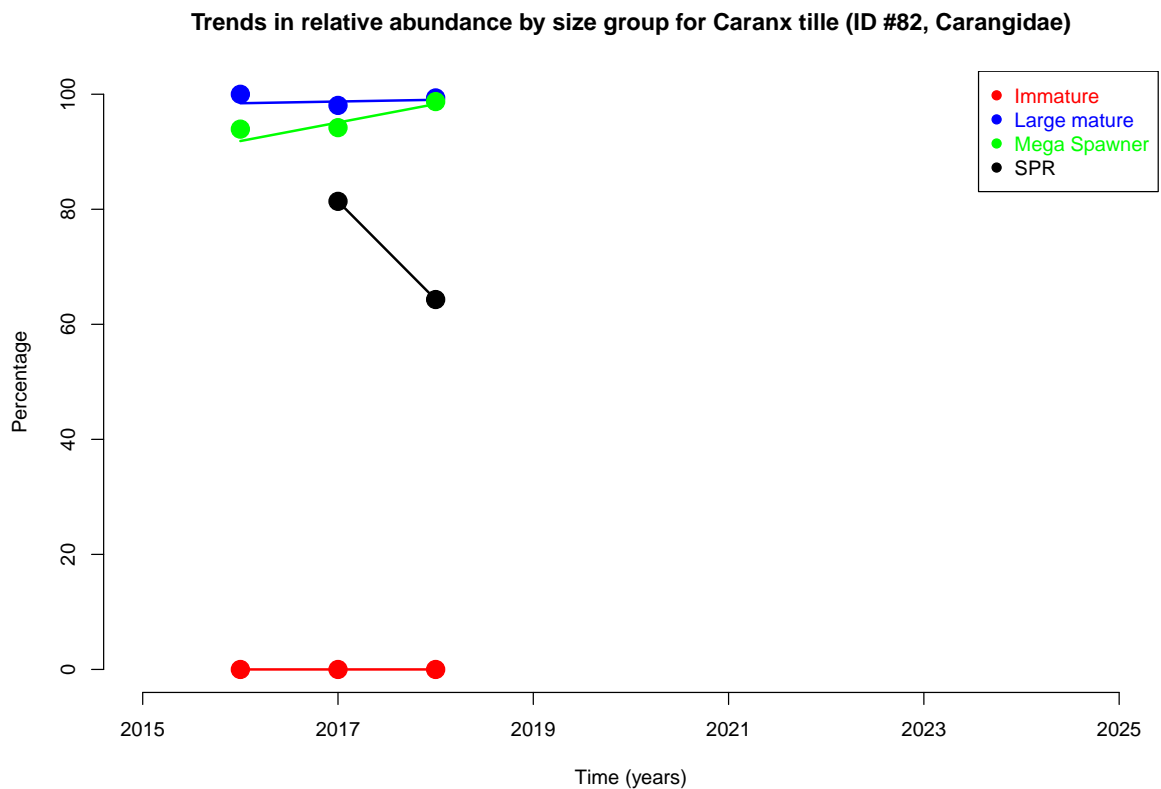
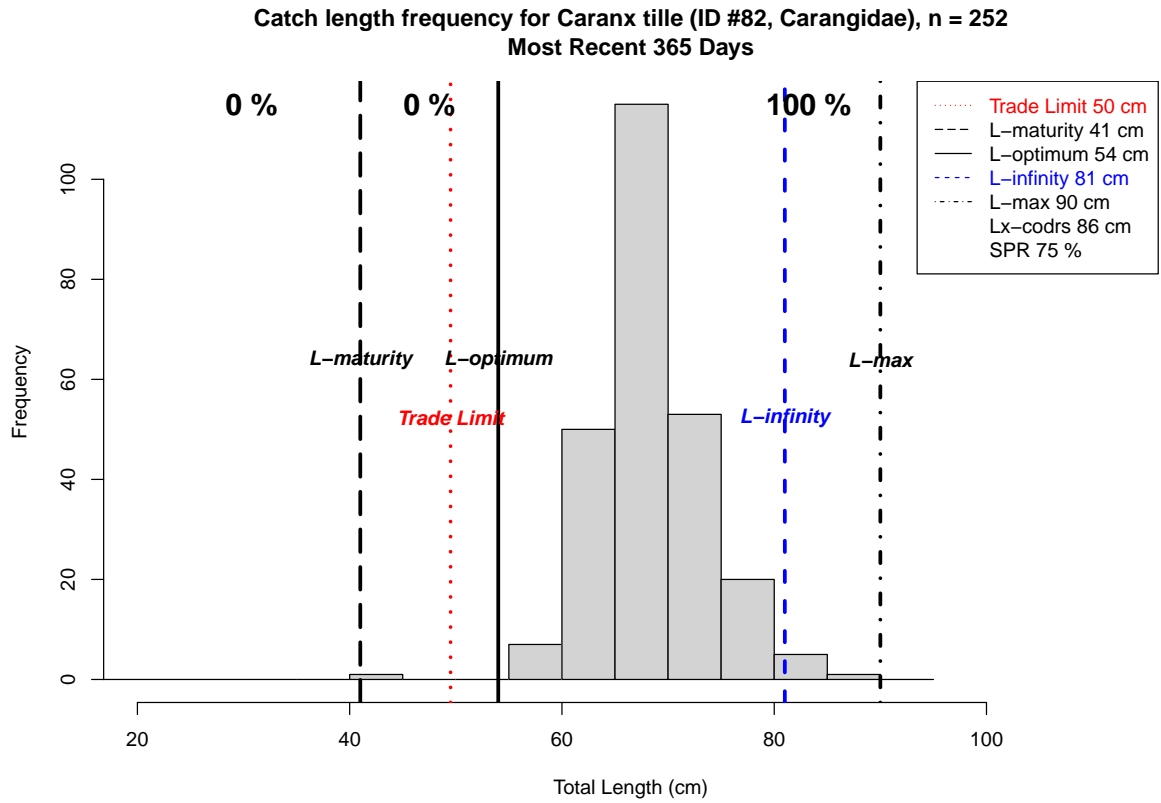
Trends in relative abundance by size group for *Lutjanus vitta* (ID #27, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.296

% Large Mature rising over recent years, situation improving. P: 0.419

% Mega Spawner rising over recent years, situation improving. P: 0.214

% SPR rising over recent years, situation improving. P: 0.132



The percentages of *Caranx tille* (ID #82, Carangidae) in most recent 365 days, n=252
Immature (< 41cm): 0%
Small mature (\geq 41cm, < 54cm): 0%
Large mature (\geq 54cm): 100%
Mega spawner (\geq 59.4cm): 98% (subset of large mature fish)
Spawning Potential Ratio: 75 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

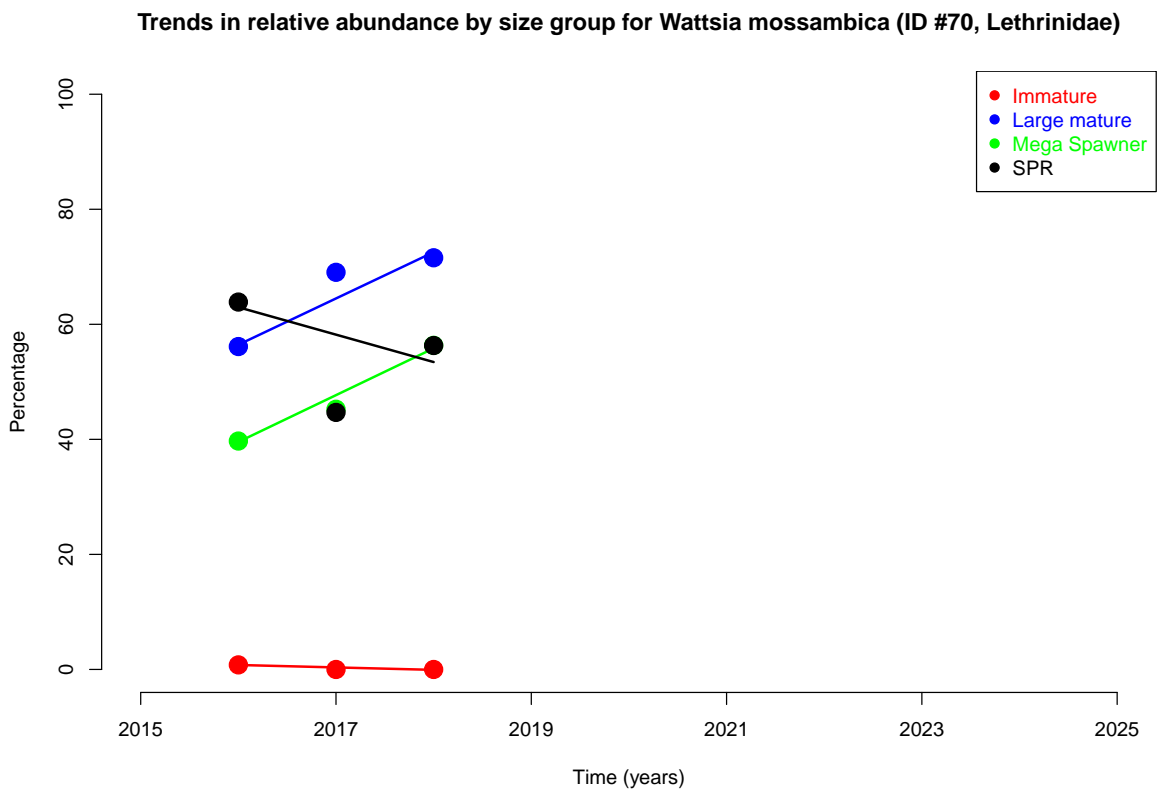
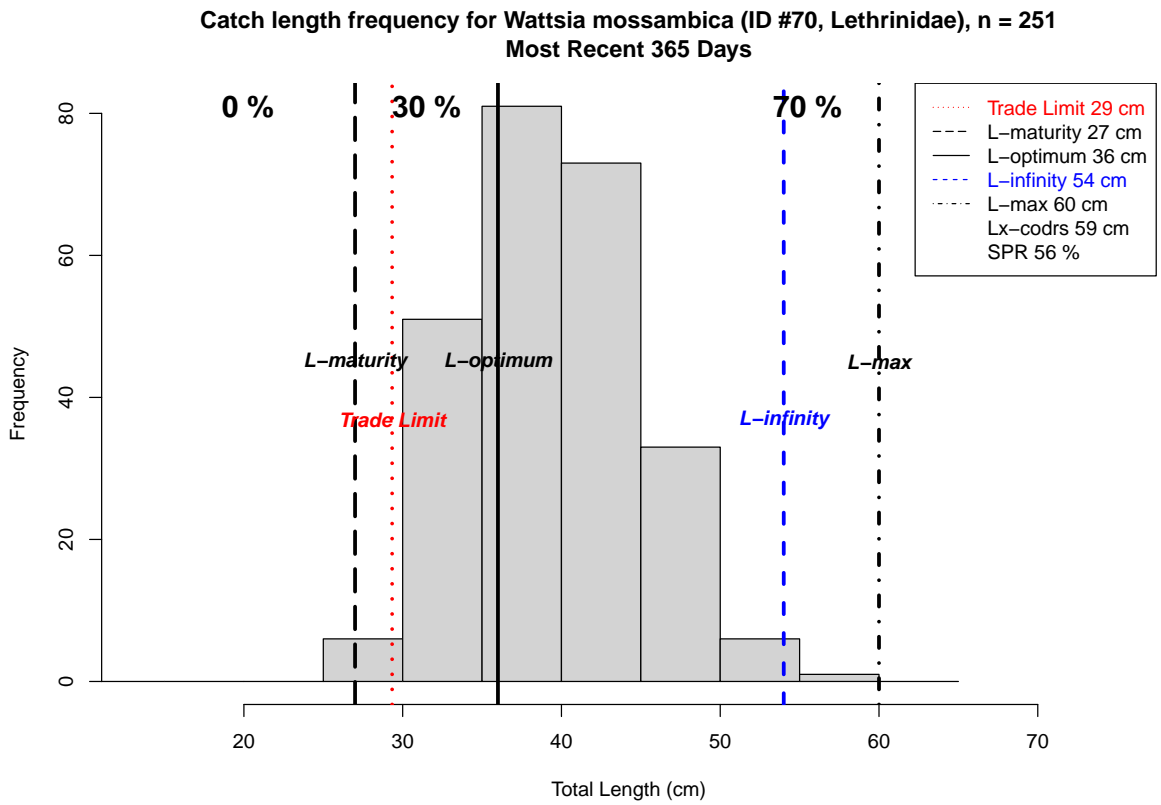
The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Caranx tille* (ID #82, Carangidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: not available
% Large Mature rising over recent years, situation improving. P: 0.826
% Mega Spawner rising over recent years, situation improving. P: 0.265
% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Wattsia mossambica* (ID #70, Lethrinidae) in most recent 365 days, n=251
Immature (< 27cm): 0%
Small mature (\geq 27cm, < 36cm): 30%
Large mature (\geq 36cm): 70%
Mega spawner (\geq 39.6cm): 53% (subset of large mature fish)
Spawning Potential Ratio: 56 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

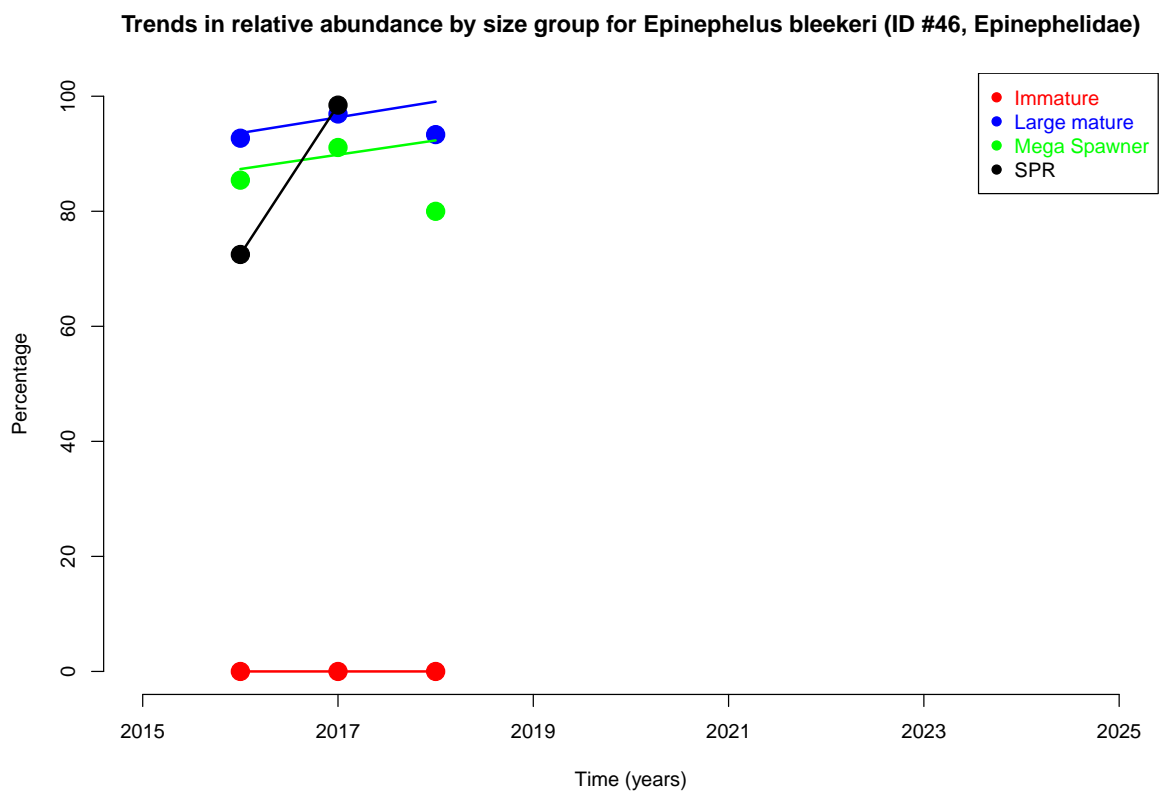
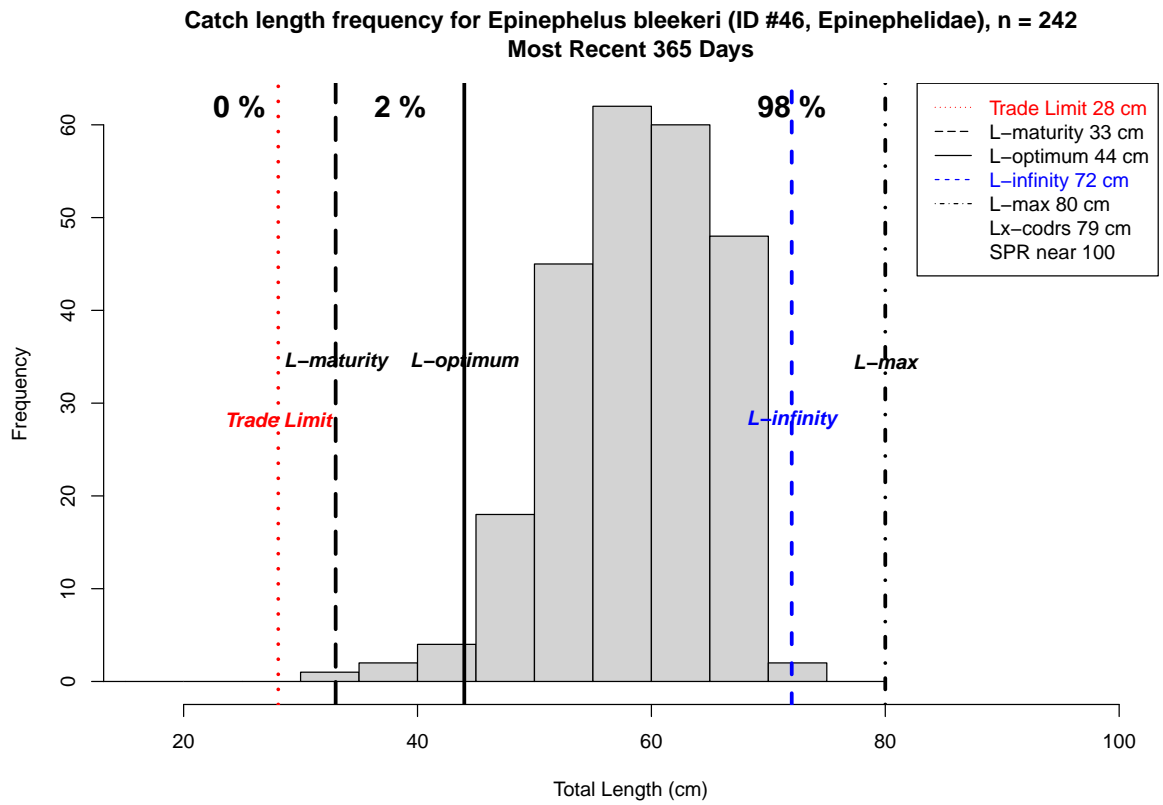
Trends in relative abundance by size group for *Wattsia mossambica* (ID #70, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.199

% Large Mature rising over recent years, situation improving. P: 0.139

% Mega Spawner rising over recent years, situation improving. P: 0.075

% SPR falling over recent years, situation deteriorating. P: 0.534



The percentages of *Epinephelus bleekeri* (ID #46, Epinephelidae) in most recent 365 days, n=242
Immature (< 33cm): 0%
Small mature (\geq 33cm, < 44cm): 2%
Large mature (\geq 44cm): 98%
Mega spawner (\geq 48.4cm): 94% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

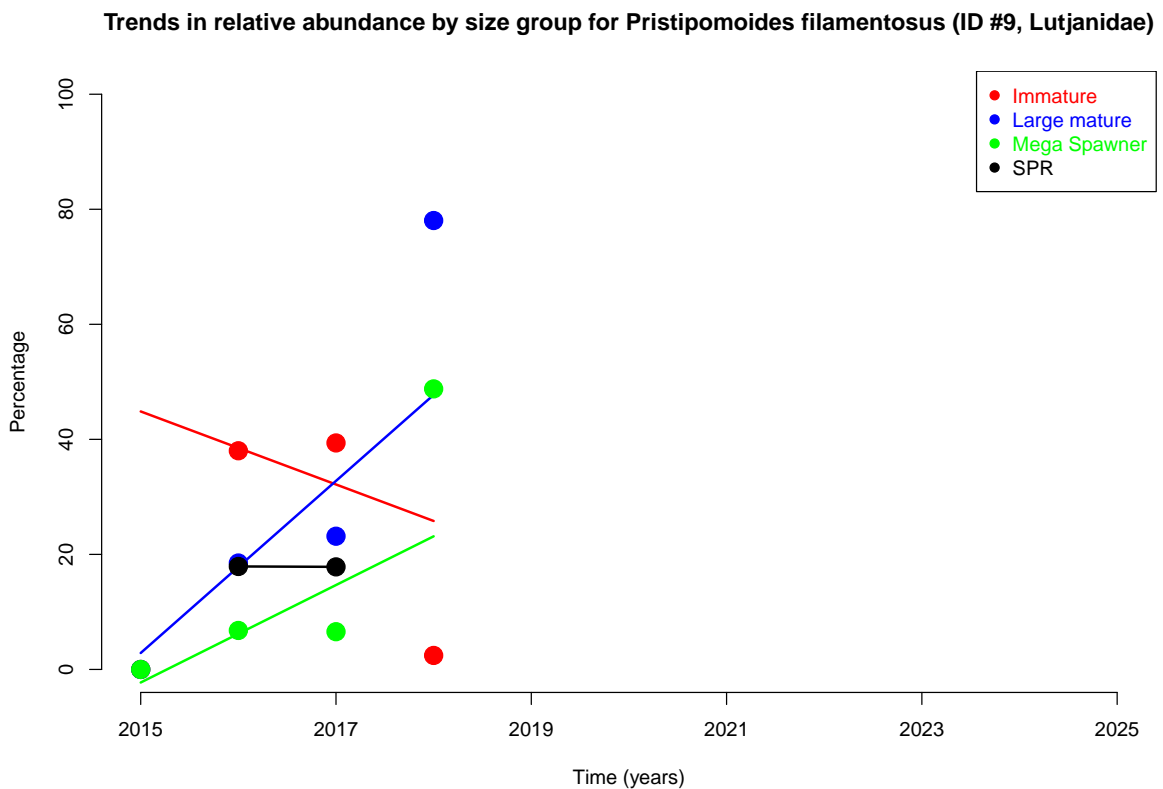
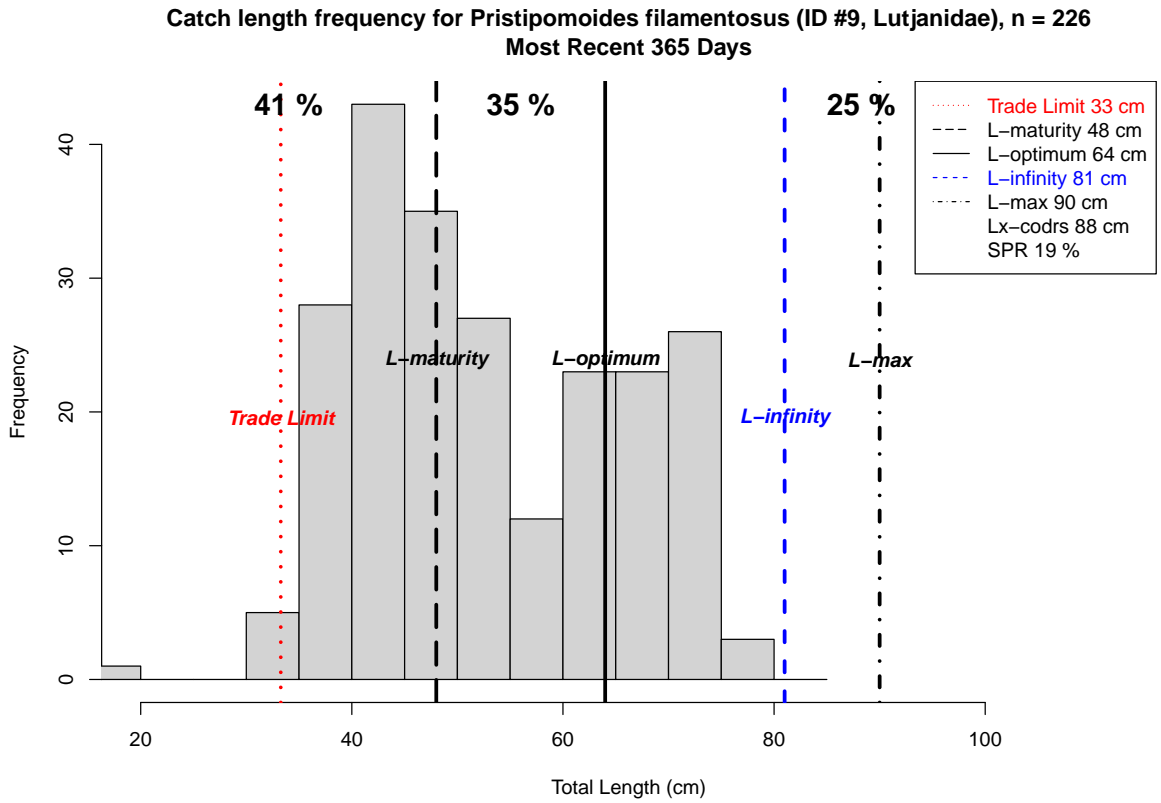
Trends in relative abundance by size group for *Epinephelus bleekeri* (ID #46, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.492

% Mega Spawner rising over recent years, situation improving. P: 0.739

% SPR rising over recent years, situation improving. P: not available



The percentages of *Pristipomoides filamentosus* (ID #9, Lutjanidae) in most recent 365 days, n=226
Immature (< 48cm): 41%
Small mature (\geq 48cm, < 64cm): 35%
Large mature (\geq 64cm): 25%
Mega spawner (\geq 70.4cm): 13% (subset of large mature fish)
Spawning Potential Ratio: 19 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

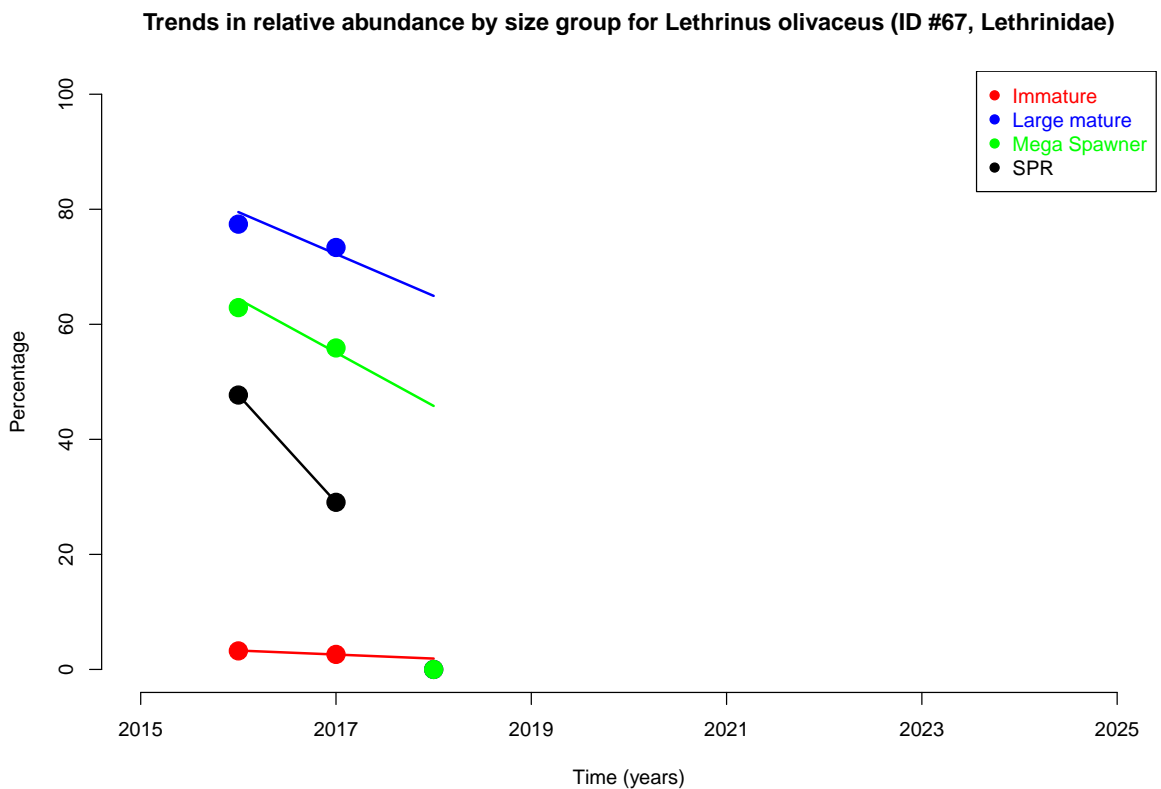
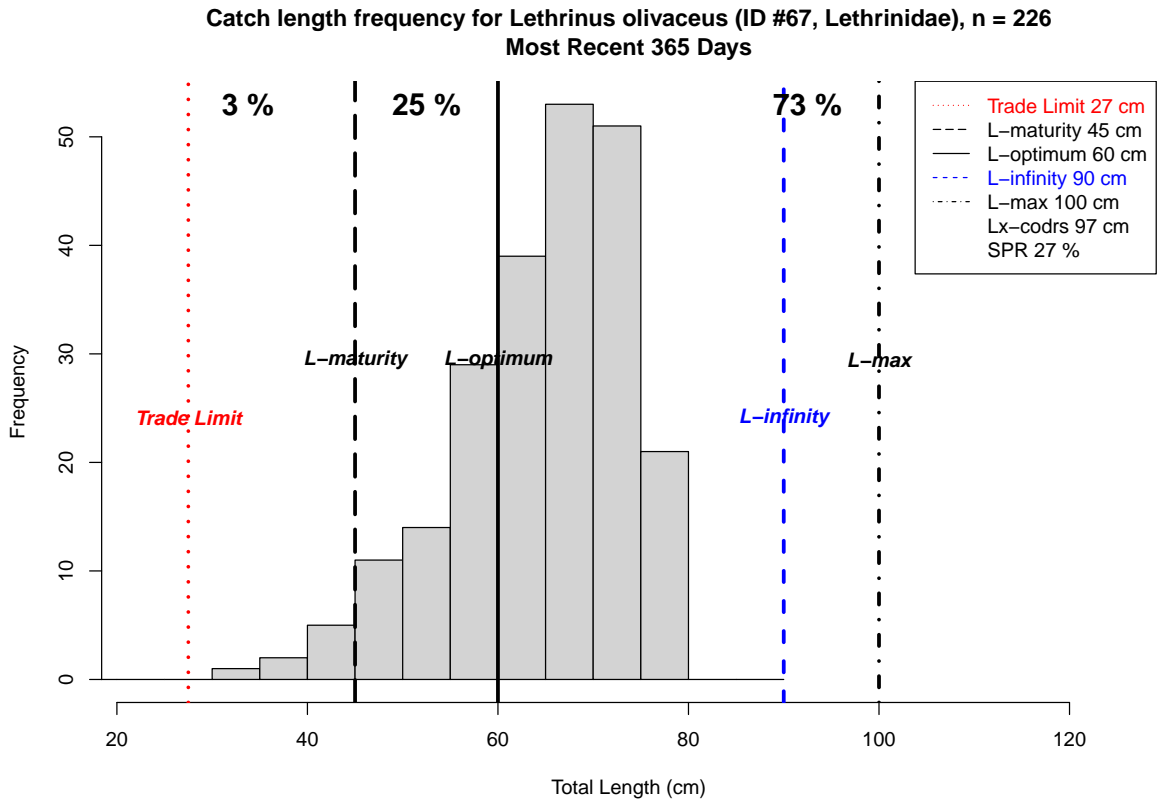
Trends in relative abundance by size group for *Pristipomoides filamentosus* (ID #9, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.471

% Large Mature rising over recent years, situation improving. P: 0.246

% Mega Spawner rising over recent years, situation improving. P: 0.390

% SPR no trend over recent years, situation stable. P: not available



The percentages of *Lethrinus olivaceus* (ID #67, Lethrinidae) in most recent 365 days, n=226
Immature (< 45cm): 3%
Small mature (\geq 45cm, < 60cm): 25%
Large mature (\geq 60cm): 73%
Mega spawner (\geq 66cm): 55% (subset of large mature fish)
Spawning Potential Ratio: 27 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

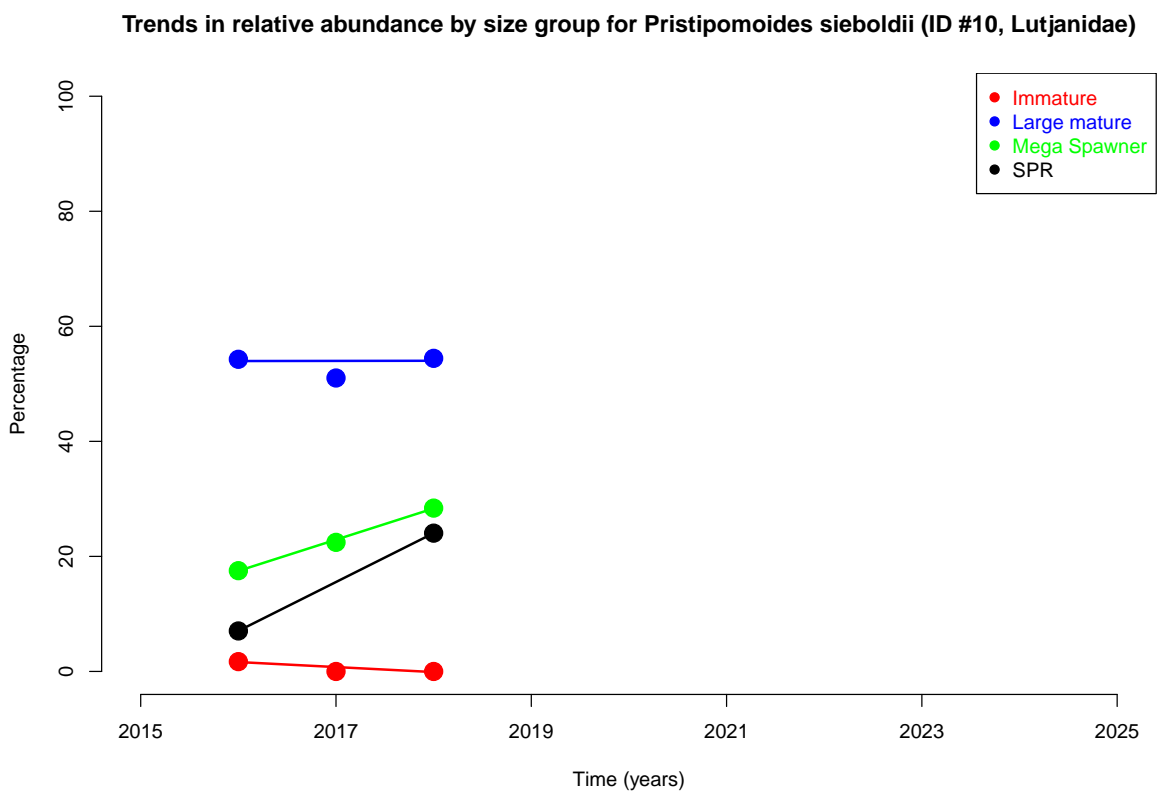
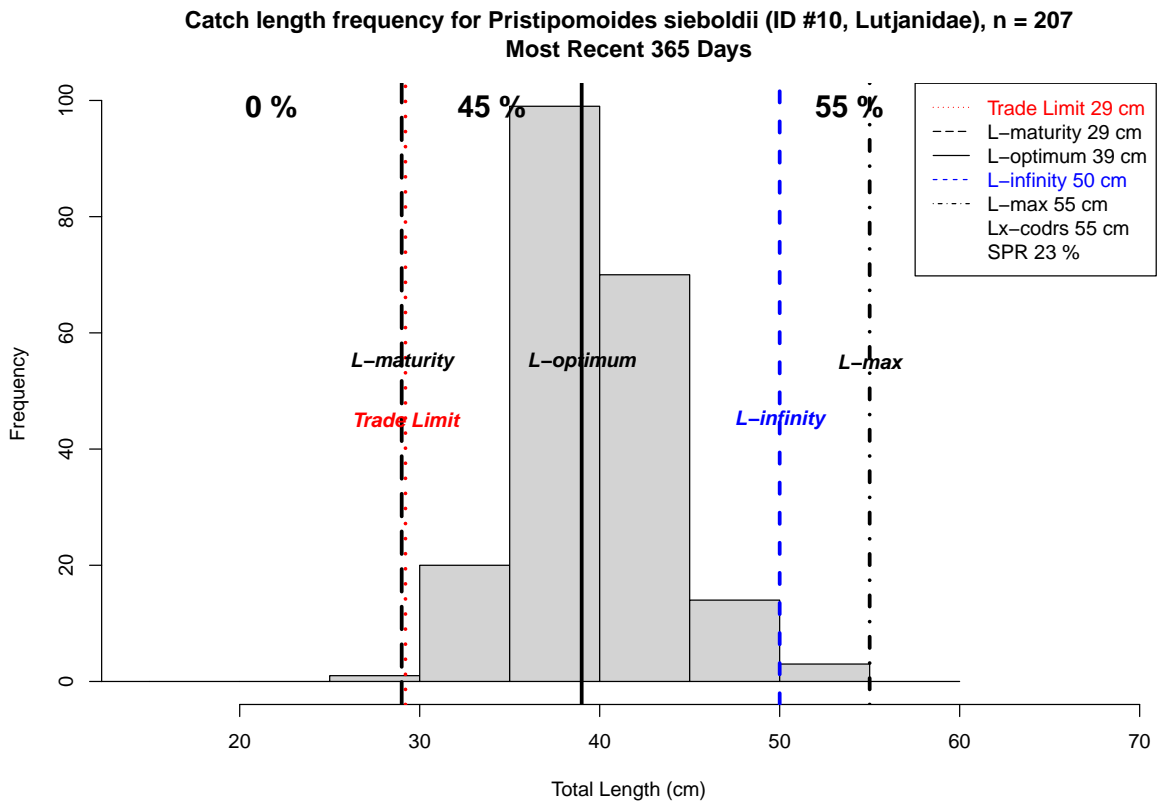
Trends in relative abundance by size group for *Lethrinus olivaceus* (ID #67, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.319

% Large Mature falling over recent years, situation deteriorating. P: 0.679

% Mega Spawner falling over recent years, situation deteriorating. P: 0.501

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Pristipomoides sieboldii* (ID #10, Lutjanidae) in most recent 365 days, n=207
Immature (< 29cm): 0%
Small mature (\geq 29cm, < 39cm): 45%
Large mature (\geq 39cm): 55%
Mega spawner (\geq 42.9cm): 28% (subset of large mature fish)
Spawning Potential Ratio: 23 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

The percentage of mega spawners is between 20 and 30%. There is no immediate reason for concern, though fishing pressure may be significantly reducing the percentage of mega-spawners, which may negatively affect the reproductive output of this population. Risk level is medium.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

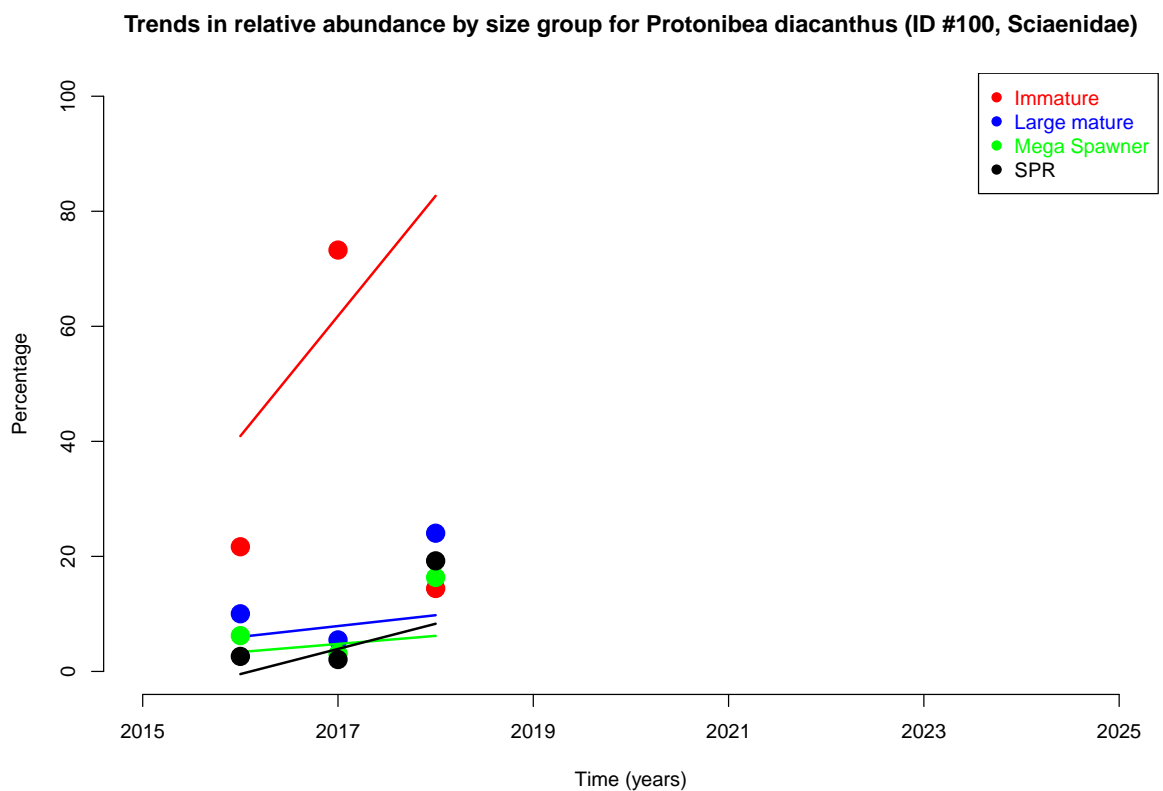
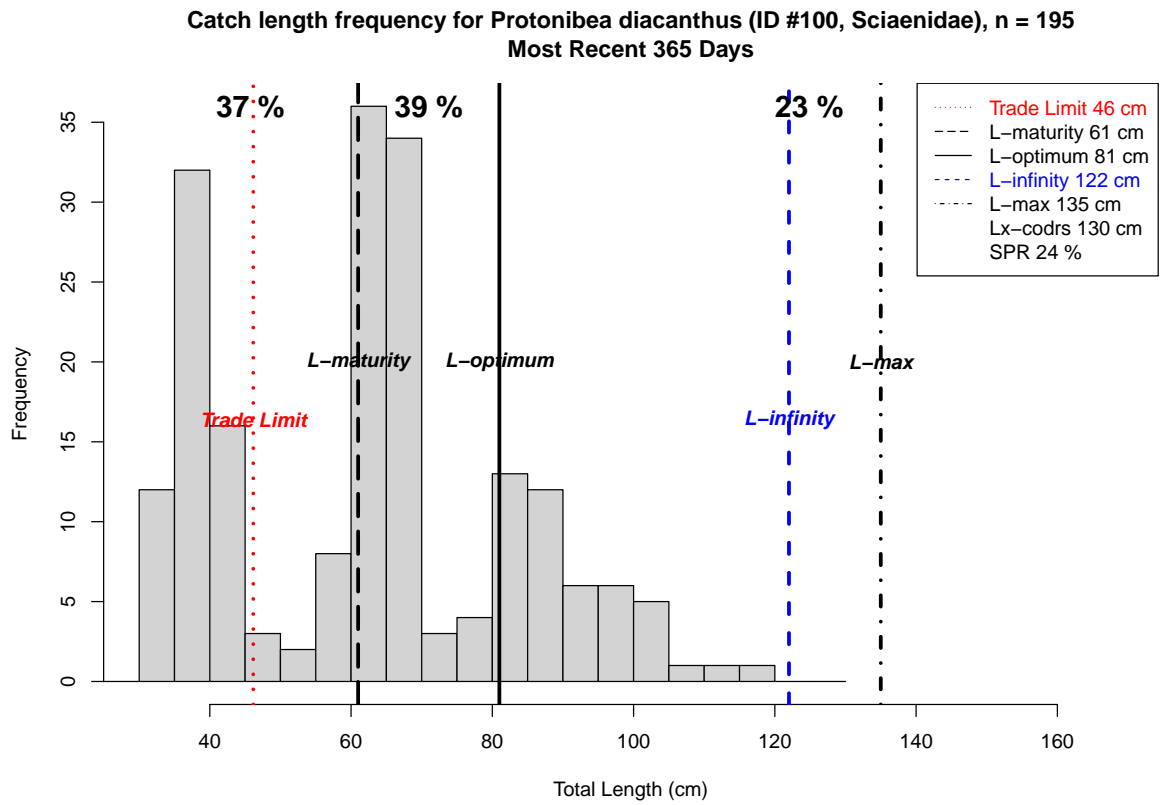
Trends in relative abundance by size group for *Pristipomoides sieboldii* (ID #10, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.201

% Large Mature no trend over recent years, situation stable. P: 0.987

% Mega Spawner rising over recent years, situation improving. P: 0.020

% SPR rising over recent years, situation improving. P: not available



The percentages of *Protonibea diacanthus* (ID #100, Sciaenidae) in most recent 365 days, n=195
Immature (< 61cm): 37%
Small mature (\geq 61cm, < 81cm): 39%
Large mature (\geq 81cm): 23%
Mega spawner (\geq 89.1cm): 13% (subset of large mature fish)
Spawning Potential Ratio: 24 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

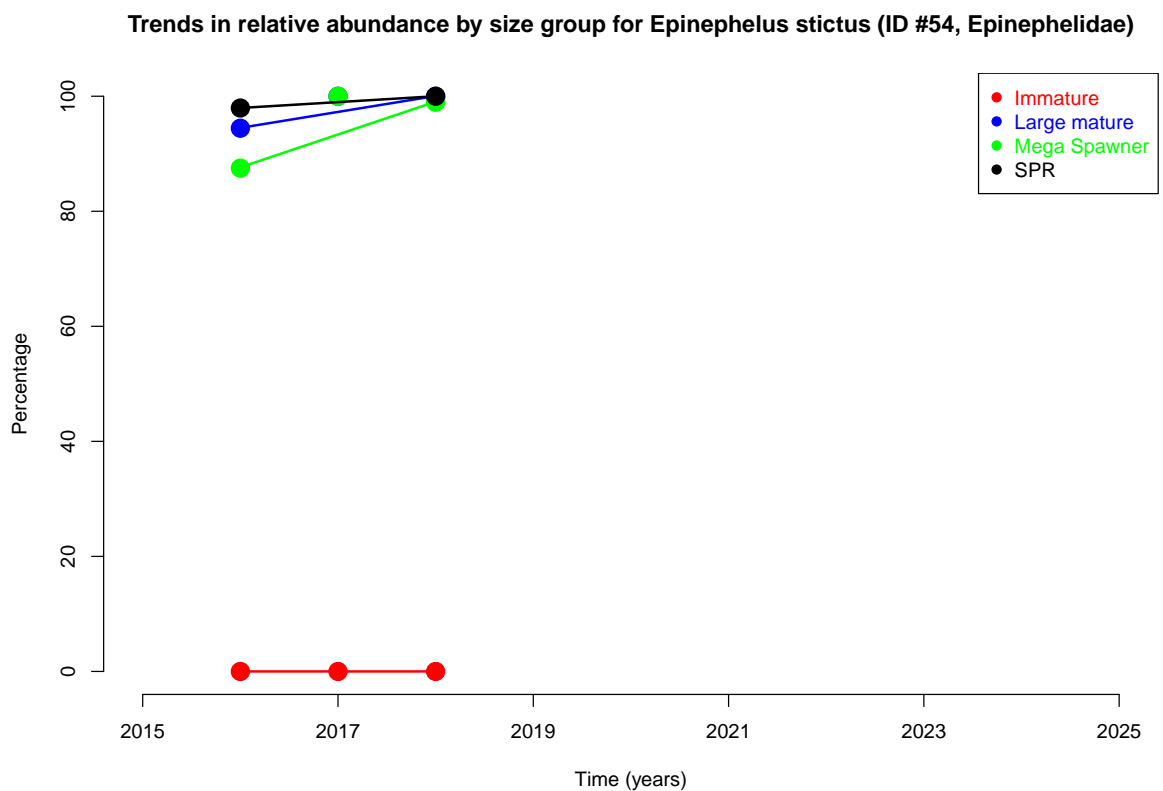
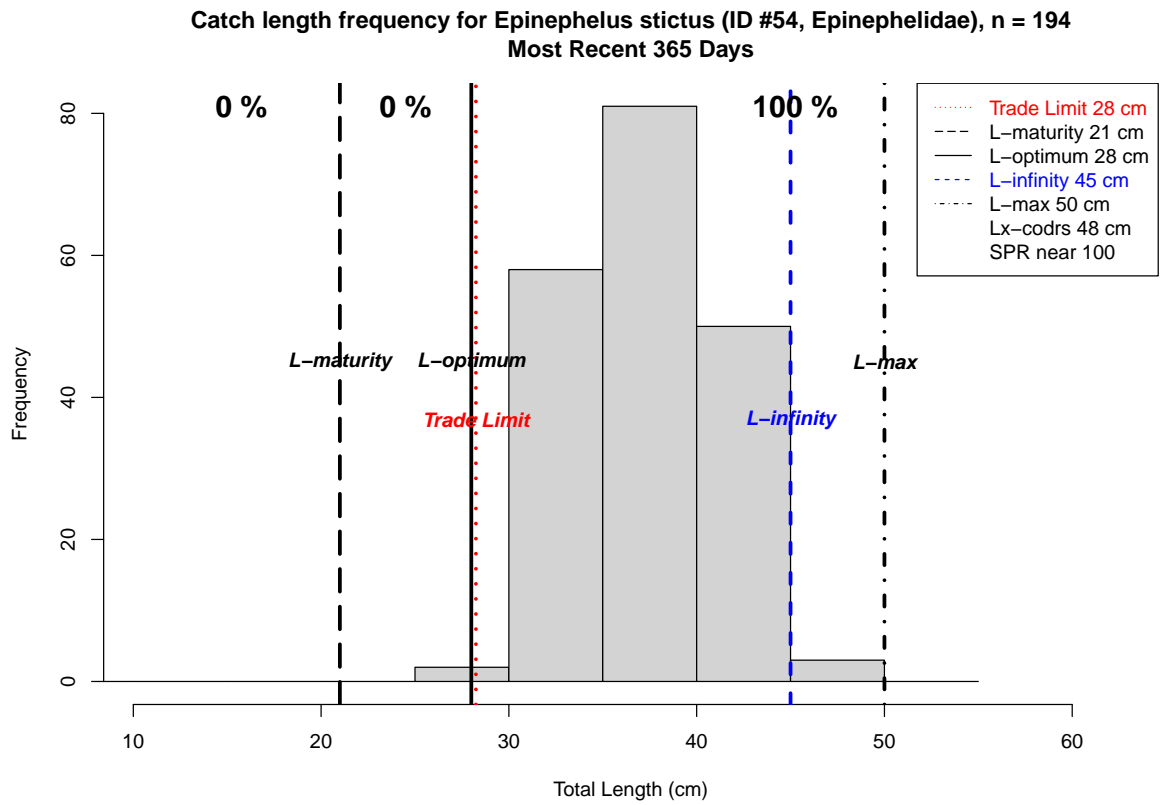
Trends in relative abundance by size group for *Protonibea diacanthus* (ID #100, Sciaenidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.710

% Large Mature rising over recent years, situation improving. P: 0.867

% Mega Spawner rising over recent years, situation improving. P: 0.861

% SPR rising over recent years, situation improving. P: 0.637



The percentages of *Epinephelus stictus* (ID #54, Epinephelidae) in most recent 365 days, n=194
Immature (< 21cm): 0%
Small mature (\geq 21cm, < 28cm): 0%
Large mature (\geq 28cm): 100%
Mega spawner (\geq 30.8cm): 99% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Epinephelus stictus* (ID #54, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

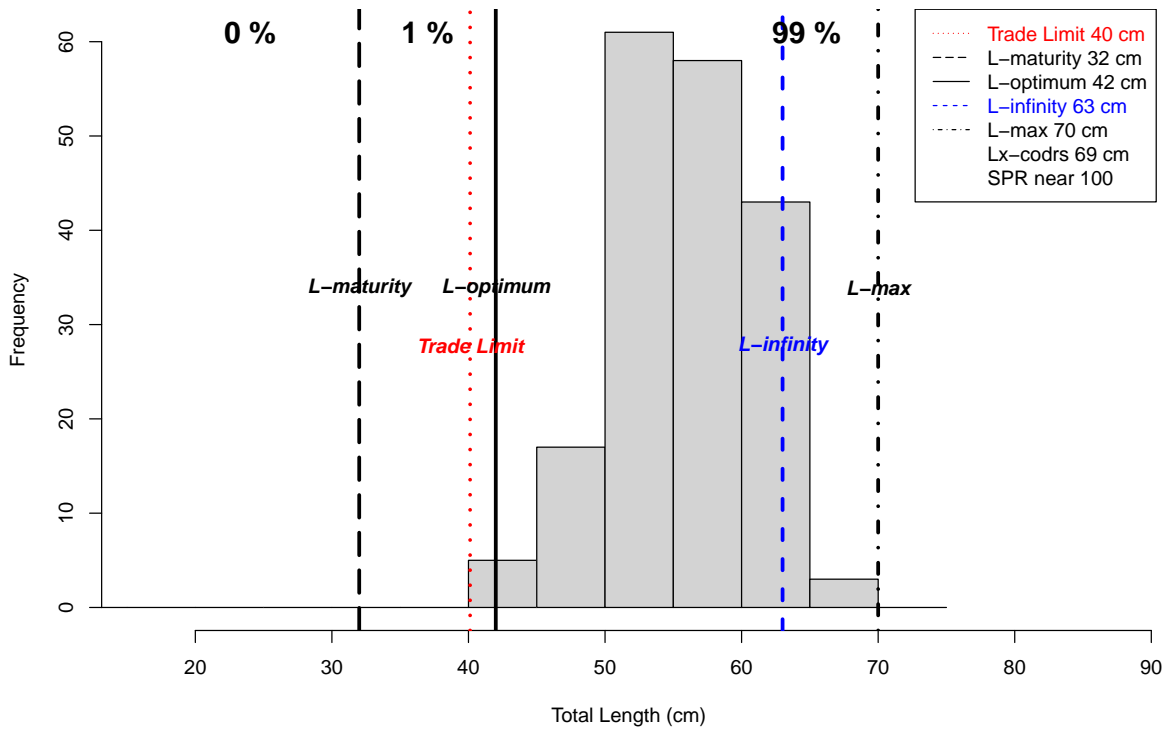
% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.085

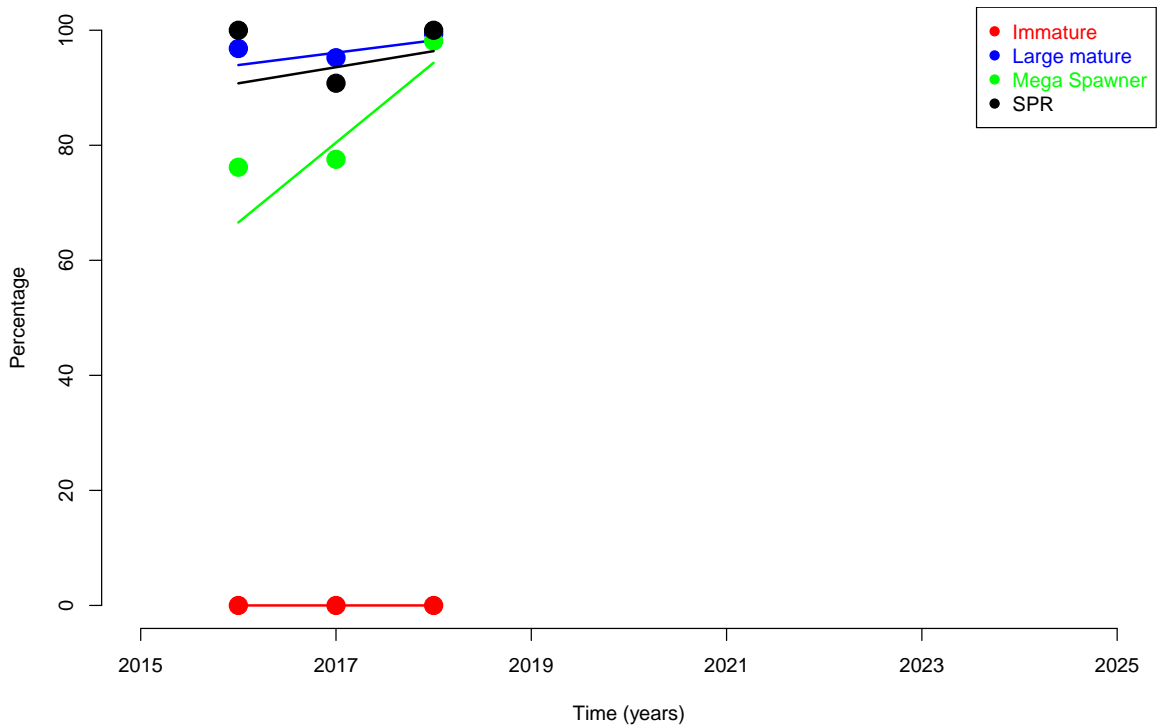
% Mega Spawner rising over recent years, situation improving. P: 0.100

% SPR rising over recent years, situation improving. P: not available

Catch length frequency for *Carangoides coeruleopinnatus* (ID #73, Carangidae), n = 187
 Most Recent 365 Days



Trends in relative abundance by size group for *Carangoides coeruleopinnatus* (ID #73, Carangidae)



The percentages of *Carangoides coeruleopinnatus* (ID #73, Carangidae) in most recent 365 days, n=187

Immature (< 32cm): 0%

Small mature ($\geq 32\text{cm}$, < 42cm): 1%

Large mature ($\geq 42\text{cm}$): 99%

Mega spawner ($\geq 46.2\text{cm}$): 97% (subset of large mature fish)

Spawning Potential Ratio: near 100

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Carangoides coeruleopinnatus* (ID #73, Carangidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

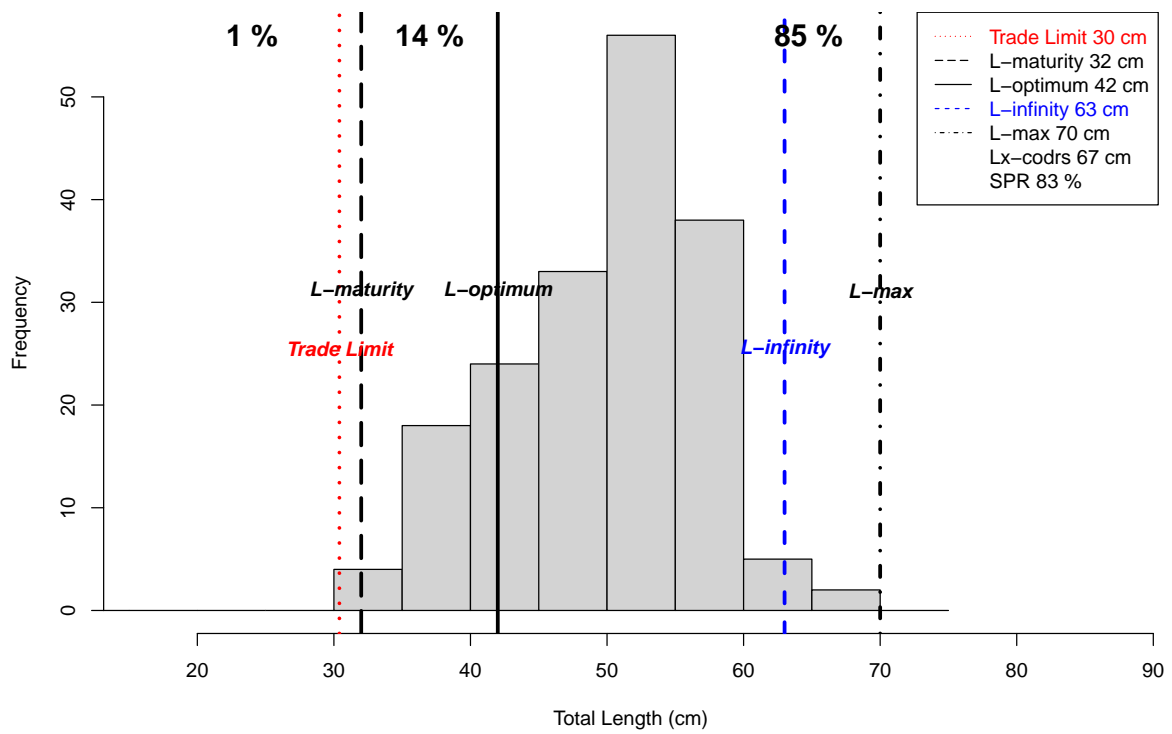
% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.513

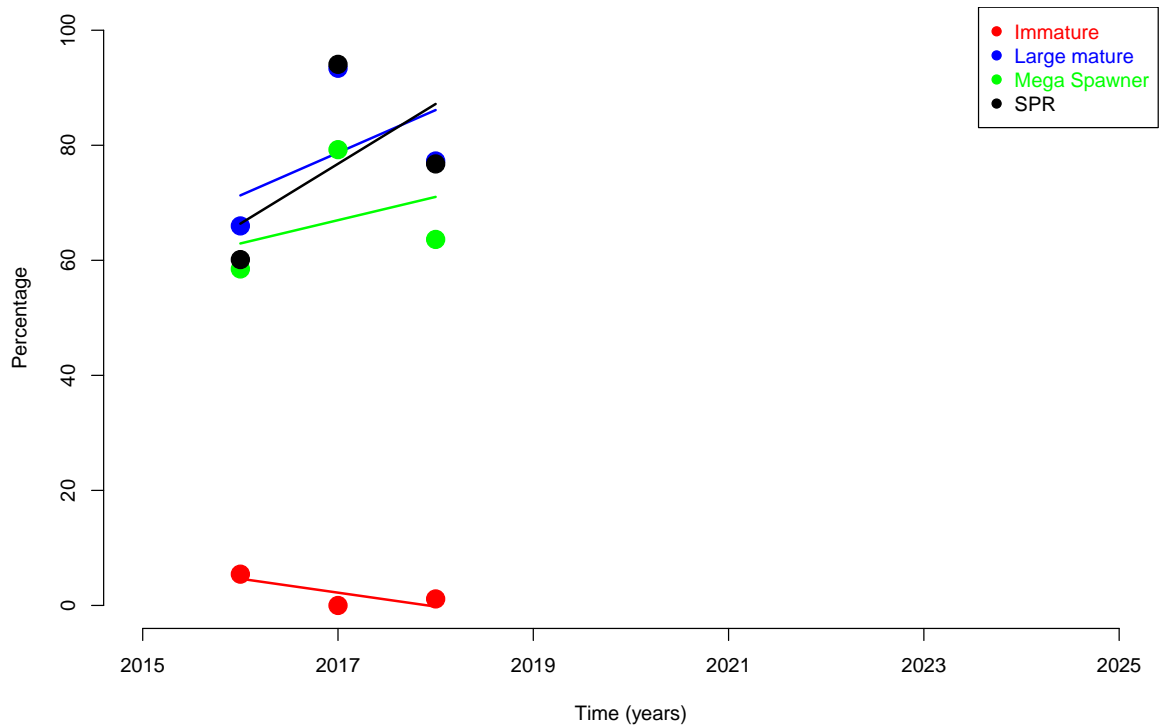
% Mega Spawner rising over recent years, situation improving. P: 0.314

% SPR rising over recent years, situation improving. P: 0.763

Catch length frequency for *Glaucosoma buergeri* (ID #89, Glaucosomatidae), n = 180
 Most Recent 365 Days



Trends in relative abundance by size group for *Glaucosoma buergeri* (ID #89, Glaucosomatidae)



The percentages of *Glaucosoma buergeri* (ID #89, Glaucosomatidae) in most recent 365 days, n=180
Immature (< 32cm): 1%
Small mature (\geq 32cm, < 42cm): 14%
Large mature (\geq 42cm): 85%
Mega spawner (\geq 46.2cm): 72% (subset of large mature fish)
Spawning Potential Ratio: 83 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

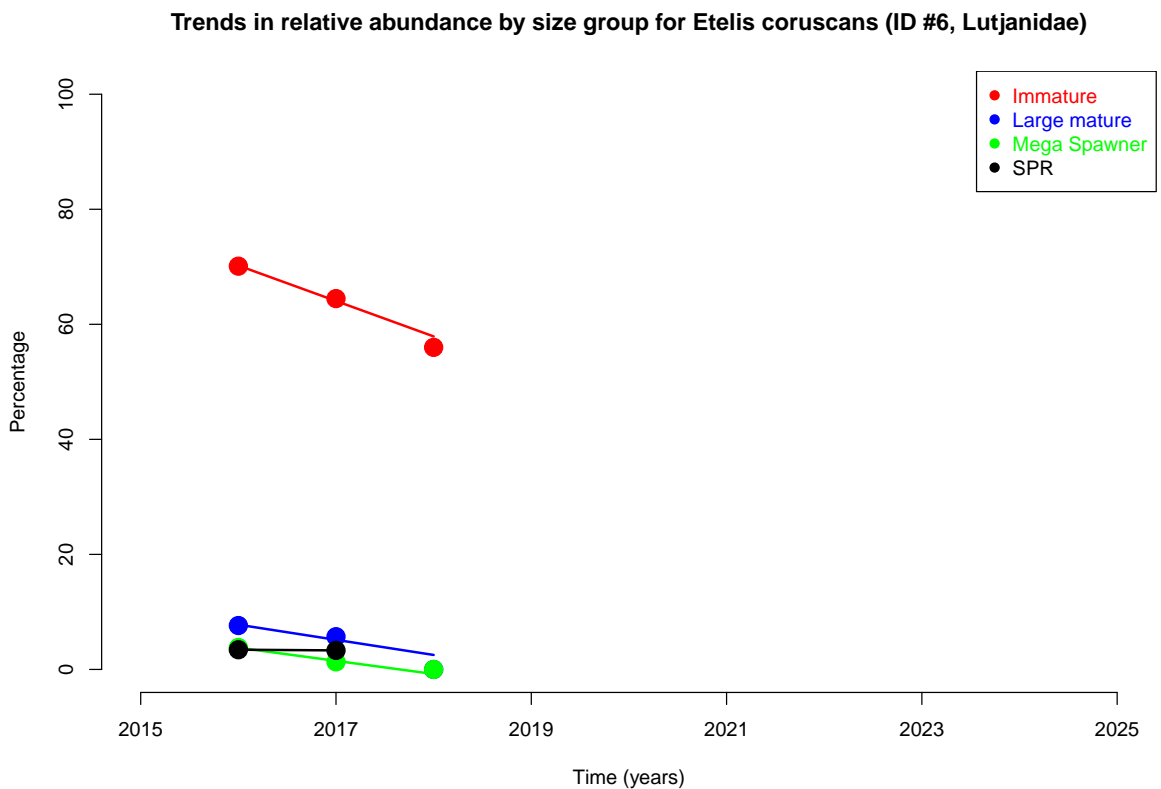
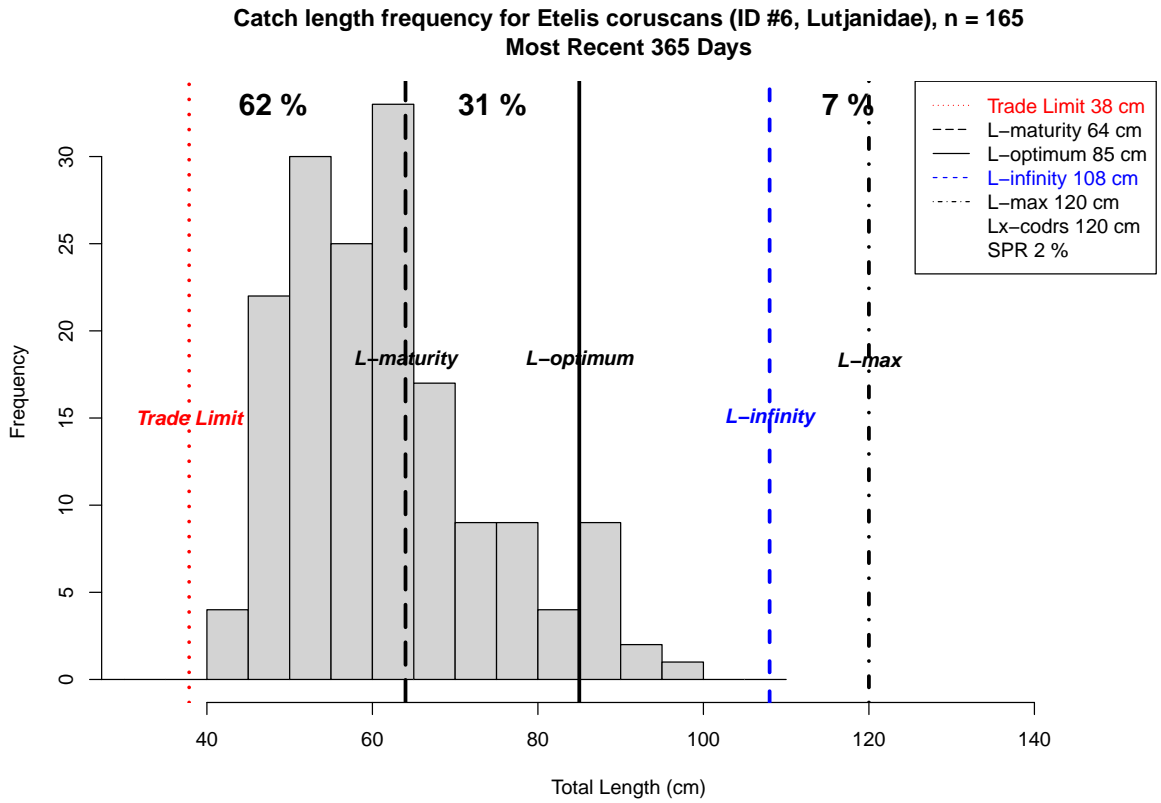
Trends in relative abundance by size group for *Glaucosoma buergeri* (ID #89, Glaucosomatidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.416

% Large Mature rising over recent years, situation improving. P: 0.654

% Mega Spawner rising over recent years, situation improving. P: 0.761

% SPR rising over recent years, situation improving. P: 0.603



The percentages of *Etelis coruscans* (ID #6, Lutjanidae) in most recent 365 days, n=165
Immature (< 64cm): 62%
Small mature (\geq 64cm, < 85cm): 31%
Large mature (\geq 85cm): 7%
Mega spawner (\geq 93.5cm): 1% (subset of large mature fish)
Spawning Potential Ratio: 2 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

The majority of the fish in the catch have not had a chance to reproduce before capture. This fishery is most likely overfished already if fishing mortality is high for all size classes in the population. An immediate shift away from targeting juvenile fish and a reduction in overall fishing pressure is essential to prevent collapse of the stock. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

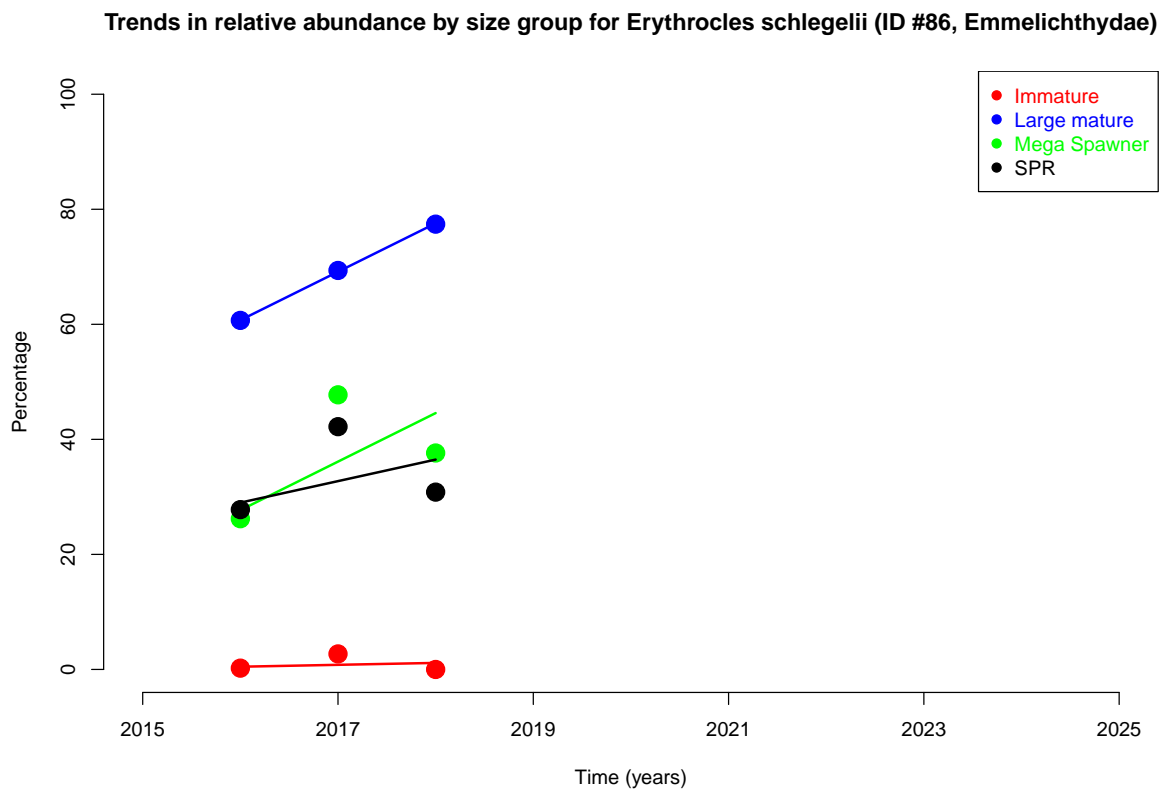
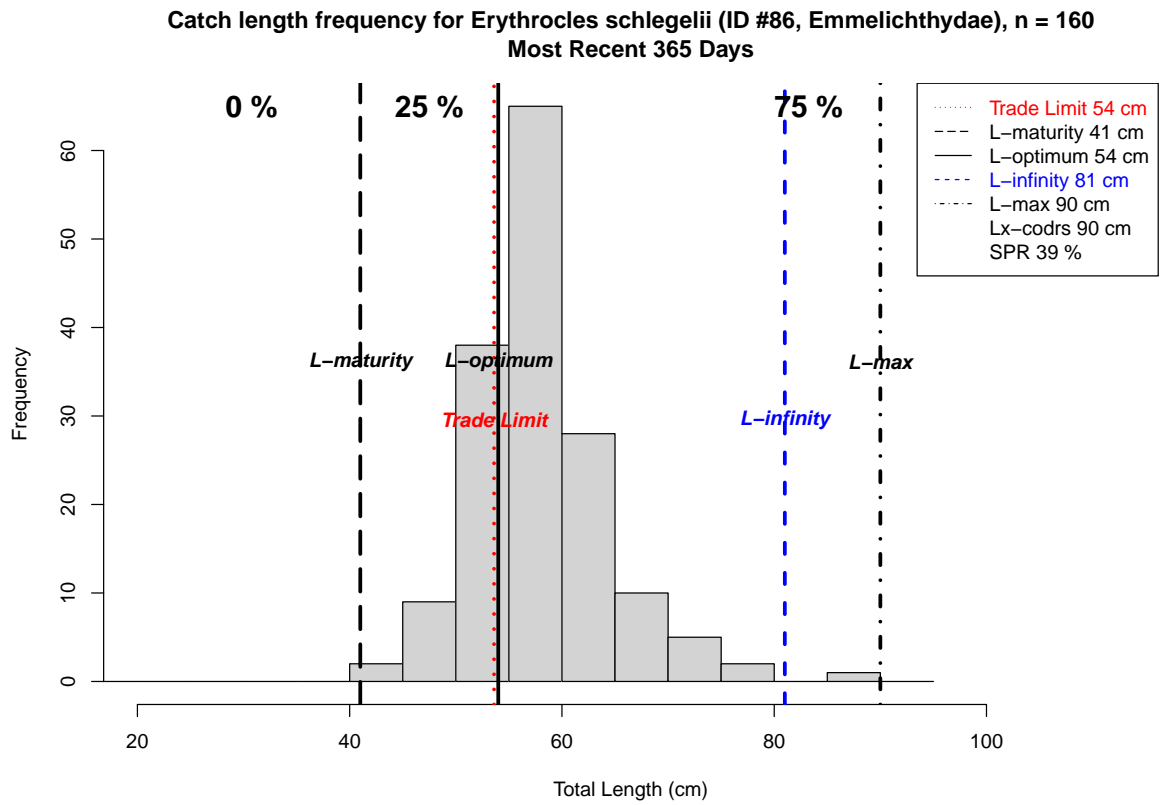
Trends in relative abundance by size group for *Etelis coruscans* (ID #6, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.081

% Large Mature falling over recent years, situation deteriorating. P: 0.240

% Mega Spawner falling over recent years, situation deteriorating. P: 0.091

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Erythrocles schlegelii* (ID #86, Emmelichthydae) in most recent 365 days, n=160
Immature (< 41cm): 0%
Small mature (\geq 41cm, < 54cm): 25%
Large mature (\geq 54cm): 75%
Mega spawner (\geq 59.4cm): 39% (subset of large mature fish)
Spawning Potential Ratio: 39 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

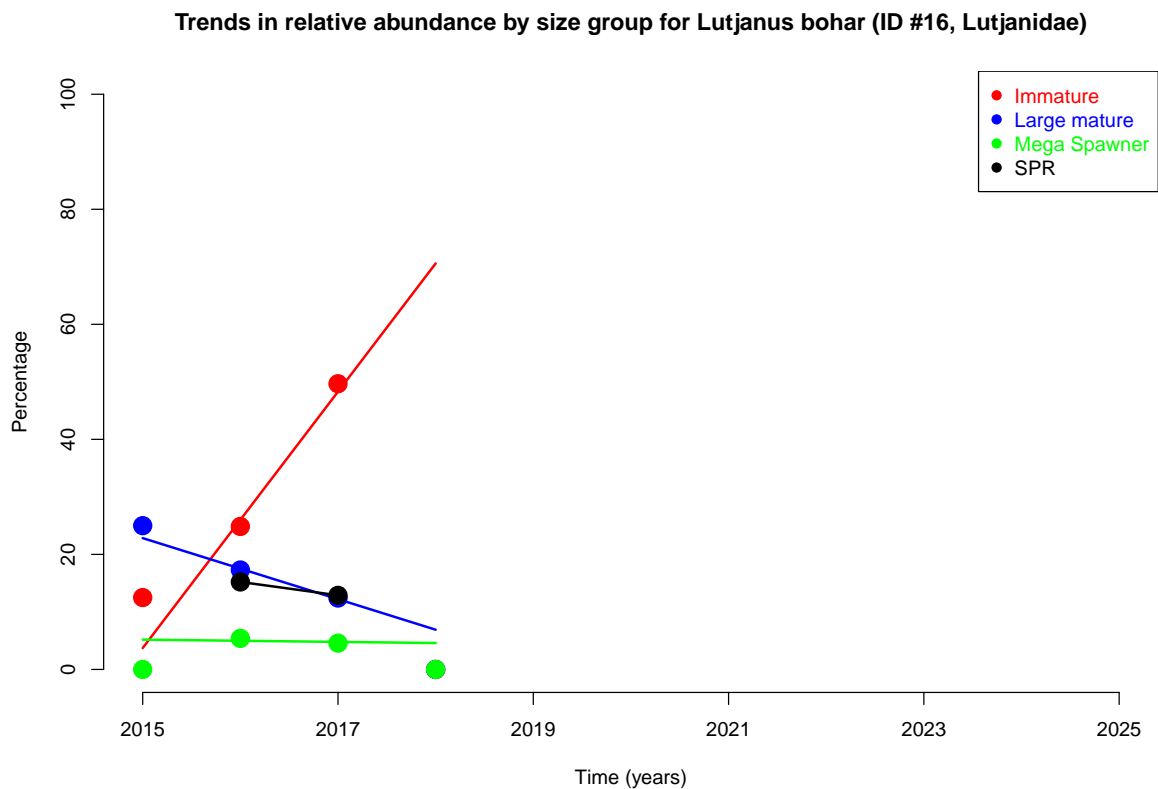
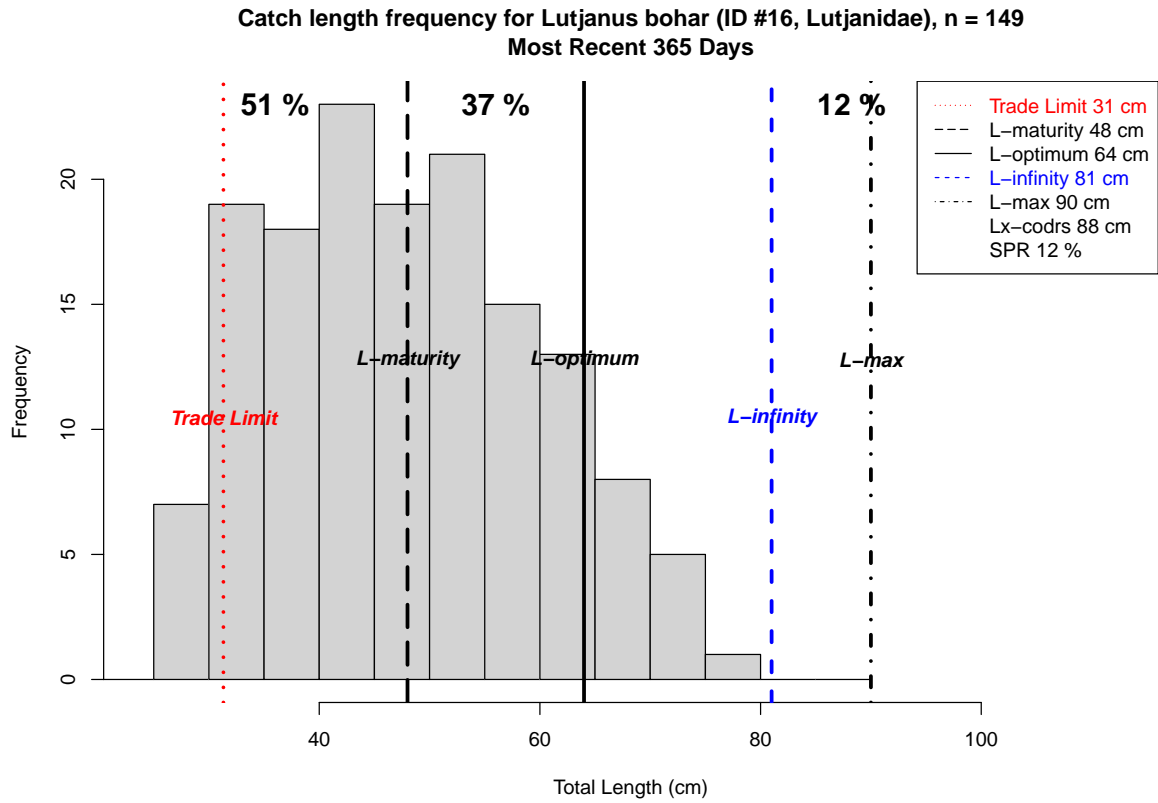
Trends in relative abundance by size group for *Erythrocles schlegelii* (ID #86, Emmelichthydae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.836

% Large Mature rising over recent years, situation improving. P: 0.012

% Mega Spawner rising over recent years, situation improving. P: 0.471

% SPR rising over recent years, situation improving. P: 0.657



The percentages of *Lutjanus bohar* (ID #16, Lutjanidae) in most recent 365 days, n=149
Immature (< 48cm): 51%
Small mature (\geq 48cm, < 64cm): 37%
Large mature (\geq 64cm): 12%
Mega spawner (\geq 70.4cm): 4% (subset of large mature fish)
Spawning Potential Ratio: 12 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

The majority of the fish in the catch have not had a chance to reproduce before capture. This fishery is most likely overfished already if fishing mortality is high for all size classes in the population. An immediate shift away from targeting juvenile fish and a reduction in overall fishing pressure is essential to prevent collapse of the stock. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

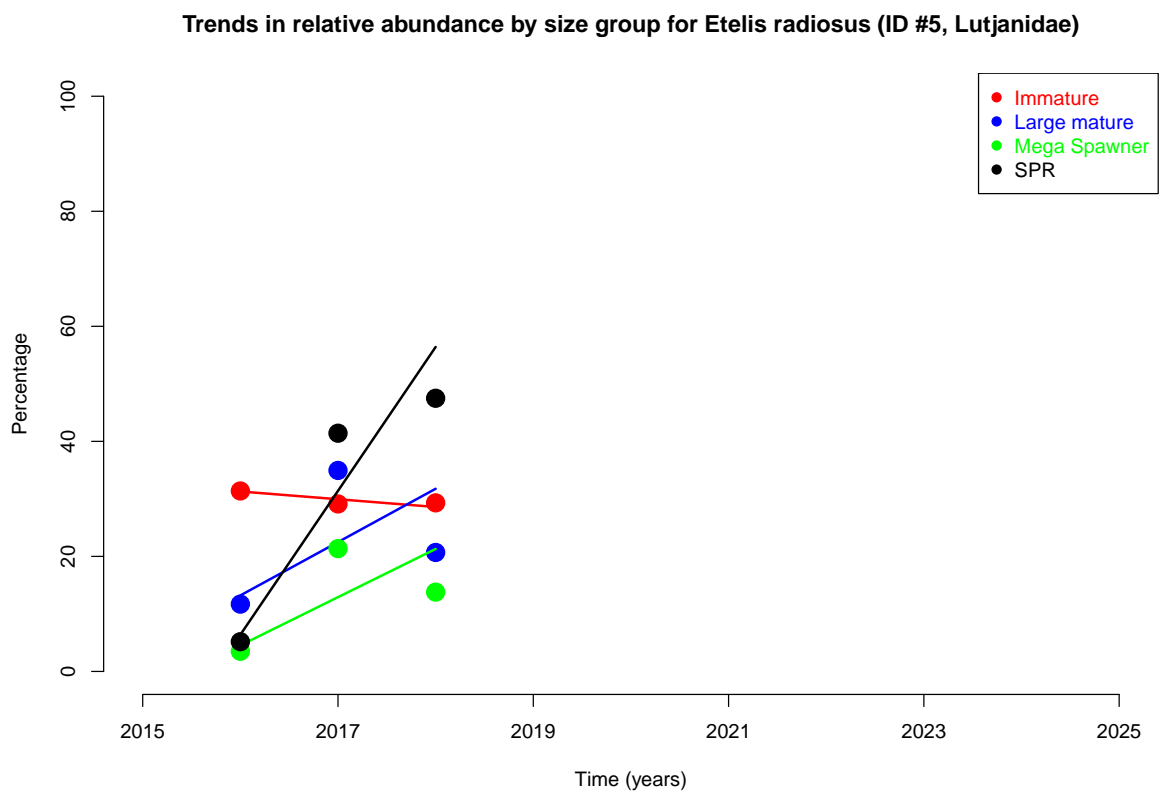
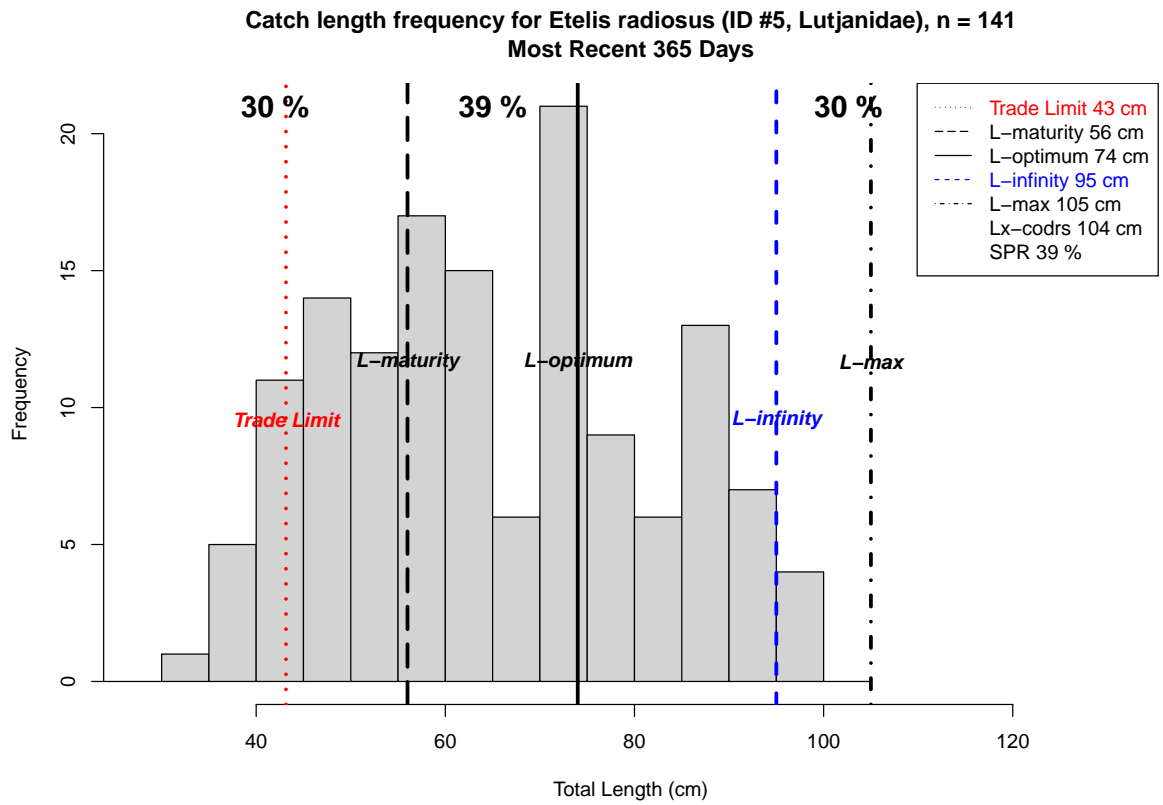
Trends in relative abundance by size group for *Lutjanus bohar* (ID #16, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.055

% Large Mature falling over recent years, situation deteriorating. P: 0.017

% Mega Spawner falling over recent years, situation deteriorating. P: 0.881

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Etelis radiosus* (ID #5, Lutjanidae) in most recent 365 days, n=141
Immature (< 56cm): 30%
Small mature (\geq 56cm, < 74cm): 39%
Large mature (\geq 74cm): 30%
Mega spawner (\geq 81.4cm): 20% (subset of large mature fish)
Spawning Potential Ratio: 39 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 30% and 50% of the fish in the catch are immature and have not had a chance to reproduce before capture. The fishery is in immediate danger of overfishing through overharvesting of juveniles, if fishing pressure is high. Catching small and immature fish needs to be actively avoided and a limit on overall fishing pressure is warranted. Risk level is high.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is between 25% and 40%. The stock is heavily exploited, and there is some risk that the fishery will cause further decline of the stock. Risk level is medium.

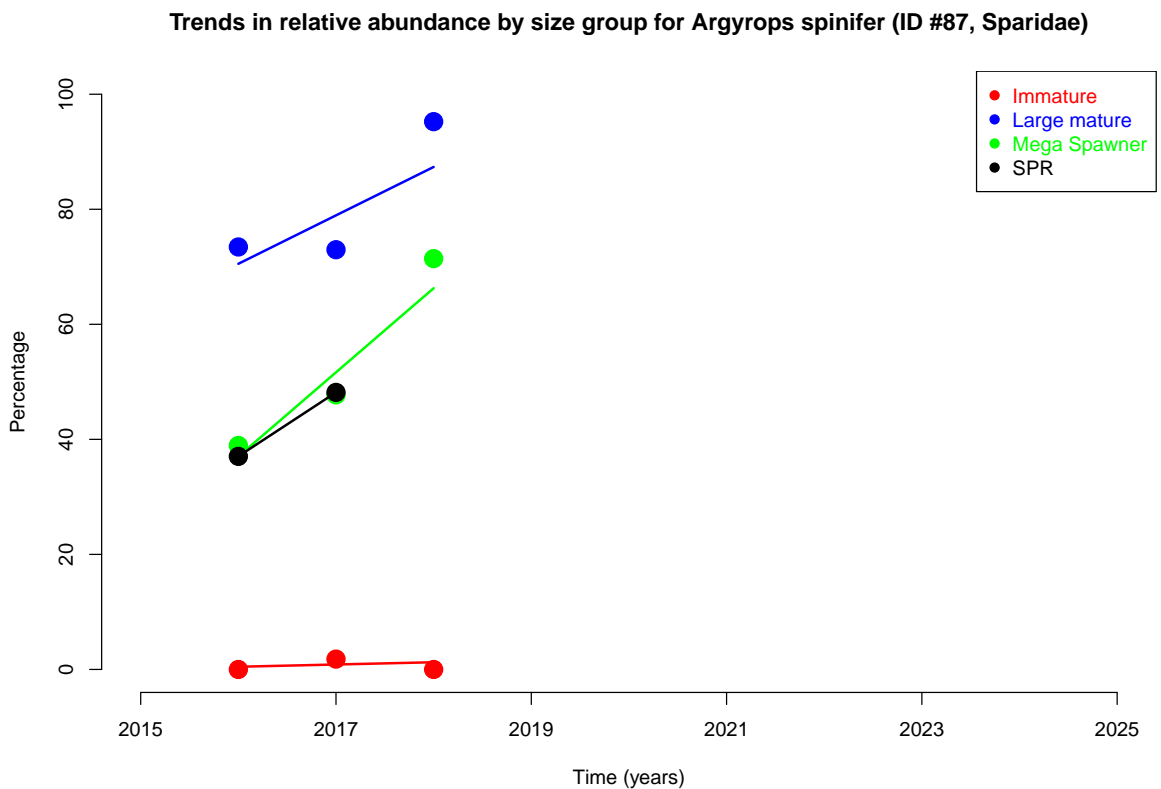
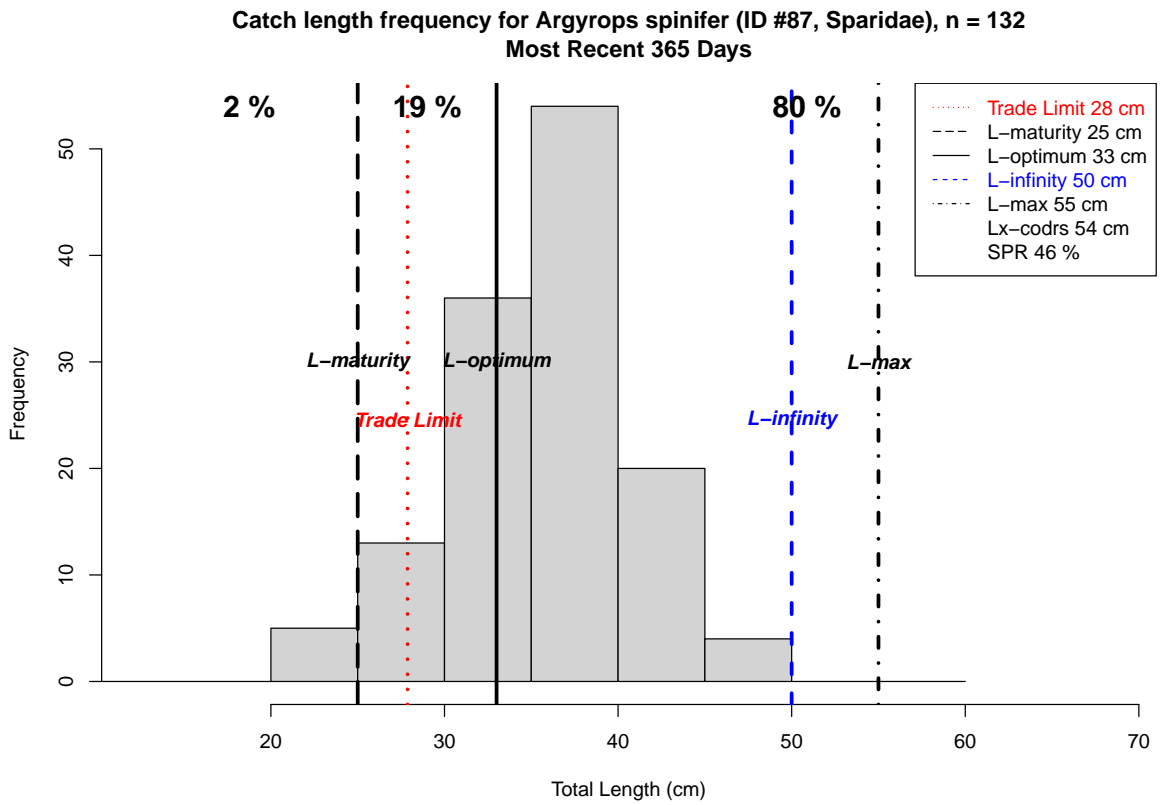
Trends in relative abundance by size group for *Etelis radiosus* (ID #5, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.280

% Large Mature rising over recent years, situation improving. P: 0.516

% Mega Spawner rising over recent years, situation improving. P: 0.425

% SPR rising over recent years, situation improving. P: 0.193



The percentages of *Argyrops spinifer* (ID #87, Sparidae) in most recent 365 days, n=132
Immature (< 25cm): 2%
Small mature (\geq 25cm, < 33cm): 19%
Large mature (\geq 33cm): 80%
Mega spawner (\geq 36.3cm): 53% (subset of large mature fish)
Spawning Potential Ratio: 46 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

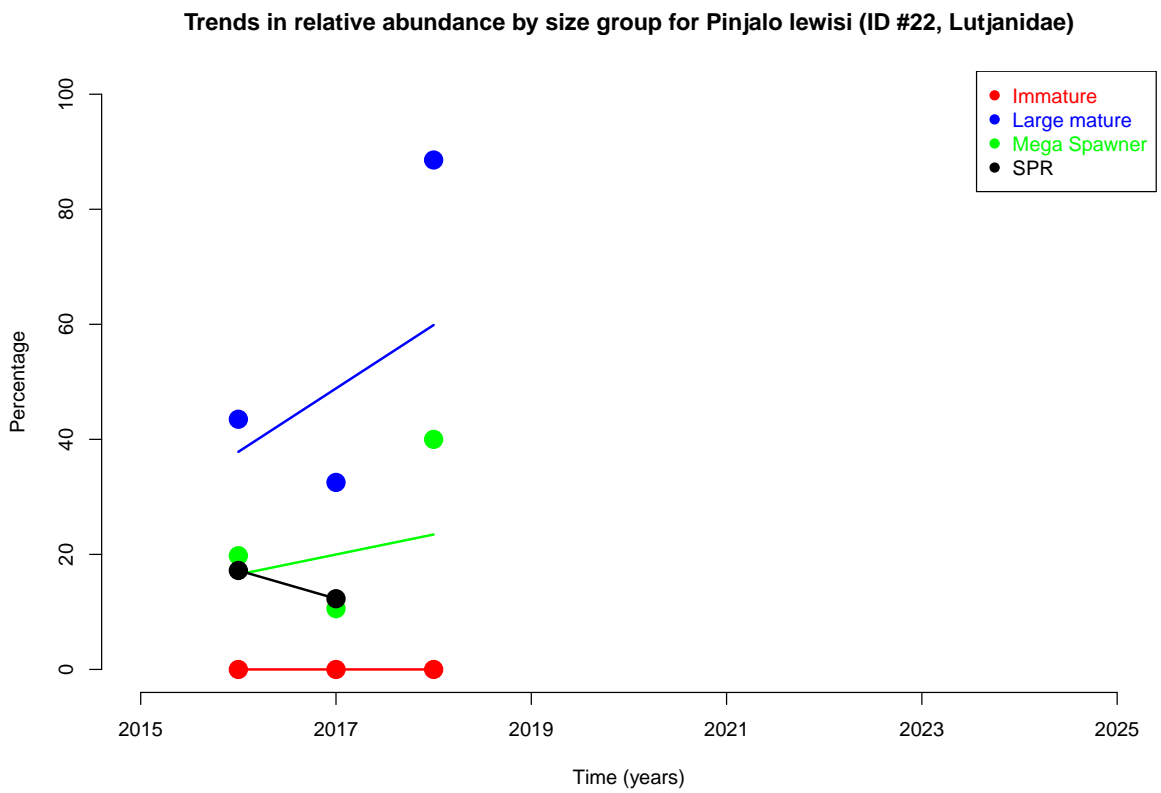
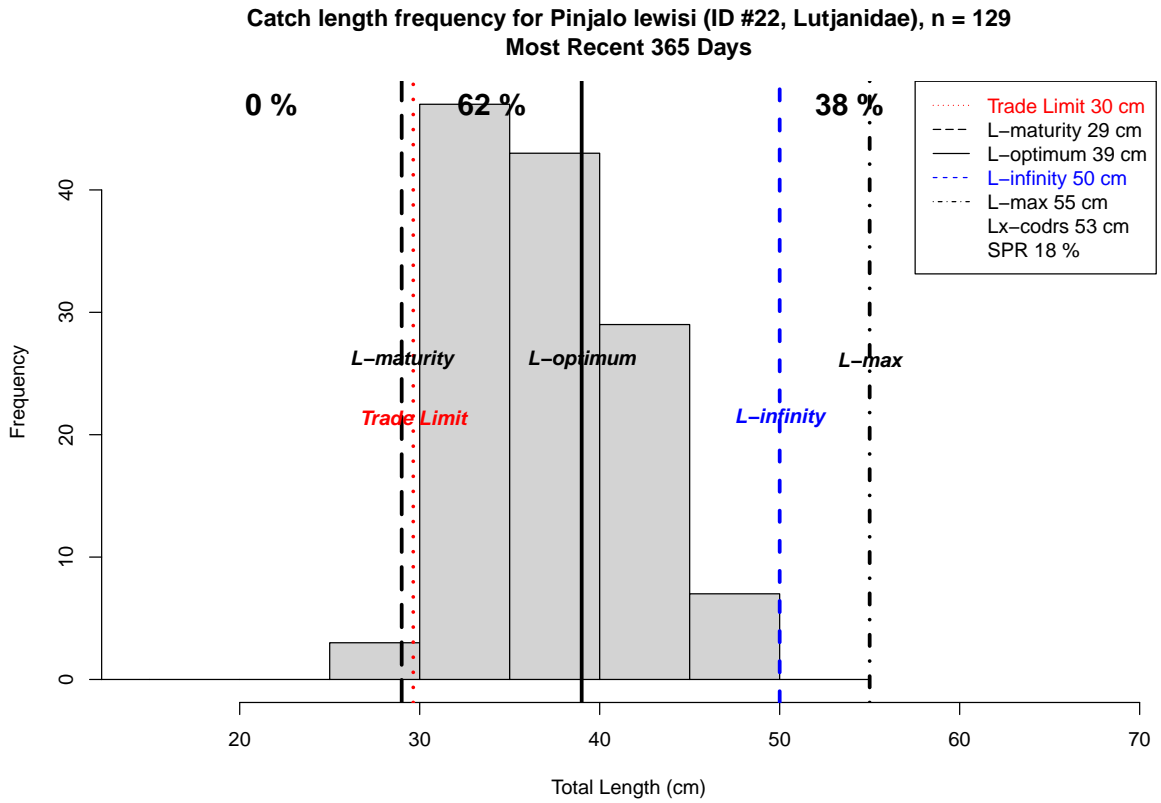
Trends in relative abundance by size group for *Argyrops spinifer* (ID #87, Sparidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.795

% Large Mature rising over recent years, situation improving. P: 0.461

% Mega Spawner rising over recent years, situation improving. P: 0.204

% SPR rising over recent years, situation improving. P: not available



The percentages of Pinjalo lewisi (ID #22, Lutjanidae) in most recent 365 days, n=129
Immature (< 29cm): 0%
Small mature (\geq 29cm, < 39cm): 62%
Large mature (\geq 39cm): 38%
Mega spawner (\geq 42.9cm): 16% (subset of large mature fish)
Spawning Potential Ratio: 18 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The bulk of the catch includes age groups that have just matured and are about to achieve their full growth potential. This indicates that the fishery is probably at least being fully exploited. Risk level is medium.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

Trends in relative abundance by size group for Pinjalo lewisi (ID #22, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

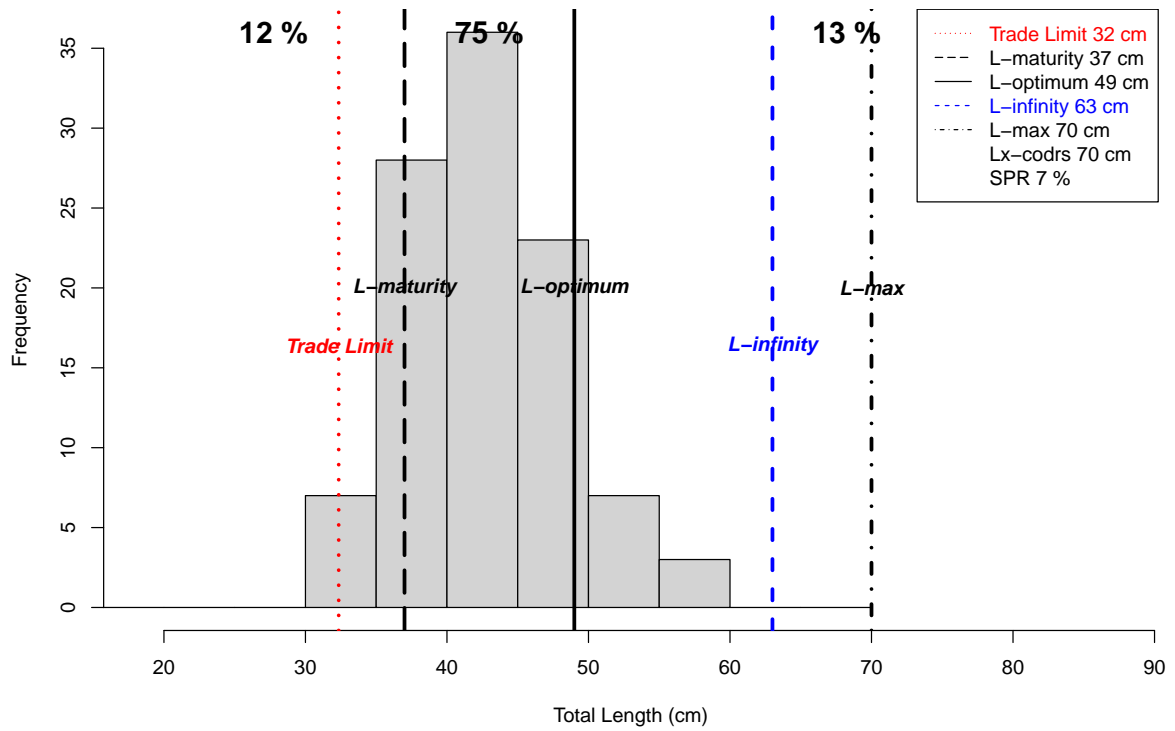
% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.693

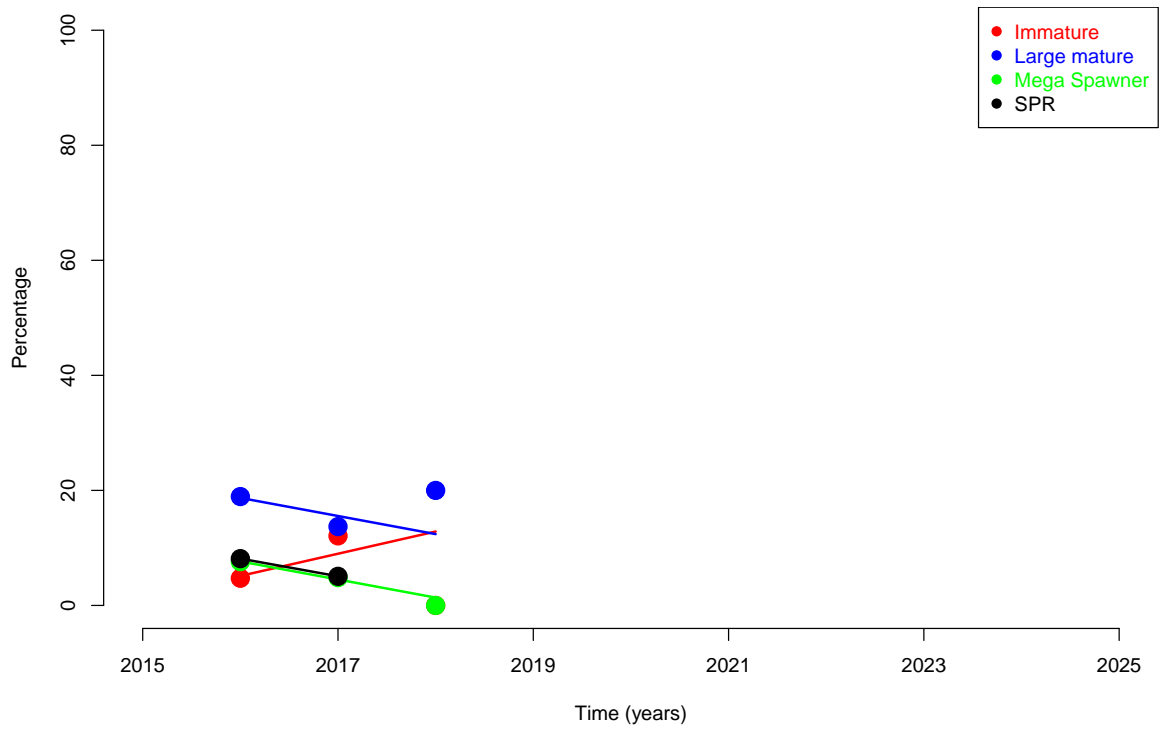
% Mega Spawner rising over recent years, situation improving. P: 0.822

% SPR falling over recent years, situation deteriorating. P: not available

Catch length frequency for *Paracaesio stonei* (ID #35, Lutjanidae), n = 104
 Most Recent 365 Days



Trends in relative abundance by size group for *Paracaesio stonei* (ID #35, Lutjanidae)



The percentages of *Paracaesio stonei* (ID #35, Lutjanidae) in most recent 365 days, n=104
Immature (< 37cm): 12%
Small mature (\geq 37cm, < 49cm): 75%
Large mature (\geq 49cm): 13%
Mega spawner (\geq 53.9cm): 3% (subset of large mature fish)
Spawning Potential Ratio: 7 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

Between 10% and 20% of the fish in the catch are juveniles that have not yet reproduced. There is no immediate concern in terms of overfishing through over harvesting of juveniles, but the fishery needs to be monitored closely for any further increase in this indicator and incentives need to be geared towards targeting larger fish. Risk level is medium.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

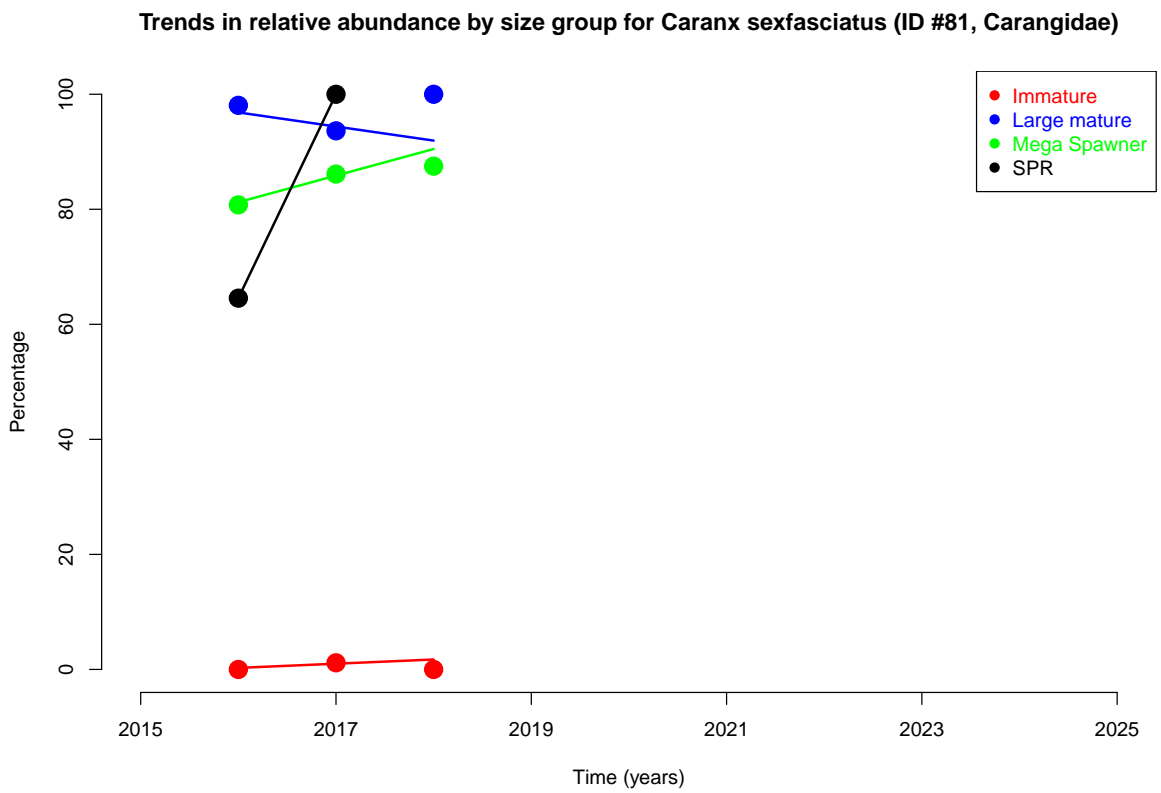
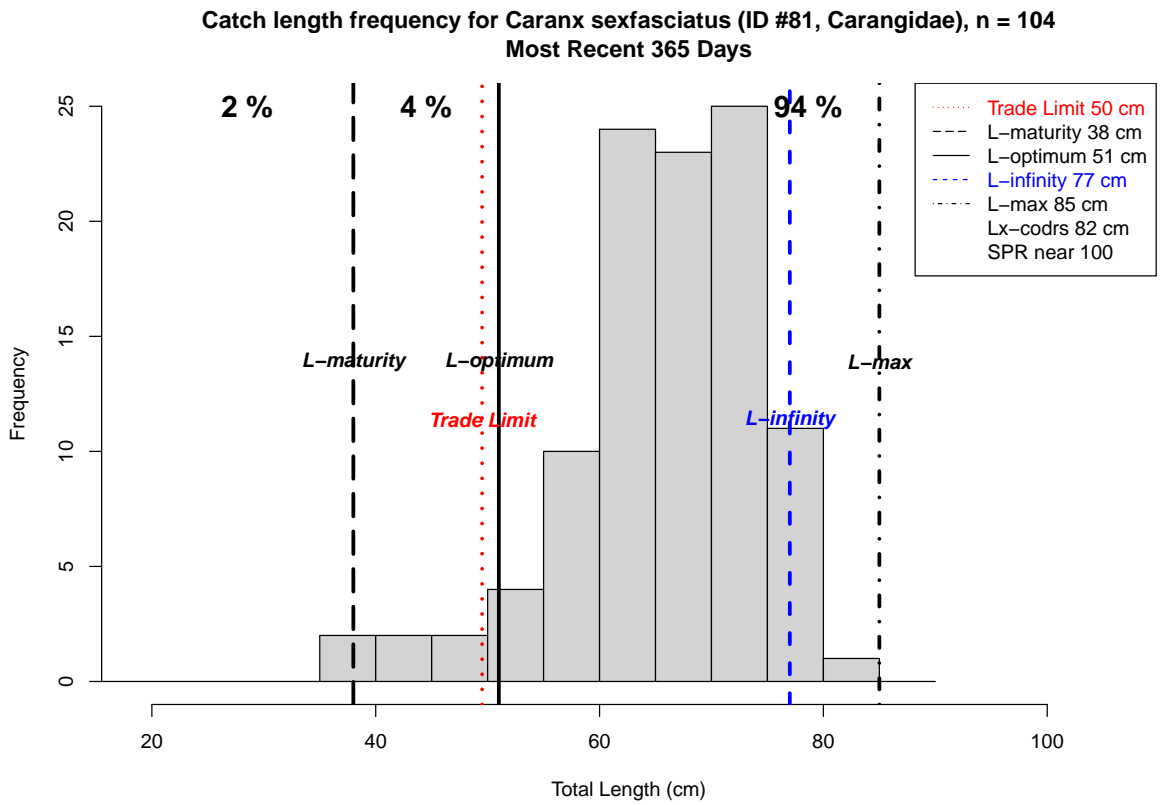
Trends in relative abundance by size group for *Paracaesio stonei* (ID #35, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.586

% Large Mature falling over recent years, situation deteriorating. P: 0.484

% Mega Spawner falling over recent years, situation deteriorating. P: 0.108

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Caranx sexfasciatus* (ID #81, Carangidae) in most recent 365 days, n=104
Immature (< 38cm): 2%
Small mature (\geq 38cm, < 51cm): 4%
Large mature (\geq 51cm): 94%
Mega spawner (\geq 56.1cm): 90% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

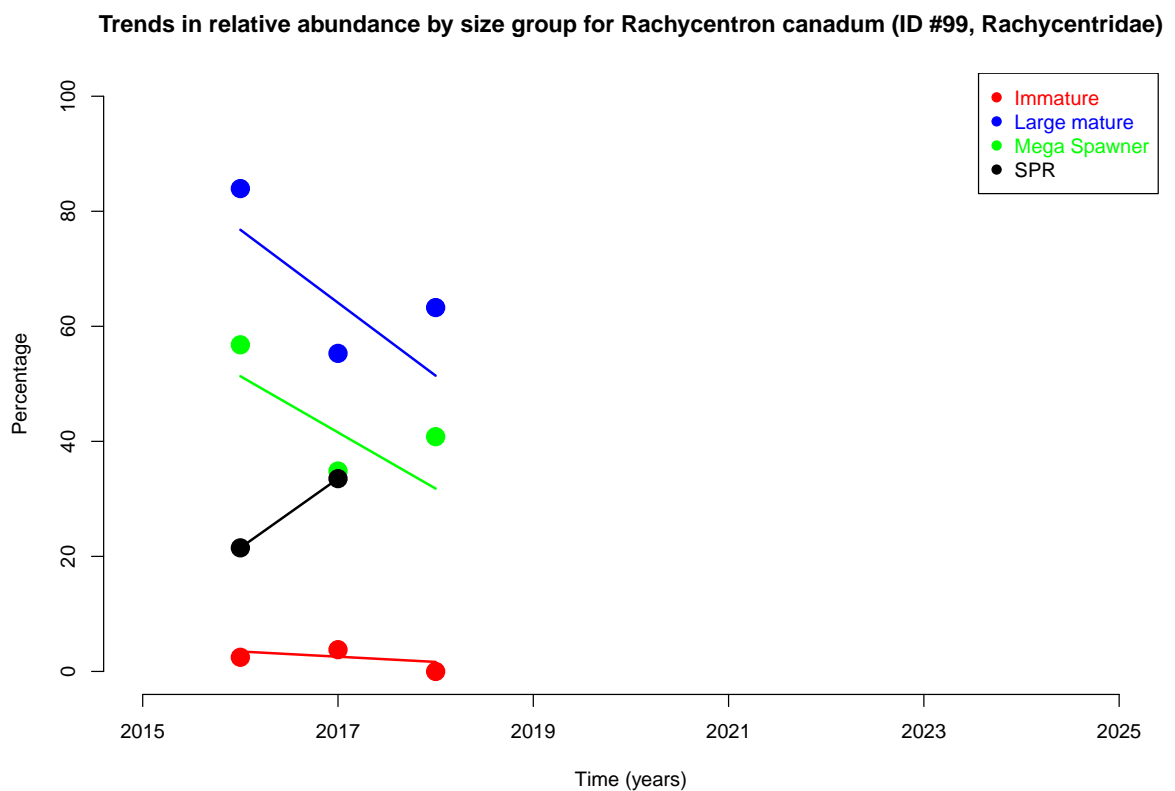
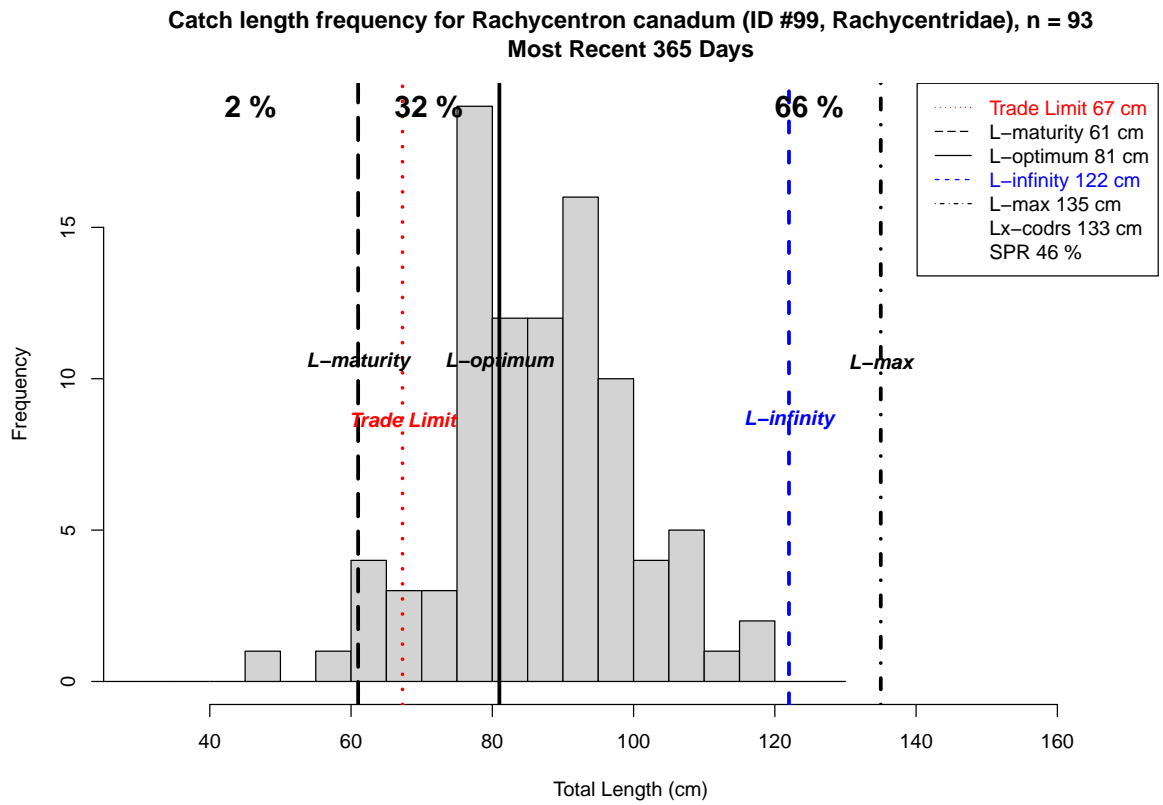
Trends in relative abundance by size group for *Caranx sexfasciatus* (ID #81, Carangidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.523

% Large Mature falling over recent years, situation deteriorating. P: 0.625

% Mega Spawner rising over recent years, situation improving. P: 0.181

% SPR rising over recent years, situation improving. P: not available



The percentages of *Rachycentron canadum* (ID #99, Rachycentridae) in most recent 365 days, n=93
Immature (< 61cm): 2%
Small mature (\geq 61cm, < 81cm): 32%
Large mature (\geq 81cm): 66%
Mega spawner (\geq 89.1cm): 43% (subset of large mature fish)
Spawning Potential Ratio: 46 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

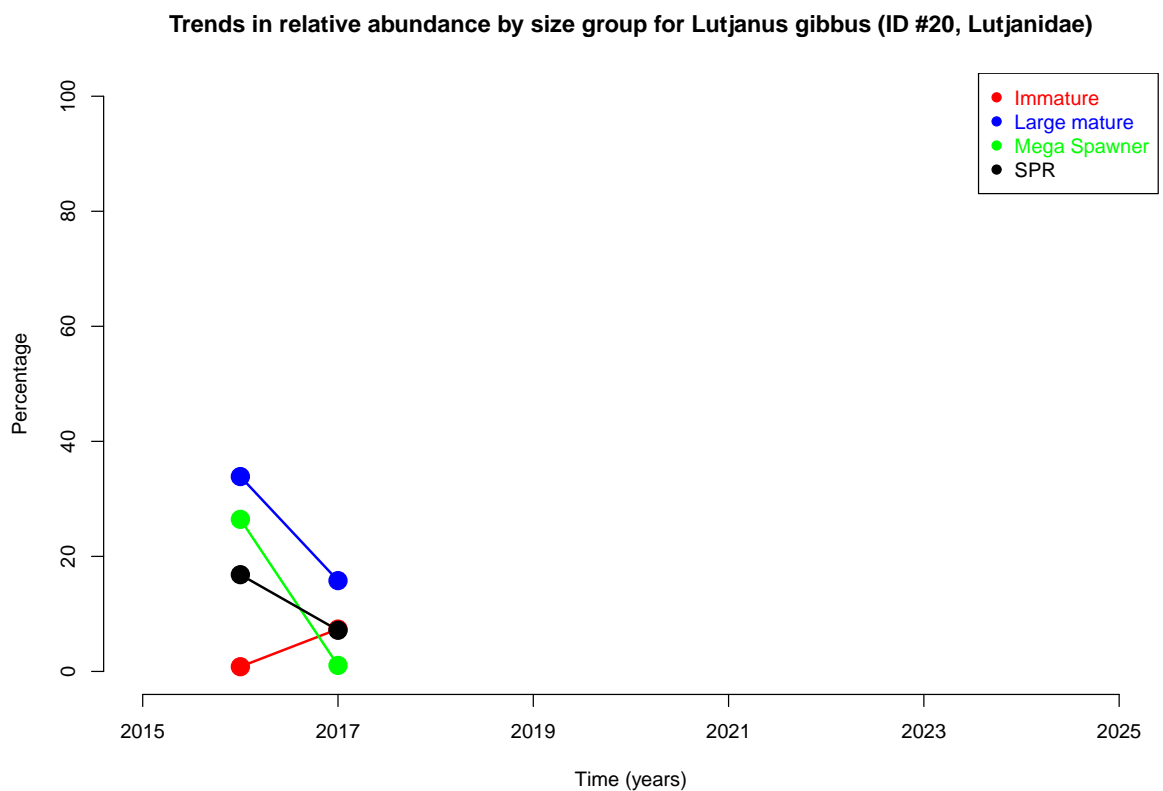
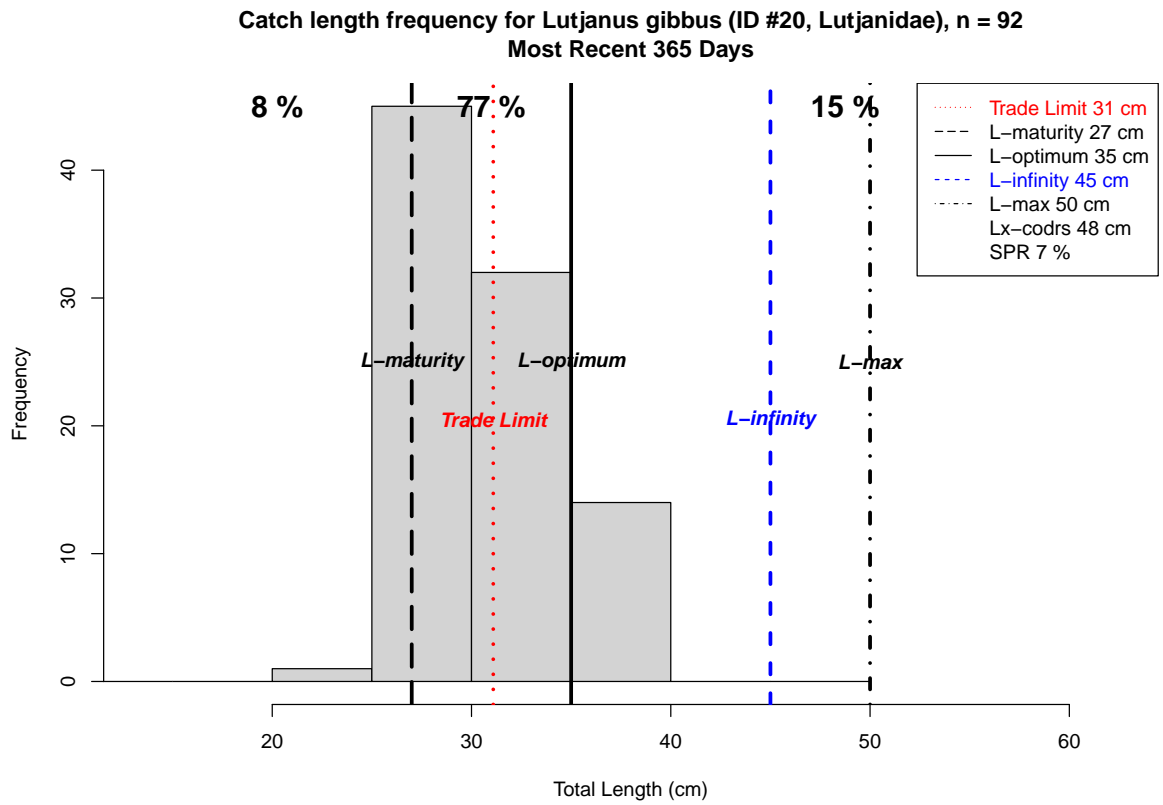
Trends in relative abundance by size group for *Rachycentron canadum* (ID #99, Rachycentridae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.704

% Large Mature falling over recent years, situation deteriorating. P: 0.507

% Mega Spawner falling over recent years, situation deteriorating. P: 0.504

% SPR rising over recent years, situation improving. P: not available



The percentages of *Lutjanus gibbus* (ID #20, Lutjanidae) in most recent 365 days, n=92
Immature (< 27cm): 8%
Small mature (\geq 27cm, < 35cm): 77%
Large mature (\geq 35cm): 15%
Mega spawner (\geq 38.5cm): 1% (subset of large mature fish)
Spawning Potential Ratio: 7 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The vast majority of the fish in the catch have not yet achieved their growth potential. The harvest of small fish promotes growth overfishing and the size distribution for this species indicates that over exploitation through growth overfishing may already be happening. Risk level is high.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

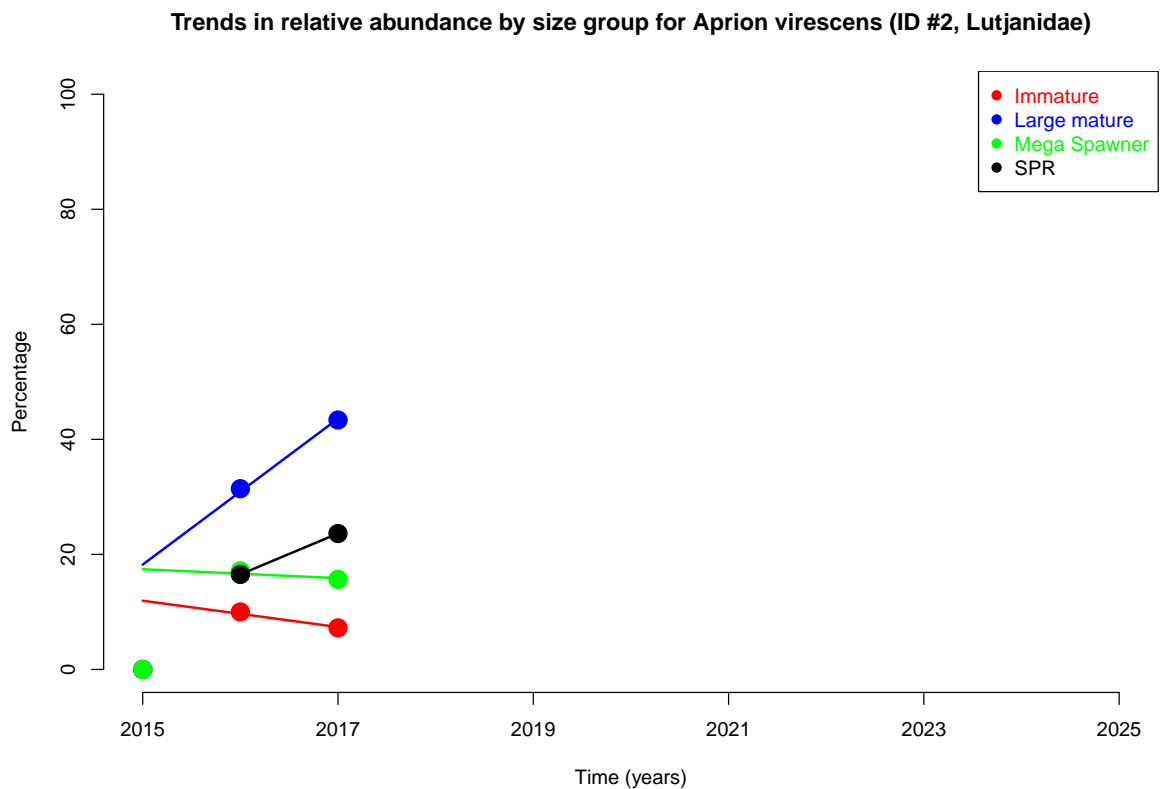
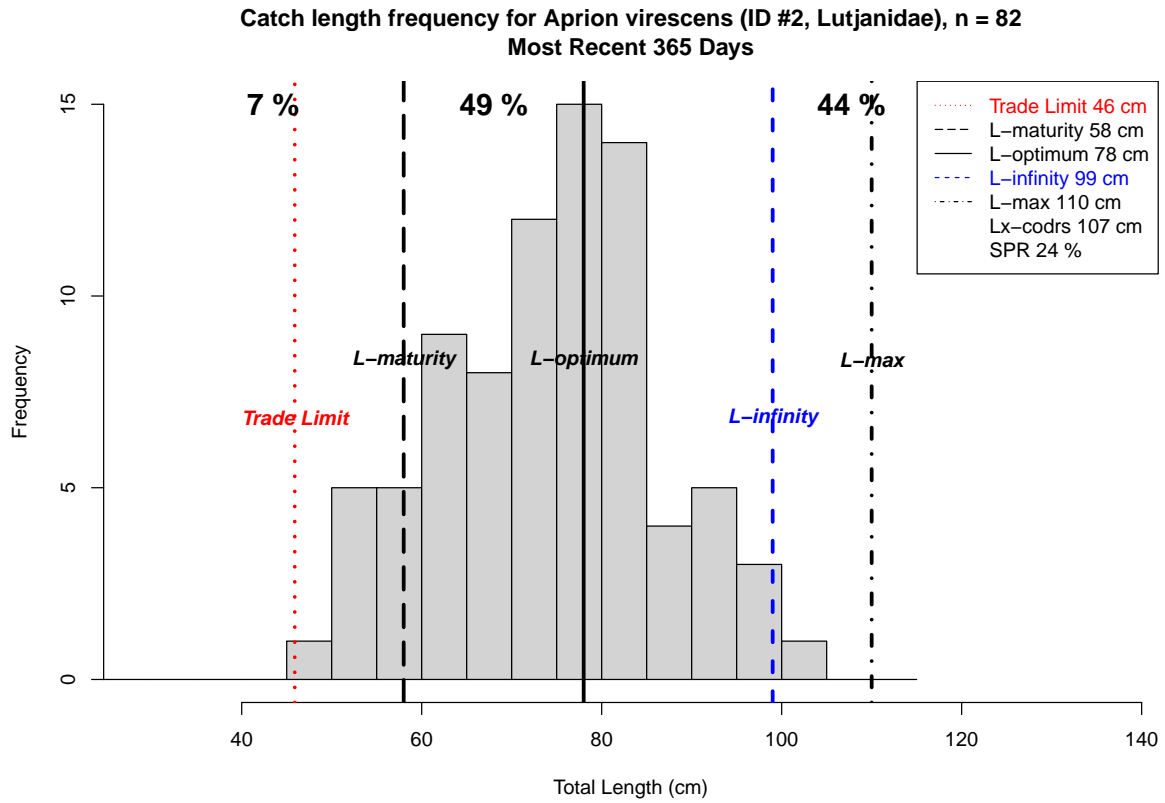
Trends in relative abundance by size group for *Lutjanus gibbus* (ID #20, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: not available

% Large Mature falling over recent years, situation deteriorating. P: not available

% Mega Spawner falling over recent years, situation deteriorating. P: not available

% SPR falling over recent years, situation deteriorating. P: not available



The percentages of *Aprion virescens* (ID #2, Lutjanidae) in most recent 365 days, n=82
Immature (< 58cm): 7%
Small mature (\geq 58cm, < 78cm): 49%
Large mature (\geq 78cm): 44%
Mega spawner (\geq 85.8cm): 16% (subset of large mature fish)
Spawning Potential Ratio: 24 %

The trade limit is significantly lower than the length at first maturity. This means that the trade encourages capture of immature fish, which impairs sustainability. Risk level is high.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The bulk of the catch includes age groups that have just matured and are about to achieve their full growth potential. This indicates that the fishery is probably at least being fully exploited. Risk level is medium.

Less than 20% of the catch comprises of mega spawners. This indicates that the population may be severely affected by the fishery, and that there is a substantial risk of recruitment overfishing through over harvesting of the mega spawners, unless large numbers of mega spawners would be surviving at other habitats. There is no reason to assume that this is the case and therefore a reduction of fishing effort may be necessary in this fishery. Risk level is high.

SPR is less than 25%. The fishery probably over-exploits the stock, and there is a substantial risk that the fishery will cause severe decline of the stock if fishing effort is not reduced. Risk level is high.

Trends in relative abundance by size group for *Aprion virescens* (ID #2, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

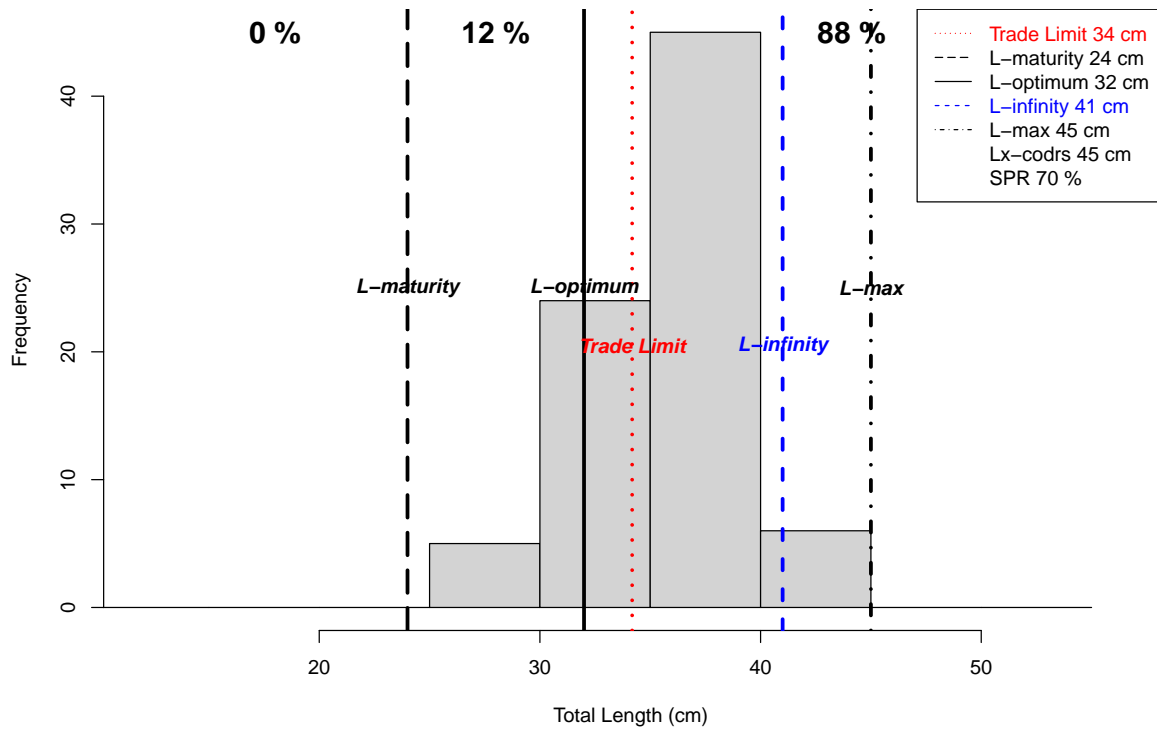
% Immature falling over recent years, situation improving. P: 0.449

% Large Mature rising over recent years, situation improving. P: 0.146

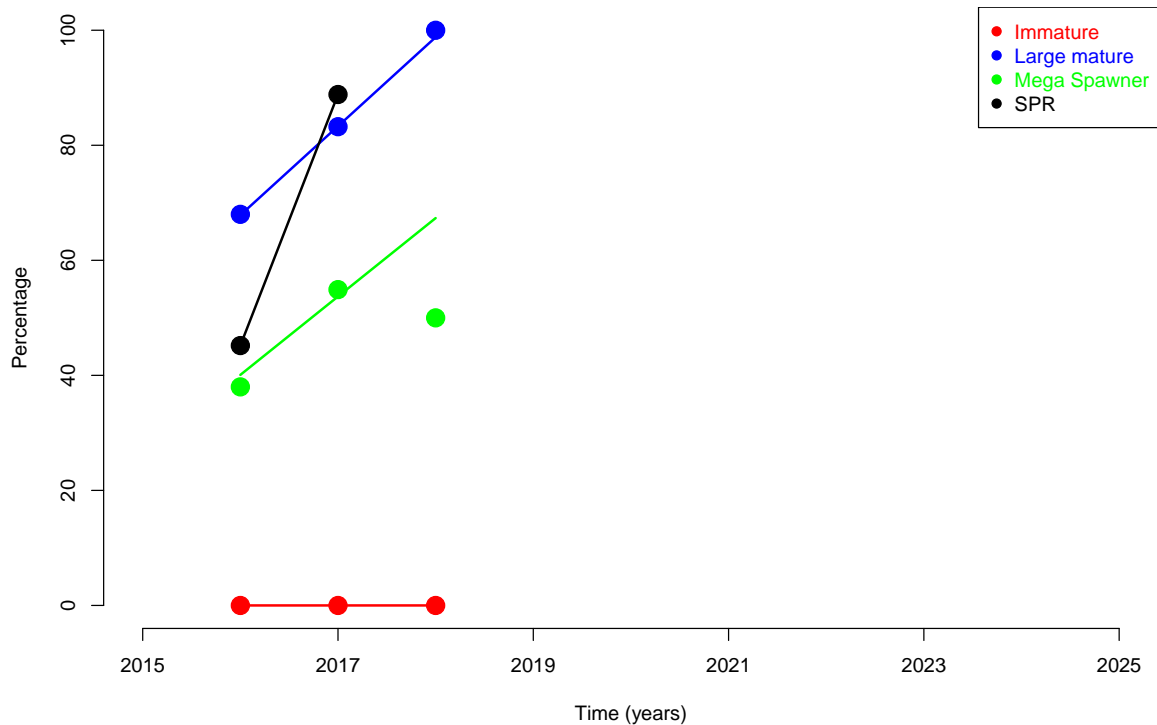
% Mega Spawner falling over recent years, situation deteriorating. P: 0.831

% SPR rising over recent years, situation improving. P: not available

Catch length frequency for *Lutjanus bitaeniatus* (ID #14, Lutjanidae), n = 80
 Most Recent 365 Days



Trends in relative abundance by size group for *Lutjanus bitaeniatus* (ID #14, Lutjanidae)



The percentages of *Lutjanus bitaeniatus* (ID #14, Lutjanidae) in most recent 365 days, n=80
Immature (< 24cm): 0%
Small mature (\geq 24cm, < 32cm): 12%
Large mature (\geq 32cm): 88%
Mega spawner (\geq 35.2cm): 64% (subset of large mature fish)
Spawning Potential Ratio: 70 %

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

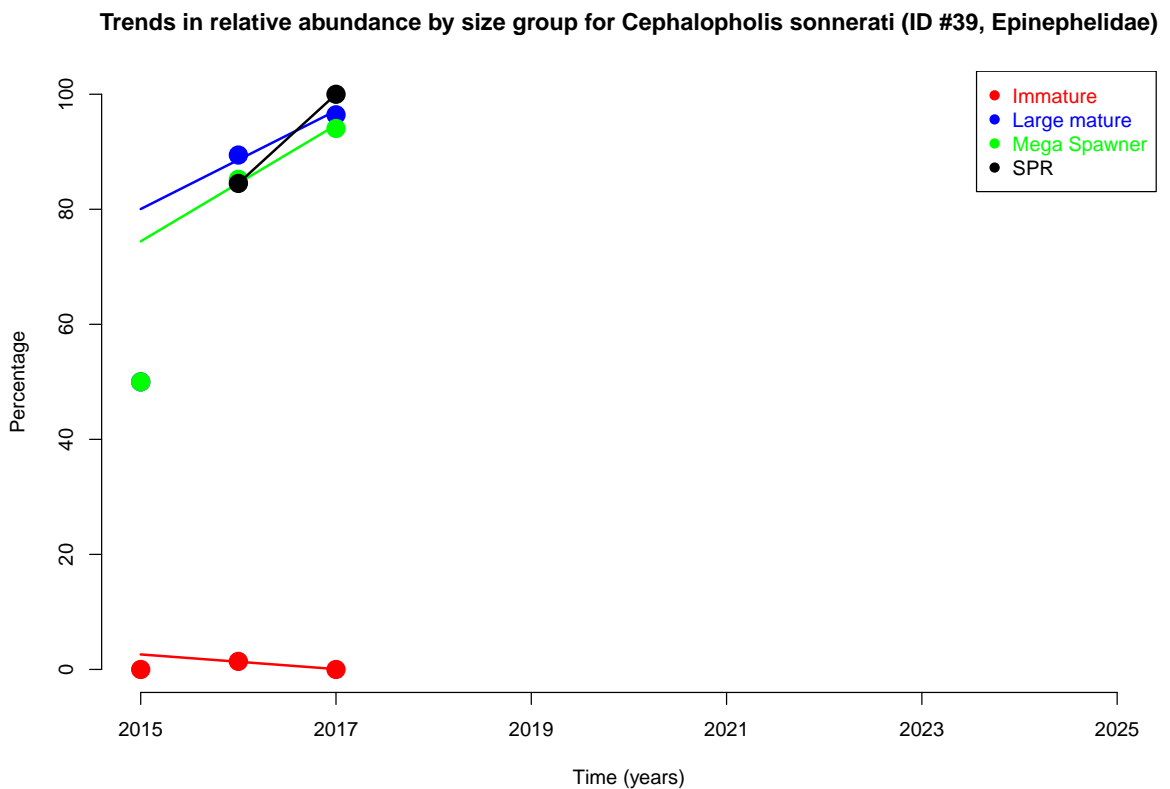
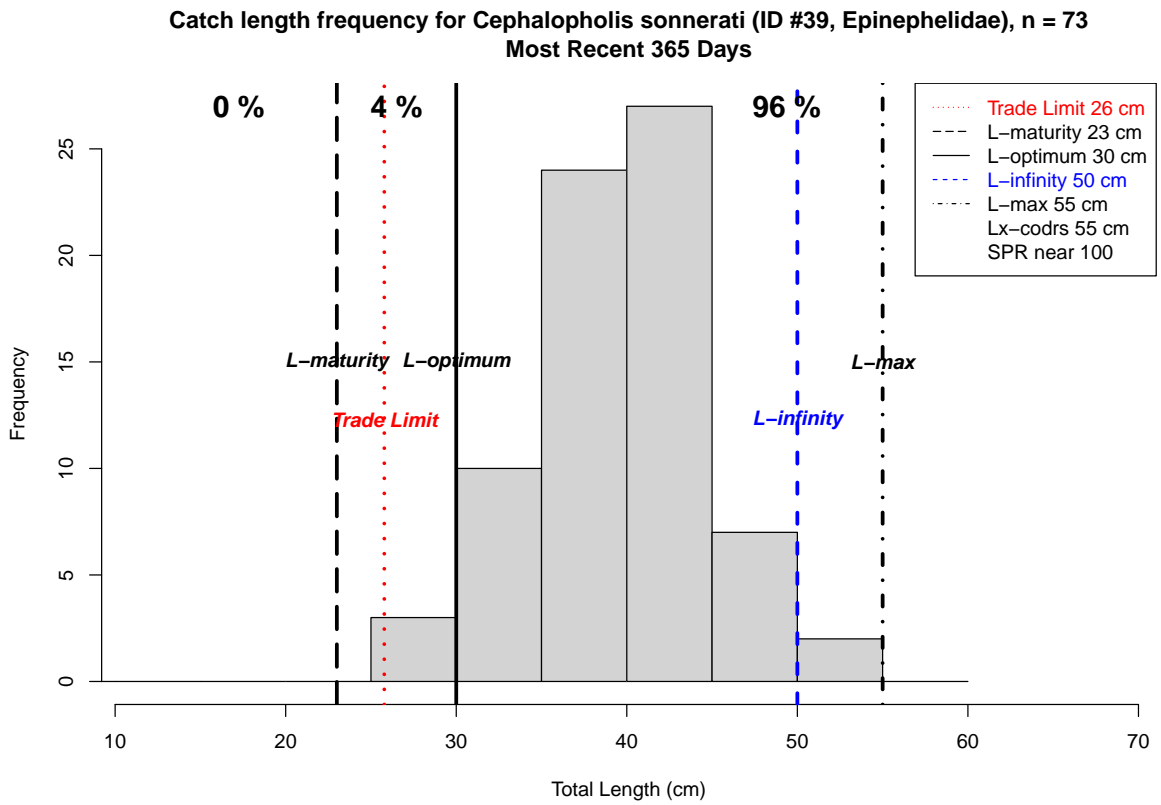
Trends in relative abundance by size group for *Lutjanus bitaeniatus* (ID #14, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.020

% Mega Spawner rising over recent years, situation improving. P: 0.299

% SPR rising over recent years, situation improving. P: not available



The percentages of *Cephalopholis sonnerati* (ID #39, Epinephelidae) in most recent 365 days, n=73
Immature (< 23cm): 0%
Small mature (\geq 23cm, < 30cm): 4%
Large mature (\geq 30cm): 96%
Mega spawner (\geq 33cm): 93% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

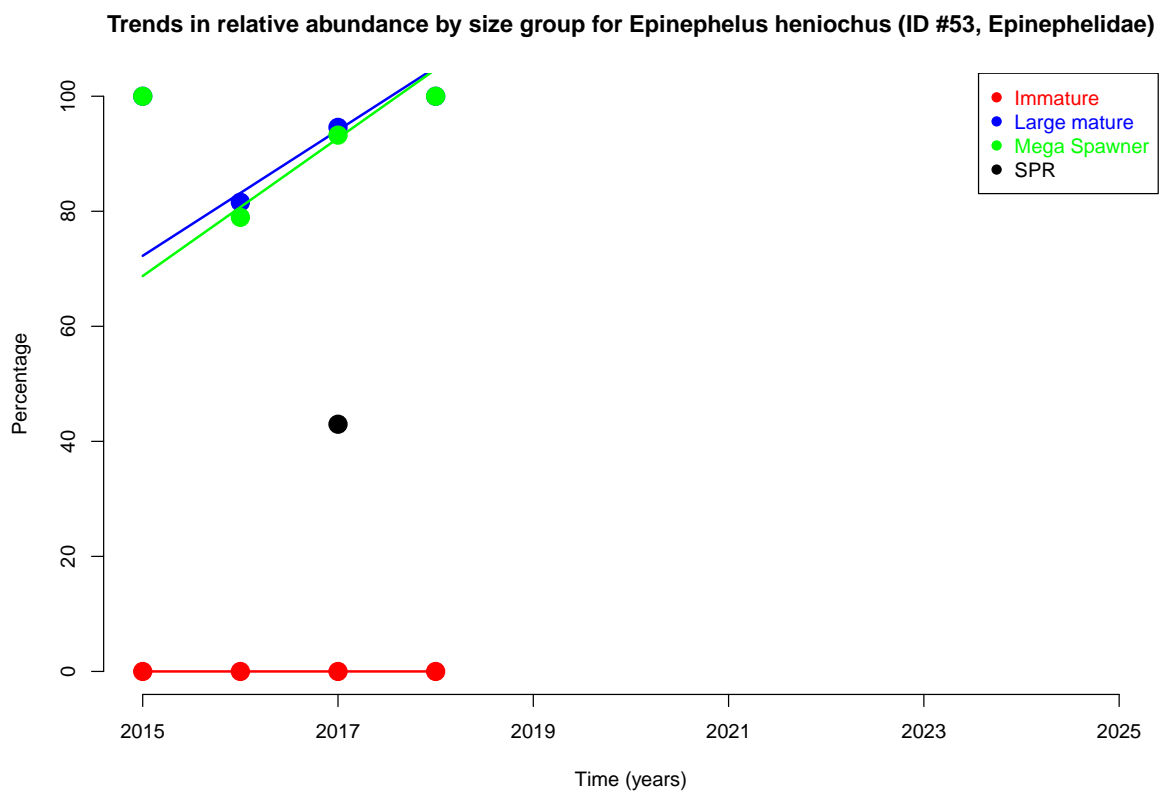
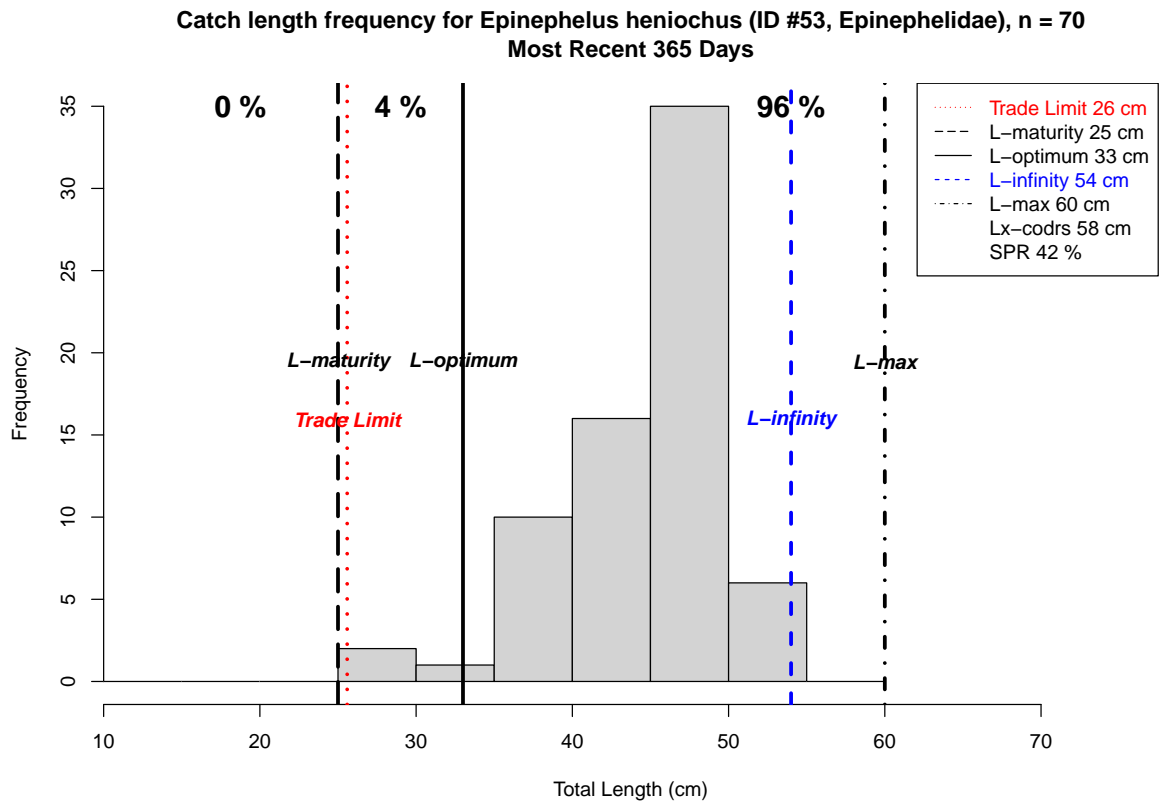
Trends in relative abundance by size group for *Cephalopholis sonnerati* (ID #39, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.243

% Large Mature rising over recent years, situation improving. P: 0.383

% Mega Spawner rising over recent years, situation improving. P: 0.281

% SPR rising over recent years, situation improving. P: not available



The percentages of *Epinephelus heniochus* (ID #53, Epinephelidae) in most recent 365 days, n=70
Immature (< 25cm): 0%
Small mature (\geq 25cm, < 33cm): 4%
Large mature (\geq 33cm): 96%
Mega spawner (\geq 36.3cm): 94% (subset of large mature fish)
Spawning Potential Ratio: 42 %

The trade limit is about the same as the length at first maturity. This means that the trade puts a premium on fish that have spawned at least once, which improves sustainability of the fishery. Risk level is medium.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

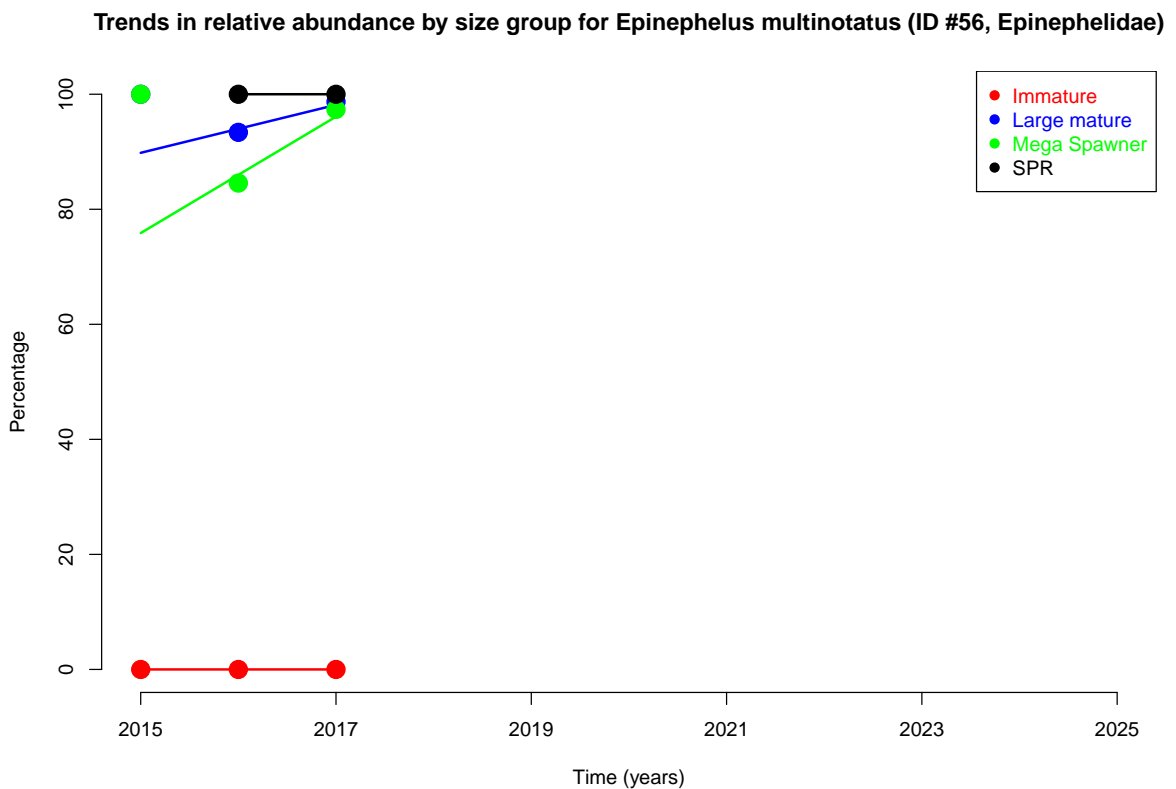
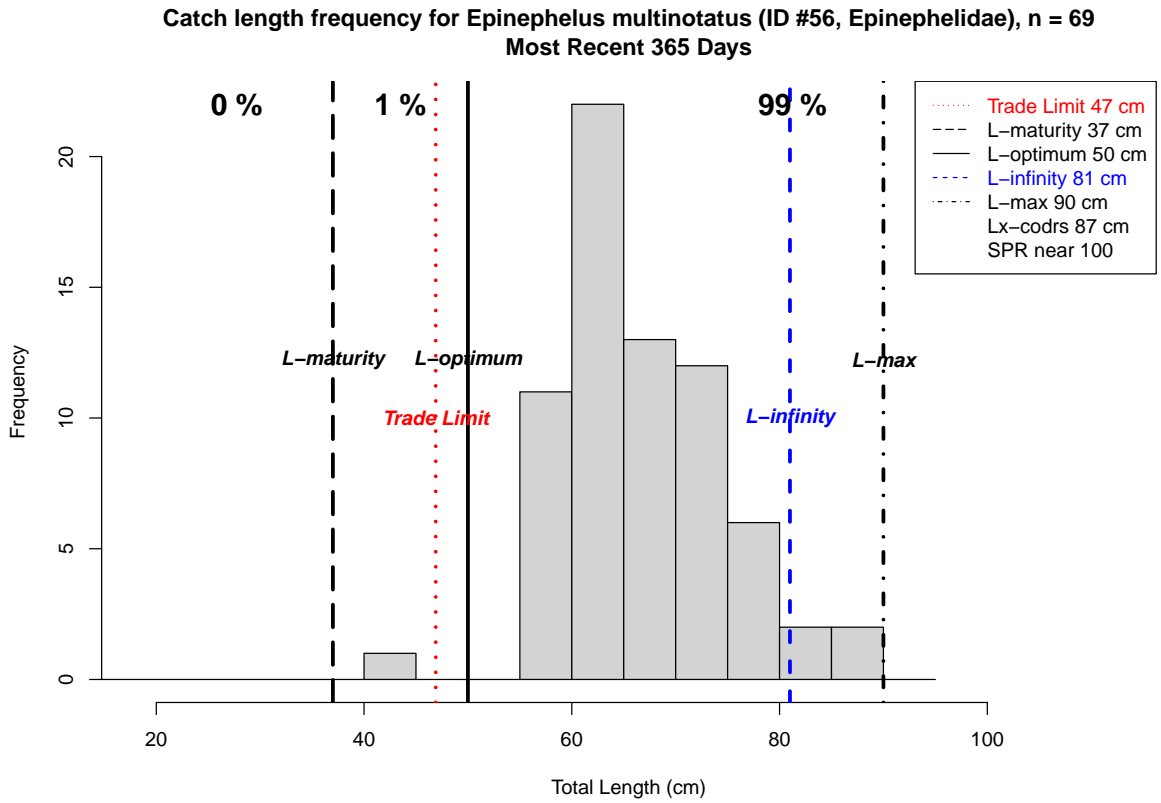
Trends in relative abundance by size group for *Epinephelus heniochus* (ID #53, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.108

% Mega Spawner rising over recent years, situation improving. P: 0.112

% SPR no trend over recent years, situation stable. P: not available



The percentages of *Epinephelus multinotatus* (ID #56, Epinephelidae) in most recent 365 days, n=69
Immature (< 37cm): 0%
Small mature (\geq 37cm, < 50cm): 1%
Large mature (\geq 50cm): 99%
Mega spawner (\geq 55cm): 99% (subset of large mature fish)
Spawning Potential Ratio: near 100

The trade limit is significantly higher than length at first maturity. This means that the trade puts a premium on fish that have spawned at least once. The trade does not cause any concern of recruitment overfishing for this species. Risk level is low.

At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of juveniles for this species. Risk level is low.

The majority of the catch consists of size classes around or above the optimum harvest size. This means that the impact of the fishery is minimized for this species. Potentially higher yields of this species could be achieved by catching them at somewhat smaller size, although capture of smaller specimen may take place already in other fisheries. Risk level is low.

More than 30% of the catch consists of mega spawners which indicates that this fish population is in good health unless large amounts of much smaller fish from the same population are caught by other fisheries. Risk level is low.

SPR is more than 40%. The stock is probably not over exploited, and the risk that the fishery will cause further stock decline is small. Risk level is low.

Trends in relative abundance by size group for *Epinephelus multinotatus* (ID #56, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: not available

% Large Mature rising over recent years, situation improving. P: 0.392

% Mega Spawner rising over recent years, situation improving. P: 0.384

% SPR no trend over recent years, situation stable. P: not available

Table 4.1: Values of indicators in length-based assessment for top 50 species, ranked by abundance in catches. Based on the most recent 365 days of catches in WPP 718

Rank	#ID	Species	Trade Limit Prop. Lmat	Immature %	Exploitation %imm+%smat	Mega Spawn %	SPR %
1	17	<i>Lutjanus malabaricus</i>	0.66	9.77	83.90	6.94	13 %
2	7	<i>Pristipomoides multidens</i>	0.73	13.05	76.72	5.84	12 %
3	65	<i>Lethrinus laticaudis</i>	0.91	0.30	18.57	69.65	73 %
4	18	<i>Lutjanus sebae</i>	0.59	51.05	97.81	0.59	2 %
5	8	<i>Pristipomoides typus</i>	0.80	34.99	88.06	4.47	11 %
6	4	<i>Etelis sp.</i>	0.51	48.50	89.20	4.00	9 %
7	45	<i>Epinephelus areolatus</i>	1.37	0.12	8.44	82.30	71 %
8	90	<i>Diagramma labiosum</i>	1.02	0.15	4.11	89.15	78 %
9	64	<i>Lethrinus lentjan</i>	1.05	0.90	20.30	68.81	93 %
10	24	<i>Lutjanus johnii</i>	0.59	4.24	69.26	13.07	19 %
11	25	<i>Lutjanus russelli</i>	1.06	0.73	32.49	45.55	99 %
12	34	<i>Paracaesio kusakarii</i>	0.77	9.90	95.53	0.97	3 %
13	66	<i>Lethrinus nebulosus</i>	0.95	1.03	26.95	65.64	near 100
14	21	<i>Lutjanus erythropterus</i>	0.86	3.61	48.83	27.81	37 %
15	15	<i>Lutjanus argentimaculatus</i>	0.64	8.37	75.11	9.87	22 %
16	78	<i>Caranx bucculentus</i>	1.47	2.18	60.78	10.46	11 %
17	92	<i>Pomadasys kaakan</i>	0.92	1.32	9.69	74.23	71 %
18	41	<i>Epinephelus latifasciatus</i>	1.04	1.86	33.26	28.60	29 %
19	71	<i>Gymnocranius grandoculis</i>	0.90	0.74	18.72	63.79	73 %
20	50	<i>Epinephelus coioides</i>	0.94	1.80	32.34	50.00	70 %
21	1	<i>Aphareus rutilans</i>	0.81	10.66	76.49	12.85	12 %
22	58	<i>Epinephelus amblycephalus</i>	1.39	0.99	10.86	74.01	61 %
23	76	<i>Carangoides chrysophrys</i>	1.17	1.03	15.12	67.35	56 %
24	19	<i>Lutjanus timorensis</i>	1.04	1.47	47.62	26.74	38 %
25	27	<i>Lutjanus vitta</i>	1.15	3.68	70.22	11.40	11 %
26	82	<i>Caranx tille</i>	1.21	0.00	0.40	98.41	75 %
27	70	<i>Wattsia mossambica</i>	1.09	0.00	30.28	53.39	56 %
28	46	<i>Epinephelus bleekeri</i>	0.85	0.00	2.07	94.21	near 100
29	9	<i>Pristipomoides filamentosus</i>	0.69	40.71	75.22	12.83	19 %
30	67	<i>Lethrinus olivaceus</i>	0.61	2.65	27.43	55.31	27 %
31	10	<i>Pristipomoides sieboldii</i>	1.01	0.00	45.41	28.02	23 %
32	100	<i>Protonibea diacanthus</i>	0.76	37.44	76.92	12.82	24 %
33	54	<i>Epinephelus stictus</i>	1.34	0.00	0.00	98.97	near 100
34	73	<i>Carangoides coeruleopinnatus</i>	1.25	0.00	0.53	97.33	near 100
35	89	<i>Glaucosoma buergeri</i>	0.95	0.56	15.00	71.67	83 %
36	6	<i>Etelis coruscans</i>	0.59	61.82	92.73	1.21	2 %
37	86	<i>Erythrocles schlegelii</i>	1.31	0.00	25.00	38.75	39 %
38	16	<i>Lutjanus bohar</i>	0.65	51.01	87.92	4.03	12 %
39	5	<i>Etelis radius</i>	0.77	30.50	69.50	19.86	39 %
40	87	<i>Argyrops spinifer</i>	1.11	1.52	20.45	53.03	46 %
41	22	<i>Pinjalo lewisi</i>	1.02	0.00	62.02	16.28	18 %
42	35	<i>Paracaesio stonei</i>	0.87	11.54	86.54	2.88	7 %
43	81	<i>Caranx sexfasciatus</i>	1.30	1.92	5.77	90.38	near 100
44	99	<i>Rachycentron canadum</i>	1.10	2.15	34.41	43.01	46 %
45	20	<i>Lutjanus gibbus</i>	1.15	7.61	84.78	1.09	7 %
46	2	<i>Aprion virescens</i>	0.79	7.32	56.10	15.85	24 %
47	14	<i>Lutjanus bitaeniatus</i>	1.42	0.00	12.50	63.75	70 %
48	39	<i>Cephalopholis sonnerati</i>	1.12	0.00	4.11	93.15	near 100
49	53	<i>Epinephelus heniochus</i>	1.02	0.00	4.29	94.29	42 %
50	56	<i>Epinephelus multinotatus</i>	1.27	0.00	1.45	98.55	near 100

Table 4.2: Risk level in fisheries for top 50 species, ranked by abundance in catches.
Based on most recent 365 days of catches in WPP 718

Rank	#ID	Species	Trade Limit	Immature	Exploitation	Mega Spawn	SPR
1	17	Lutjanus malabaricus	high	low	high	high	high
2	7	Pristipomoides multidentis	high	medium	high	high	high
3	65	Lethrinus laticaudis	medium	low	low	low	low
4	18	Lutjanus sebae	high	high	high	high	high
5	8	Pristipomoides typus	high	high	high	high	high
6	4	Etelis sp.	high	high	high	high	high
7	45	Epinephelus areolatus	low	low	low	low	low
8	90	Diagramma labiosum	medium	low	low	low	low
9	64	Lethrinus lentjan	medium	low	low	low	low
10	24	Lutjanus johnii	high	low	high	high	high
11	25	Lutjanus russelli	medium	low	low	low	low
12	34	Paracaesio kusakarii	high	low	high	high	high
13	66	Lethrinus nebulosus	medium	low	low	low	low
14	21	Lutjanus erythropterus	high	low	low	medium	medium
15	15	Lutjanus argentimaculatus	high	low	high	high	high
16	78	Caranx bucculentus	low	low	medium	high	high
17	92	Pomadysys kaakan	medium	low	low	low	low
18	41	Epinephelus latifasciatus	medium	low	low	medium	medium
19	71	Gymnocranius grandoculis	high	low	low	low	low
20	50	Epinephelus coioides	medium	low	low	low	low
21	1	Aphareus rutilans	high	medium	high	high	high
22	58	Epinephelus amblycephalus	low	low	low	low	low
23	76	Carangoides chrysophrys	low	low	low	low	low
24	19	Lutjanus timorensis	medium	low	low	medium	medium
25	27	Lutjanus vitta	low	low	high	high	high
26	82	Caranx tille	low	low	low	low	low
27	70	Wattsia mossambica	medium	low	low	low	low
28	46	Epinephelus bleekeri	high	low	low	low	low
29	9	Pristipomoides filamentosus	high	high	high	high	high
30	67	Lethrinus olivaceus	high	low	low	low	medium
31	10	Pristipomoides sieboldii	medium	low	low	medium	high
32	100	Protonibeia diacanthus	high	high	high	high	high
33	54	Epinephelus stictus	low	low	low	low	low
34	73	Carangoides coeruleopinnatus	low	low	low	low	low
35	89	Glaucosoma buergeri	medium	low	low	low	low
36	6	Etelis coruscans	high	high	high	high	high
37	86	Erythrocles schlegelii	low	low	low	low	medium
38	16	Lutjanus bohar	high	high	high	high	high
39	5	Etelis radiusus	high	high	high	high	medium
40	87	Argyrops spinifer	low	low	low	low	low
41	22	Pinjalo lewisi	medium	low	medium	high	high
42	35	Paracaesio stonei	high	medium	high	high	high
43	81	Caranx sexfasciatus	low	low	low	low	low
44	99	Rachycentron canadum	low	low	low	low	low
45	20	Lutjanus gibbus	low	low	high	high	high
46	2	Aprion virescens	high	low	medium	high	high
47	14	Lutjanus bitaeniatus	low	low	low	low	low
48	39	Cephalopholis sonnerati	low	low	low	low	low
49	53	Epinephelus heniochus	medium	low	low	low	low
50	56	Epinephelus multinotatus	low	low	low	low	low

Table 4.3: Trends in SPR and relative abundance by size group for top 50 species in WPP 718

Rank	#ID	Species	% Immature	% Large Mature	% Mega Spawner	% SPR
1	17	Lutjanus malabaricus	improving	deteriorating	deteriorating	deteriorating
2	7	Pristipomoides multidens	improving	improving	improving	improving
3	65	Lethrinus laticaudis	deteriorating	deteriorating	deteriorating	deteriorating
4	18	Lutjanus sebae	improving	improving	improving	improving
5	8	Pristipomoides typus	deteriorating	improving	improving	improving
6	4	Etelis sp.	improving	improving	improving	improving
7	45	Epinephelus areolatus	stable	stable	improving	improving
8	90	Diagramma labiosum	improving	deteriorating	deteriorating	improving
9	64	Lethrinus lentjan	deteriorating	deteriorating	deteriorating	improving
10	24	Lutjanus johnii	improving	deteriorating	deteriorating	deteriorating
11	25	Lutjanus russelli	improving	deteriorating	deteriorating	deteriorating
12	34	Paracaesio kusakarii	deteriorating	deteriorating	deteriorating	deteriorating
13	66	Lethrinus nebulosus	deteriorating	deteriorating	deteriorating	stable
14	21	Lutjanus erythropterus	deteriorating	deteriorating	deteriorating	improving
15	15	Lutjanus argentimaculatus	improving	deteriorating	deteriorating	deteriorating
16	78	Caranx bucculentus	improving	deteriorating	deteriorating	deteriorating
17	92	Pomadasydys kaakan	deteriorating	improving	improving	improving
18	41	Epinephelus latifasciatus	improving	improving	deteriorating	deteriorating
19	71	Gymnocranius grandoculis	improving	improving	improving	improving
20	50	Epinephelus coioides	improving	improving	improving	improving
21	1	Aphareus rutilans	deteriorating	deteriorating	improving	improving
22	58	Epinephelus amblycephalus	improving	improving	improving	improving
23	76	Carangoides chrysophrys	stable	improving	improving	deteriorating
24	19	Lutjanus timorensis	deteriorating	deteriorating	deteriorating	deteriorating
25	27	Lutjanus vitta	deteriorating	improving	improving	improving
26	82	Caranx tille	stable	improving	improving	deteriorating
27	70	Wattsia mossambica	improving	improving	improving	deteriorating
28	46	Epinephelus bleekeri	stable	improving	improving	improving
29	9	Pristipomoides filamentosus	improving	improving	improving	stable
30	67	Lethrinus olivaceus	improving	deteriorating	deteriorating	deteriorating
31	10	Pristipomoides sieboldii	improving	stable	improving	improving
32	100	Protonibea diacanthus	deteriorating	improving	improving	improving
33	54	Epinephelus stictus	stable	improving	improving	improving
34	73	Carangoides coeruleopinnatus	stable	improving	improving	improving
35	89	Glaucosoma buergeri	improving	improving	improving	improving
36	6	Etelis coruscans	improving	deteriorating	deteriorating	deteriorating
37	86	Erythrocles schlegelii	deteriorating	improving	improving	improving
38	16	Lutjanus bohar	deteriorating	deteriorating	deteriorating	deteriorating
39	5	Etelis radius	improving	improving	improving	improving
40	87	Argyrops spinifer	deteriorating	improving	improving	improving
41	22	Pinjalo lewisi	stable	improving	improving	deteriorating
42	35	Paracaesio stonei	deteriorating	deteriorating	deteriorating	deteriorating
43	81	Caranx sexfasciatus	deteriorating	deteriorating	improving	improving
44	99	Rachycentron canadum	improving	deteriorating	deteriorating	improving
45	20	Lutjanus gibbus	deteriorating	deteriorating	deteriorating	deteriorating
46	2	Aprion virescens	improving	improving	deteriorating	improving
47	14	Lutjanus bitaeniatus	stable	improving	improving	improving
48	39	Cephalopholis sonnerati	improving	improving	improving	improving
49	53	Epinephelus heniochus	stable	improving	improving	stable
50	56	Epinephelus multinotatus	stable	improving	improving	stable

5 Discussion and conclusions

Deepwater drop line fishing occurs in WPP 718 on deep slopes bordering the Banda Sea and in the Timor Trough, at depths between 50 and 500 meters. Bottom long line fishing in WPP 718 occurs on the shelf areas and tops of slopes, mainly in the Arafura Sea with a relatively flat bottom profile at depths ranging from 50 to 150 meters. Bottom long line fishing grounds overlap with those previously heavily fished with bottom trawlers, a practice which is now prohibited throughout Indonesia. It is unclear how much bottom trawling still continues illegally, in remote areas, or with dragging gear that is given different names.

The deep water drop line fishery for snappers, groupers and emperors is a fairly “clean” fishery when it comes to the species spectrum in the catch (Table 5.1), even though it is much more species-rich than sometimes assumed, also within the “snapper” category, which forms the main target group. The bottom long line fishery is characterized by a more substantial by-catch of small sharks, cobia and trevallies, which are currently not preferred by the processors who are buying the target species. By-catch species are usually sun-dried by the crew and sold separately, outside of the catch of snappers, groupers and emperors, which belongs to the owner of the boat and goes to the processors for middle and higher end local and export markets.

Drop line fisheries are characterized by a very low impact on habitat at the fishing grounds, whereas some more impact from entanglement can be expected from bottom long lines. Nothing near the habitat impact from destructive dragging gears is evident from either one of the two deep hook and line fisheries. However, due to limited available habitat (fishing grounds) and predictable locations of fish concentrations, combined with a very high fishing effort on the best known fishing grounds, as well as the targeting of juveniles, there is a high potential for overfishing in the deep slope fisheries.

Risks of overfishing are high for all the larger snappers which are common on deep slopes in Eastern Indonesia (Table 4.1 and Table 4.2), especially for those species which complete their life cycle in the habitats covered by the fishing grounds and which at the same time are easily caught with drop line and bottom long line gears. The snapper feeding aggregations are at predictable and well known locations and the snappers are therefore among the most vulnerable species in these fisheries. Fishing mortality (from deep slope hook and line fisheries) relative to natural mortality in all major target snapper species seems to be unacceptably high while the catches of these species include large percentages of relatively small and immature specimen. For many species of snappers, sizes are consistently targeted and landed well below the size where these fish reach maturity. Bigger specimen of the largest snapper species are already becoming extremely rare in our region.

Interestingly, the groupers seem to be less vulnerable to the deep slope hook and line fisheries than the snappers are. Impact by the deep slope drop line and longline fisheries on grouper populations is limited compared to the snappers. This may be because most groupers are staying closer to high rugosity bottom habitat, which is avoided by longline vessels due to risk of entanglement, while drop line fishers are targeting schooling snappers that are hovering higher in the water column, above the grouper habitat. Fishing mortality (from deep slope hook and line fisheries) relative to natural mortality in large mature groupers seems to be considerably lower than what we see for the snappers.

Groupers generally mature as females at a size relative to their maximum size which is lower than for snappers. This strategy enables them to reproduce before they are being caught, although fecundity is still relatively low at sizes below the optimum length. Fecundity for the population as a whole peaks at the optimum size for each species, and this is also the size around which sex change from females to males happens in groupers. Separate analysis of all grouper data shows that most groupers have already reached or passed their optimum size (and the size where sex change takes place) when they are caught by the deep slope hook and line fisheries.

For those grouper species which spend all or most of their life cycle in these habitats, the relatively low vulnerability to the deep slope hook and line fisheries is very good news. For other grouper species which spend major parts of their life cycle in shallower habitats, like coral reefs or mangroves or estuaries for example, the reality is that their populations in general are in extremely bad shape due to excessive fishing pressure by small scale fisheries in those shallower habitats. This situation is also evident for a few snapper species such as for example the mangrove jack.

Overall there is a clear scope for some straightforward fisheries improvements supported by relatively uncomplicated fisheries management policies and regulations. Our first recommendation for industry led fisheries improvements is for traders to adjust trading limits (incentives to fishers) species by species (which they are basically doing already) to the length at maturity for each species. For a number of important species the trade limits need adjustments upwards, with government support through regulations on minimum allowable sizes. Many of the deep water snappers are traded at sizes that are too small, and this impairs sustainability. The impact is clearly visible already in landed catches.

Adjustment upwards of trading limits towards the size at first maturity would be a straight forward improvement in these fisheries. By refusing undersized fish in high value supply lines, the market can provide incentives for captains of catcher boats to target larger specimen. The captains can certainly do this by using their day to day experiences, selecting locations, fishing depths, habitat types, hook sizes, etc. Literature data shows habitat separation between size groups in many species, as well as size selectivity of specific hook sizes. Captains know about this from experience.

Market preference for certain (small) size classes (like “plate size” and “golden size”) could potentially be adjusted by awareness campaigns that clarify to the public that such sizes for many species actually represent immature juveniles and targeting these specifically will impair fisheries sustainability. Filleting techniques for larger fish can be adjusted to relatively thin slicing under an angle to produce similar cuts as “plate size” fillets, instead of the currently more common cutting of thick “portions” from large fillets, which are less preferred in some markets. This could support an increased focus on larger fish by fishing companies, especially if supported by size based policies and regulation like minimum sizes.

Some of the less well known snapper species (e.g. *Paracaesio* spp.) are actually good quality fish that are caught in great quantities, but are under-valued in the trade as they are simply not known by high end buyers and lack the valuable color red. Awareness campaigns (including tasting tests) on the quality of these species could help to support fishing companies obtain better prices for these species and offset with that some of the temporary losses that may occur when undersized fish will be actively avoided.

Besides size selectivity, fishing effort is a very important factor in resulting overall catch and size frequency of the catch. All major target snappers show a rapid decline in numbers above the size where the species becomes most vulnerable to the fisheries. This rapid decline in numbers, as visible in the LFD graphs, indicates a high fishing mortality for the vulnerable size classes. Fishing effort is probably too high to be sustainable and many species seem to be at risk in the deep drop and long line fisheries, judging from a number of indicators as presented in this report.

Highly important fishing grounds in the Indonesian part of the Arafura Sea are heavily fished by large numbers of Indonesian boats targeting the snapper resources there. Possibly the only reason that this fishery is still profitable is the huge amount of shelf habitat across the Australian border, which is well-managed and experiences low fishing pressure. The Indonesian boats are “fishing the line” here in the most literal sense, and profiting from a spillover effect from that Australian shelf area where fish stocks of at least some of the target species are doing well. The differences in stock densities and fish sizes on either side of the border are stark and very well known by fishing boat captains. This has led to IUU incidences and arrests of Indonesian boats in Australian waters.

One very much needed fisheries management intervention is to cap fishing effort (number of boats) at current level and to start looking at incentives for effort reductions. A reduction of effort will need to be supported and implemented by government to ensure an even playing field among fishing companies. An improved licensing system and an effort control system based on the Indonesia’s mandatory Vessel Monitoring System, using more accurate data on Gross Tonnage for all fishing boats, could be used to better manage fishing effort. Continuous monitoring of trends in the various presented indicators will show in which direction these fisheries are heading and what the effects are of any fisheries management measures in future years.

Government policies and regulations can be formulated to support fishers and traders with the implementation of improvements across the sector. Our recommendations for supporting government policies in relation to the snapper fisheries include:

- Use scientific (Latin) fish names in fisheries management and in trade.
- Incorporate length-based assessments in management of specific fisheries.
- Develop species-specific length based regulations for these fisheries.
- Implement a controlled access management system for regulation of fishing effort on specific fishing grounds.
- Increase public awareness on unknown species and preferred size classes by species.
- Incorporate traceability systems in fleet management by fisheries.

Recommendations for specific regulations may include:

- Make mandatory correct display of scientific name (labeling) of all traded fish.
- Adopt legal minimum sizes for specific or even all traded species, at the length at maturity for each species.
- Make mandatory for each fishing vessel of all sizes to carry a simple GPS tracking device that needs to be functioning at all times. Indonesia already has a mandatory Vessel Monitoring System for vessels larger than 30 GT, so Indonesia could consider expanding this requirement to fishing vessels of smaller sizes.
- Cap fishing effort in the snapper fisheries at the current level and explore options to reduce effort to more sustainable levels.

Table 5.1: Sample sizes over the period 2015 to 2025 for the others species in WPP 718

Family Name	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total	%Catch
Ariidae	0	9	43	1	0	0	0	0	0	0	0	53	0.039
Bramidae	0	1	0	0	0	0	0	0	0	0	0	1	0.001
Carangidae	0	81	267	73	0	0	0	0	0	0	0	421	0.313
Epinephelidae	0	21	38	6	0	0	0	0	0	0	0	65	0.048
Gempylidae	0	8	0	0	0	0	0	0	0	0	0	8	0.006
Haemulidae	0	5	3	0	0	0	0	0	0	0	0	8	0.006
Holocentridae	0	1	3	0	0	0	0	0	0	0	0	4	0.003
Lethrinidae	0	7	30	0	0	0	0	0	0	0	0	37	0.028
Lutjanidae	0	9	37	0	0	0	0	0	0	0	0	46	0.034
Malacanthidae	0	2	0	0	0	0	0	0	0	0	0	2	0.001
Nemipteridae	0	2	2	0	0	0	0	0	0	0	0	4	0.003
Other	0	62	265	247	0	0	0	0	0	0	0	574	0.427
Priacanthidae	0	2	1	0	0	0	0	0	0	0	0	3	0.002
Rays	0	0	9	0	0	0	0	0	0	0	0	9	0.007
Scombridae	0	64	256	5	0	0	0	0	0	0	0	325	0.242
Serranidae	0	0	1	0	0	0	0	0	0	0	0	1	0.001
Sharks	0	1	6	0	0	0	0	0	0	0	0	7	0.005
Sphyraenidae	0	4	2	1	0	0	0	0	0	0	0	7	0.005
Total	0	279	963	333	0	0	0	0	0	0	0	1575	1.172

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