

Length-Based Stock Assessment Of A Species Complex In Deepwater Demersal Fisheries Targeting Snappers In Indonesia Fishery Management Area WPP 573

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Peter J. Mous, Wawan B. IGede, Jos S. Pet

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PEOPLE & NATURE CONSULTING
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The Nature Conservancy Indonesia Fisheries Conservation Program

Ikat Plaza Building - Blok L
Jalan By Pass Ngurah Rai No.505, Pemogan, Denpasar Selatan
Denpasar 80221
Bali, Indonesia
Ph. +62-361-244524

People and Nature Consulting International

Grahalia Tiyng Gading 18 - Suite 2
Jalan Tukad Pancoran, Panjer, Denpasar Selatan
Denpasar 80225
Bali, Indonesia

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1 Introduction

This report presents a length-based assessment of the multi-species deep slope fisheries targeting snappers, groupers, and emperors, as well as a number of other families, at depths ranging from 50 to 500 meters, in Fisheries Management Area (WPP) 573 in Southern Indonesia (Figure 1.1). The most important fishing grounds in this area are located in the Indonesian part of the Timor Sea, near the edge of the Australian continental shelf (Figure 1.2). Fishing grounds for snappers, groupers, emperors and other target species in this region include deep slopes along the many islands as well as seamounts and other deep structures which are characteristic for this area. There is also fishing around West Timor, Rote Island and other areas around the Savu Sea, as well as on deep slopes throughout WPP 573, mostly by small-scale fishers. Vessels operating in WPP 573 originate from various ports throughout the country, and may also operate in other WPPs. Kupang is one of the main logistical hubs for the Timor Sea fisheries, whereas most of the processing happens in Bali.

Larger vessels, ranging from 15 to 100 GT, commonly make trips to distant fishing grounds located 1,000 kilometers or more from port. Smaller boats around 5 to 15 GT range up to 150 km from their home base, while the smallest boats of less than 5 GT commonly range 50 km or more. Gear types in these fisheries include drop lines and bottom-set long lines, deployed from boats of less than 5 GT to medium-scale drop line and long line vessels measuring up to 100 GT for the largest long line vessels. 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. Other deep demersal gear types like traps and gillnets are not very common in WPP 573.

The Indonesian deep demersal fisheries catches a large number of species, and stocks of 100 of the most common species are monitored on a continuous basis through a Crew Operated Data Recording System (CODRS). The current report presents the top 50 most abundant species of fish in CODRS samples (Tables 1.1 and 1.2) in WPP 573, and analyses length frequencies of the 50 most important species in the combined deep demersal catches in this fisheries management area. For a complete overview of the species composition with images of all 100 target species, 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. The first full year of data collection was in 2015 and this is also the first year for which data are included in this report. All fish captured were photographed on measuring boards by fishing crew participating in our Crew Operated Data Recording System or CODRS. Images were analysed 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>

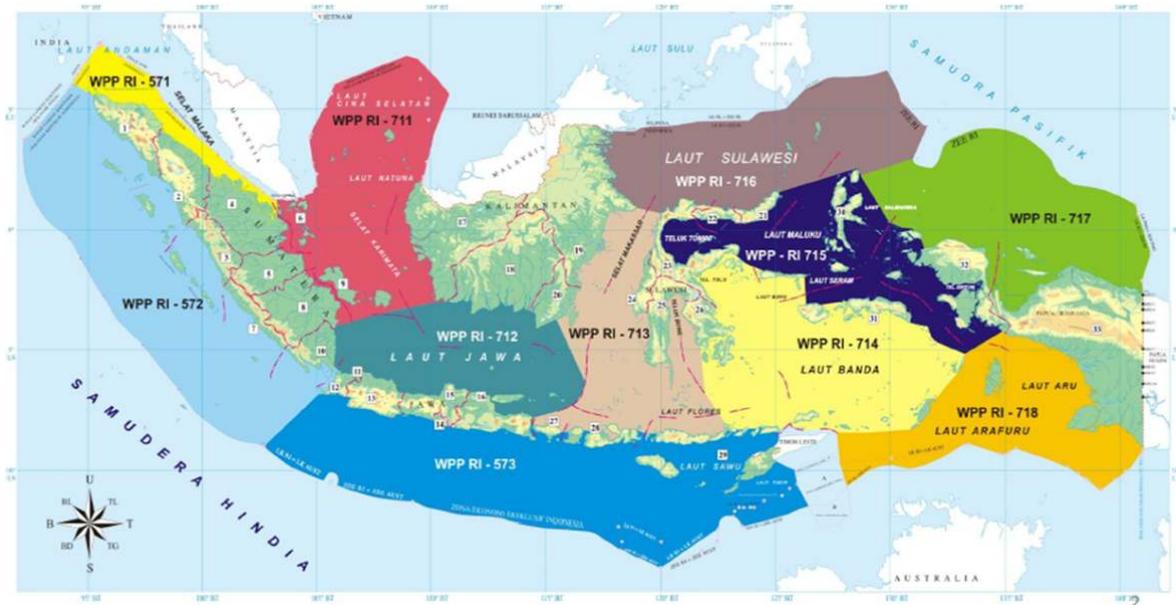


Figure 1.1: Fisheries Management Areas (*Wilayah Pengelolaan Perikanan* or WPP) in Indonesian marine waters.



Figure 1.2: Bathymetric map of the WPP 573 including Savu and Timor Sea, in Indonesia. Red lines are EEZ border, black lines are WPP border, blue lines are MPAs.

Table 1.1: Length-weight relationships, trading limits and total sample sizes (including all years) for the 50 most abundant species in CODRS samples from deep water demersal fisheries in 573

Rank	#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	7	<i>Pristipomoides multidentis</i>	500	0.020	2.944	FL	31.18	34.92	172500
2	8	<i>Pristipomoides typus</i>	500	0.014	2.916	TL	36.16	36.16	129364
3	17	<i>Lutjanus malabaricus</i>	500	0.009	3.137	FL	33.11	33.11	51863
4	45	<i>Epinephelus areolatus</i>	300	0.011	3.048	FL	28.18	28.77	43080
5	10	<i>Pristipomoides sieboldii</i>	300	0.022	2.942	FL	25.52	29.21	19253
6	9	<i>Pristipomoides filamentosus</i>	500	0.038	2.796	FL	29.70	33.27	16848
7	21	<i>Lutjanus erythropterus</i>	500	0.024	2.870	FL	31.79	31.79	15342
8	19	<i>Lutjanus timorensis</i>	500	0.009	3.137	FL	33.11	33.34	10397
9	34	<i>Paracaesio kusakarii</i>	500	0.011	3.135	FL	30.96	34.80	10270
10	6	<i>Etelis coruscans</i>	500	0.041	2.758	FL	30.28	37.85	7803
11	22	<i>Pinjalo lewisi</i>	300	0.014	2.970	FL	28.42	29.64	7354
12	4	<i>Etelis sp.</i>	500	0.022	2.950	FL	30.16	32.84	6985
13	96	<i>Parasclopsis eriomma</i>	100	0.012	2.990	FL	20.47	21.90	6890
14	18	<i>Lutjanus sebae</i>	500	0.009	3.208	FL	29.97	31.26	6516
15	27	<i>Lutjanus vitta</i>	300	0.017	2.978	FL	26.72	27.64	5554
16	1	<i>Aphareus rutilans</i>	1000	0.015	2.961	FL	42.20	49.61	5456
17	70	<i>Gymnocranius grandoculis</i>	500	0.032	2.885	FL	28.43	30.53	4406
18	5	<i>Etelis radius</i>	1000	0.056	2.689	FL	38.05	43.15	4191
19	28	<i>Lutjanus bouton</i>	300	0.034	3.000	FL	20.75	21.56	3229
20	43	<i>Epinephelus morrhua</i>	300	0.061	2.624	FL	25.59	25.59	3203
21	39	<i>Cephalopholis sonnerati</i>	300	0.015	3.058	TL	25.78	25.78	3009
22	88	<i>Glaucosoma buergeri</i>	500	0.045	2.725	TL	30.40	30.40	2732
23	69	<i>Wattsia mossambica</i>	500	0.040	2.824	FL	28.21	29.34	2594
24	32	<i>Paracaesio gonzalesi</i>	300	0.020	3.050	FL	23.24	24.96	2481
25	33	<i>Paracaesio xanthura</i>	300	0.023	3.000	SL	23.64	27.39	2422
26	84	<i>Seriola rivoliana</i>	2000	0.006	3.170	FL	54.23	60.03	1877
27	71	<i>Gymnocranius griseus</i>	500	0.032	2.885	FL	28.43	30.56	1687
28	46	<i>Epinephelus bleekeri</i>	300	0.009	3.126	TL	28.09	28.09	1678
29	41	<i>Epinephelus latifasciatus</i>	1500	0.010	3.088	TL	48.00	48.00	1676
30	35	<i>Paracaesio stonei</i>	500	0.024	2.960	FL	28.78	32.35	1562
31	20	<i>Lutjanus gibbus</i>	500	0.015	3.091	FL	28.87	31.09	1504
32	63	<i>Lethrinus lentjan</i>	300	0.020	2.986	FL	25.16	26.35	1302
33	52	<i>Epinephelus retouti</i>	300	0.027	3.000	SL	22.37	28.24	1250
34	51	<i>Epinephelus chlorostigma</i>	500	0.015	2.940	FL	34.62	34.62	1203
35	15	<i>Lutjanus argentimaculatus</i>	500	0.034	2.792	FL	31.22	31.78	1128
36	37	<i>Cephalopholis miniata</i>	300	0.026	2.864	TL	26.35	26.35	1095
37	75	<i>Carangoides chrysophrys</i>	1000	0.027	2.902	FL	37.68	42.12	1094
38	16	<i>Lutjanus bohar</i>	500	0.016	3.059	FL	29.70	31.31	954
39	92	<i>Cookeolus japonicus</i>	300	0.014	3.000	TL	27.58	27.58	926
40	86	<i>Argyrops spinifer</i>	300	0.055	2.670	TL	25.11	27.87	901
41	67	<i>Lethrinus amboinensis</i>	300	0.029	2.851	FL	25.49	28.06	889
42	30	<i>Lipocheilus carnolabrum</i>	500	0.149	2.488	FL	26.13	28.32	887
43	14	<i>Lutjanus bitaeniatus</i>	500	0.014	2.980	FL	33.61	34.18	861
44	85	<i>Erythrocles schlegelii</i>	1500	0.011	3.040	FL	48.55	53.60	851
45	26	<i>Lutjanus lemniscatus</i>	300	0.020	2.907	FL	27.28	28.49	698
46	81	<i>Caranx tille</i>	2000	0.032	2.930	FL	43.43	49.51	676
47	62	<i>Variola albimarginata</i>	300	0.012	3.079	FL	26.68	30.44	647
48	25	<i>Lutjanus russelli</i>	300	0.020	2.907	FL	27.28	28.49	633
49	58	<i>Epinephelus amblycephalus</i>	1500	0.012	3.057	TL	45.99	45.99	608
50	89	<i>Diagramma labiosum</i>	500	0.014	2.988	FL	33.08	36.71	599

Table 1.2: Sample sizes over the period 2016 to 2024 for the 50 most abundant species in CODRS samples of deepwater demersal fisheries in WPP 573

Rank	Species	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
1	<i>Pristipomoides multidens</i>	20553	34911	37528	55126	16983	0	0	0	0	165101
2	<i>Pristipomoides typus</i>	13708	29811	32113	38265	10995	0	0	0	0	124892
3	<i>Lutjanus malabaricus</i>	3248	11514	11021	19144	5349	0	0	0	0	50276
4	<i>Epinephelus areolatus</i>	7490	9090	8230	9187	3530	0	0	0	0	37527
5	<i>Pristipomoides sieboldii</i>	3241	935	2121	1999	6618	0	0	0	0	14914
6	<i>Pristipomoides filamentosus</i>	3358	1296	2436	3316	2277	0	0	0	0	12683
7	<i>Lutjanus erythropterus</i>	1964	4577	4425	2034	1646	0	0	0	0	14646
8	<i>Lutjanus timorensis</i>	1358	1133	1551	4440	1332	0	0	0	0	9814
9	<i>Paracaesio kusakarii</i>	4460	1038	1414	713	470	0	0	0	0	8095
10	<i>Etelis coruscans</i>	1948	620	1977	1112	724	0	0	0	0	6381
11	<i>Pinjalo lewisi</i>	1192	367	481	768	323	0	0	0	0	3131
12	<i>Etelis sp.</i>	2098	596	1761	641	266	0	0	0	0	5362
13	<i>Parascalopsis eriomma</i>	123	82	1322	928	4402	0	0	0	0	6857
14	<i>Lutjanus sebae</i>	747	1167	1298	2382	533	0	0	0	0	6127
15	<i>Lutjanus vitta</i>	1884	702	882	860	446	0	0	0	0	4774
16	<i>Aphareus rutilans</i>	1100	232	847	1472	1116	0	0	0	0	4767
17	<i>Gymnocranius grandoculis</i>	995	1035	630	536	226	0	0	0	0	3422
18	<i>Etelis radius</i>	125	50	454	2716	742	0	0	0	0	4087
19	<i>Lutjanus bouton</i>	55	50	284	1554	1231	0	0	0	0	3174
20	<i>Epinephelus morrhua</i>	595	575	803	556	176	0	0	0	0	2705
21	<i>Cephalopholis sonnerati</i>	327	434	734	886	388	0	0	0	0	2769
22	<i>Glaucosoma buergeri</i>	524	716	629	317	59	0	0	0	0	2245
23	<i>Wattsia mossambica</i>	709	306	478	167	385	0	0	0	0	2045
24	<i>Paracaesio gonzalesi</i>	803	527	449	107	474	0	0	0	0	2360
25	<i>Paracaesio xanthura</i>	316	85	448	194	974	0	0	0	0	2017
26	<i>Seriola rivoliana</i>	226	125	447	684	247	0	0	0	0	1729
27	<i>Gymnocranius griseus</i>	248	99	227	377	556	0	0	0	0	1507
28	<i>Epinephelus bleekeri</i>	106	283	393	618	216	0	0	0	0	1616
29	<i>Epinephelus latifasciatus</i>	159	294	758	296	108	0	0	0	0	1615
30	<i>Paracaesio stonei</i>	467	270	231	184	91	0	0	0	0	1243
31	<i>Lutjanus gibbus</i>	69	6	101	325	977	0	0	0	0	1478
32	<i>Lethrinus lentjan</i>	207	161	146	359	233	0	0	0	0	1106
33	<i>Epinephelus retouti</i>	2	7	382	447	405	0	0	0	0	1243
34	<i>Epinephelus chlorostigma</i>	445	138	173	71	27	0	0	0	0	854
35	<i>Lutjanus argentimaculatus</i>	141	260	228	256	109	0	0	0	0	994
36	<i>Cephalopholis miniata</i>	42	20	192	344	473	0	0	0	0	1071
37	<i>Carangoides chrysophrys</i>	102	233	251	300	132	0	0	0	0	1018
38	<i>Lutjanus bohar</i>	178	63	65	337	241	0	0	0	0	884
39	<i>Cookeolus japonicus</i>	231	92	213	136	77	0	0	0	0	749
40	<i>Argyrops spinifer</i>	241	170	143	144	80	0	0	0	0	778
41	<i>Lethrinus amboinensis</i>	157	61	83	114	177	0	0	0	0	592
42	<i>Lipocheilus carnolabrum</i>	331	132	159	23	11	0	0	0	0	656
43	<i>Lutjanus bitaeniatus</i>	207	188	152	137	18	0	0	0	0	702
44	<i>Erythrocles schlegelii</i>	85	77	202	164	223	0	0	0	0	751
45	<i>Lutjanus lemniscatus</i>	175	184	133	106	35	0	0	0	0	633
46	<i>Caranx tille</i>	61	145	25	202	221	0	0	0	0	654
47	<i>Variola albimarginata</i>	56	37	142	185	195	0	0	0	0	615
48	<i>Lutjanus russelli</i>	67	154	147	134	39	0	0	0	0	541
49	<i>Epinephelus amblycephalus</i>	64	148	137	134	44	0	0	0	0	527
50	<i>Diagramma labiosum</i>	119	117	95	161	16	0	0	0	0	508

2 Materials and methods for data collection, analysis and reporting

2.1 Frame Survey

A country-wide frame survey was implemented to obtain complete and detailed information on the deep demersal fishing fleet in Indonesia, using a combination of satellite image analysis and ground truthing visits to all locations where either satellite imagery or other forms of information indicated deep demersal fisheries activity. During the frame survey, data were collected on boat size, gear type, port of registration, licenses for specific FMAs, captain contacts and other details, for all fishing boats in the fleet. Following practices by fisheries managers in Indonesia, we distinguished 4 boat size categories including “nano” (<5 GT), “small” (5-< 10 GT), “medium” (10-30 GT), and “large” (>30 GT). We also distinguished 4 gear types used in these fisheries, including vertical drop lines, bottom set long lines, deep water gillnets and traps. A 5th category of gear classification was needed to record operations using “mixed gear” when 2 or more of the gear types were used on the same trip and catches were not separated.

Frame survey data are continuously updated to keep records of the complete and currently active fishing fleet in the deep demersal fisheries. Fleet information is summarized by registration port and home district (Table 2.14), while actual fishing grounds are determined by placing SPOT Trace units on all fishing boats participating in the program. By late 2019, most (over 80%) of the Indonesian coastline had been surveyed and a majority of the fleet was on record. The total fleet in each WPP is a dynamic number, as boats are leaving and being added to the local fleet all the time, and therefore the fleet survey data need to be updated continuously.

2.2 Vessel Tracking and CODRS

Vessel movement and fishing activity as recorded with SPOT data generates the information on fleet dynamics. When in motion, SPOT Trace units automatically report an hourly location of each fishing boat in the program, and when at rest for more than 24 hours, they relay daily status reports. Data on species and size distributions of catches, as needed for accurate length based stock assessments, are collected via Crew Operated Data Recording Systems or CODRS. This catch data is georeferenced as the CODRS works in tandem with the SPOT Trace vessel tracking system. Captains were recruited for the CODRS program from across the full range of boat size and gear type categories.

The CODRS approach involves fishers taking photographs of the fish in the catch, displayed on measuring boards, while the SPOT tracking system records the positions. Data recording for each CODRS fishing trip begins when the boat leaves port with the GPS recording the vessel tracks while it is steaming out. After reaching the fishing grounds, fishing will start, changing the track of recorded positions into a pattern that shows fishing instead of steaming. During the fishing activity, fish is collected on the deck or in chiller boxes on deck. The captain or crew will then take pictures of the fish, positioned over measuring boards (Figure 2.1), before moving the fish from the deck or from the chiller to the hold (to be stored on ice) or to the freezer. The process is slightly different on some of the “nano” boats (around 1 GT), where some crew take pictures upon landing instead of at sea. In these situations, the timestamps of the photographs are still used as an indication of the fishing day, even though most fishing may have happened on the day before.

At the end of the trip, the storage chip from the camera is handed over for processing of the images by expert staff. Processing includes ID of the species and measurement of the length of the fish (Figure 2.2), double checking by a second expert, and data storage in the IFish data base. Sets of images from fishing trips with unacceptable low quality photographs were not further processed and not included in the dataset. Body weight at length could be calculated for all species using length-weight relationships to enable estimation of total catch weights as well as catch weights per species for individual fishing trips by CODRS vessels. Weight converted catch length frequencies of individual catches could therewith be verified against sales records of landings. These sales receipts or ledgers represent a fairly reliable estimate of the total weight of an individual catch (from a single trip, and including all species) that is independent from CODRS data.

2.3 Data Quality Control

With information from sales records we verified that individual catches were fully represented by CODRS images and we flagged catches when they were incomplete, judging from comparison with the weight converted catch size frequencies. When estimated weights from CODRS were above 90% of landed weights from receipts, they were considered complete and accepted for use in length-based analysis and calculations of CpUE. CpUE is calculated on a day by day basis, in kg/GT/day, using only those days from the trip when images were actually collected. Medium size and larger vessels (10 GT and larger) do trips of at least a week up to over a month. There may be some days on which weather or other conditions are such that no images are collected, but sufficient days with images, within those trips usually remain for daily CpUE estimates and to supply samples for length-based analysis. For boats of 10 GT and above, incomplete data sets with 30% to 90% coverage were still used for analysis, using only those days on which images were collected. For boats below 10 GT (doing day trips or trips of just a few days) only complete data sets are used for CpUE calculations. All data sets on catches with less than 30% coverage were rejected and were not used in any analysis.

2.4 Length-Frequency Distributions, CpUE, and Total Catch

By the end of 2019, more than 400 boats participated in the CODRS program (Figure 2.3) across all fishing grounds in Indonesia, with close to 40 boats enrolled in each WPP (Table 2.1). Recruitment of captains from the overall fleet into the CODRS program was not exactly proportional to composition of the fleet in terms of vessel size, gear type and the FMA where the boat normally operates. Actual fleet composition by boat size and gear type, and activity in terms of numbers of active fishing days per year for each category, are therefore used when CODRS data are used for CpUE and catch calculations. Species composition in the catch is also not exactly the same as species composition in the CODRS samples. Catch information by WPP and by fleet segment from CODRS samples needs to be combined with fleet composition and activity information to obtain accurate annual catch information and species composition for each segment of the fleet.

Converted weights from catch size frequencies on individual fishing days, in combination with activity data from onboard trackers were used to estimate catch per unit of effort (CpUE) by fleet segment (boat size * gear type), by FMA, by species, and over time. Plotted data show clear differences between CpUE values for different gear types and different boat size categories (Figure 2.4) and we therefore work with separated gear

types and boat size categories to generate CpUE values for each distinct segment of the fleet (Table 2.2 and Table 2.3). Activity data from onboard trackers on more than 400 fishing boats were used to estimate the number of active fishing days per year for each segment of the fleet (Table 2.4) and the total (hull) Gross Tonnage in each fleet segment was combined with fleet activity to establish a measure of effort. With this information, CpUE could be precisely defined in kg per GT per active fishing day for each type of gear and each category of boat size in each FMA. Annual averages of CpUE by fleet segment were plotted for the top 7 species in each FMA (Figures 2.5 through 2.11), as indicators for stock health, and to compare with indicators from length-based analysis (i.e. Spawning Potential Ratio and percentage of immature fish in the catch).

Information on fleet activity, fleet size by gear type and boat size, and average size frequencies by species (per unit of effort) are used to estimate total catch. Fishing effort in terms of the average number of active fishing days per year for each gear type and boat size category (Table 2.4), was derived from SPOT data looking at movement patterns. Fleet size by gear type and boat size category (Table 2.5) was obtained from field surveys, where each vessel was recorded in a data base with estimated GT. Average size frequency distributions by fleet segment and species for each FMA, in combination with the information on effort by fleet segment, were thus used to estimate CATCH LFD (over the entire fleet) from average CODRS LFD by fleet segment. Only annual sample sizes larger than 200 fish per species and 50 fish per fleet segment were used for further calculations. Numbers per size class for each species in the catch were multiplied with weights per size class from length-weight relationships, to calculate catches by fleet segment (Table 2.7), species distribution in the total catch (Table 2.8), as well as catch by species for each gear type separately (Tables 2.9 through 2.13).

As the CODRS program is still in development, some parts for the fleet (“fleet segments”, a combination of WPP, gear type, and boat size category) are not yet represented. For those missing fleet segments, we applied the following approach to estimate annual catch. First, within each WPP, we estimated the total catch and the total effort for all fleet segments where we had representation by CODRS. We expressed annual effort as “tonnage-days”, ie, the GT of each vessel times the annual number of fishing days. Then, we calculated the average catch-per-unit-effort, over all fleet segments that have CODRS representation within each WPP (in metric tons per tonnage-day). This resulted in one catch-per-unit-effort estimate for each WPP (CPUE-estimate-per-WPP). Then, we calculated the effort, in tonnage-days, for the fleet segments where we did not have CODRS representation, and we multiplied this effort with CPUE-estimate-per-WPP to get the estimated total annual catch for that fleet segment. This means that, within each WPP, fleet segments that do not have CODRS representation all have the same CPUE estimate-per-WPP, but their total catch estimates vary because effort between those fleet segments vary. We applied this approach for total catch as well as total catch by species.

Trends in CpUE by species and by fleet segment (Figures 2.5 through 2.11) can be used as indicator for year-on-year changes in status of the stocks, for as far as time series are available within each fleet segment. Note, however, that these time series sometimes are incomplete or interrupted. This is due to variations in the presence of fleet segments between years in each WPP, and sometimes the CODRS vessels representing a fleet segment may disappear from one WPP and show up in another WPP. This may happen due to problems with processing permits at local authorities, but also due to the emerging differences in efficiencies between gear types and boat size categories, as well as due to perceptions on opportunities in other WPPs.



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

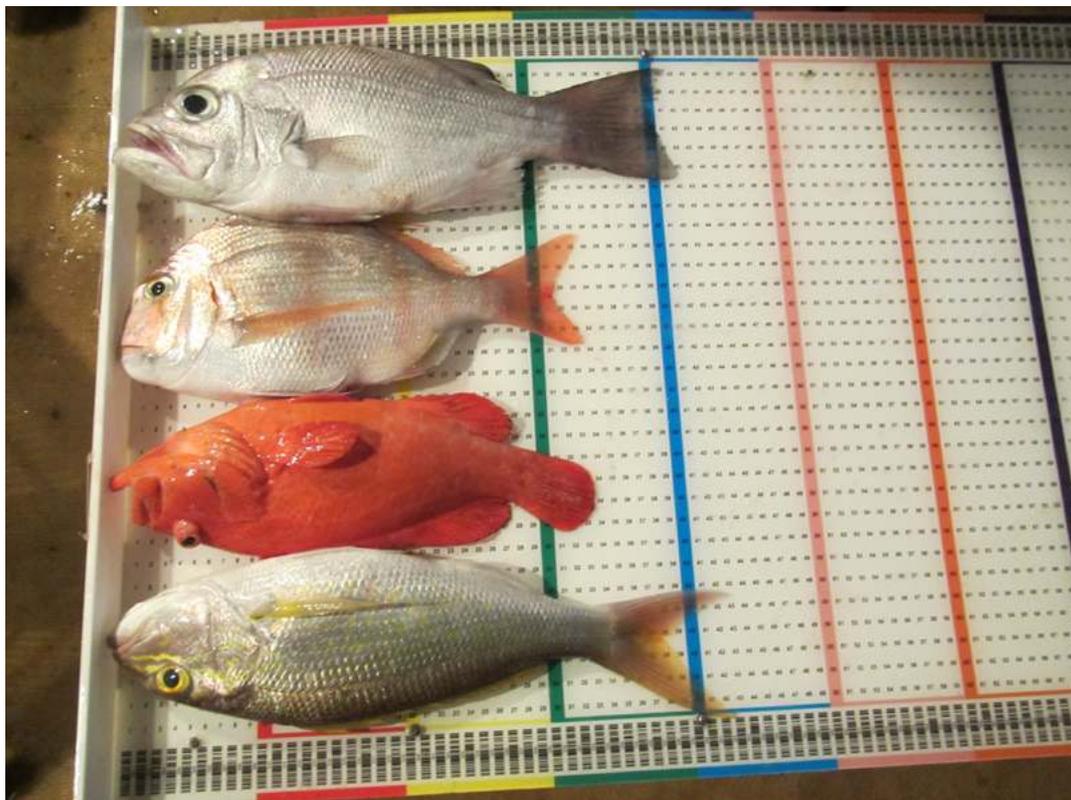


Figure 2.2: Fish photographed by fishing crew on board as part of CODRS.

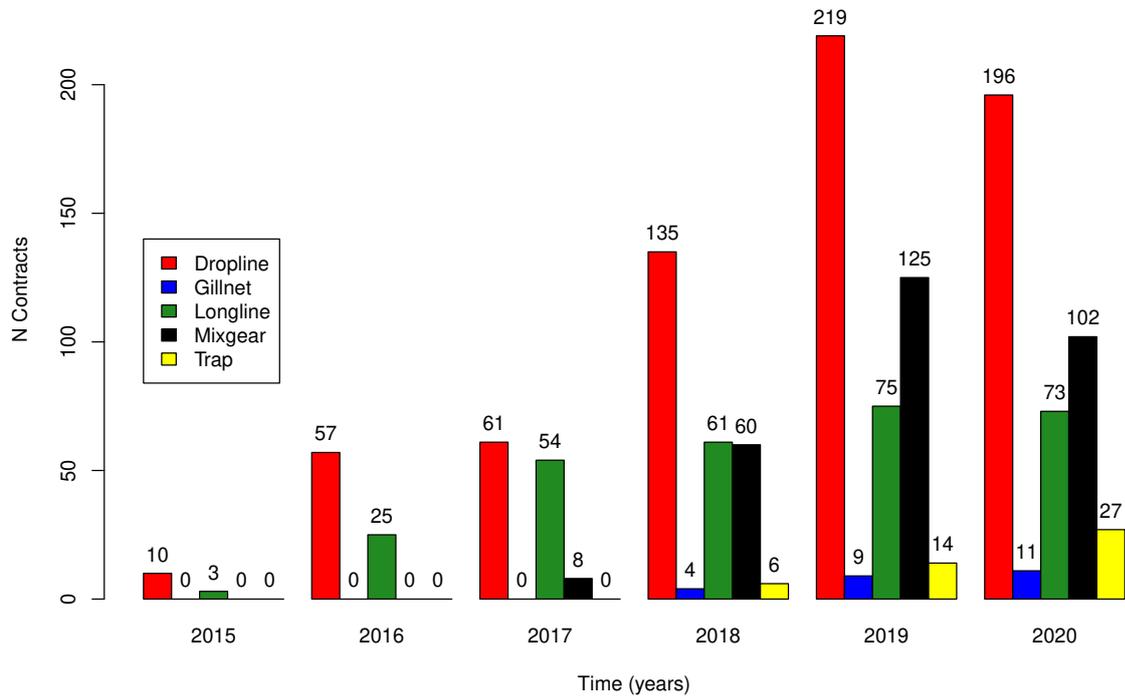


Figure 2.3: Number of CODRS contractors by gear type actively fishing in Indonesian waters.

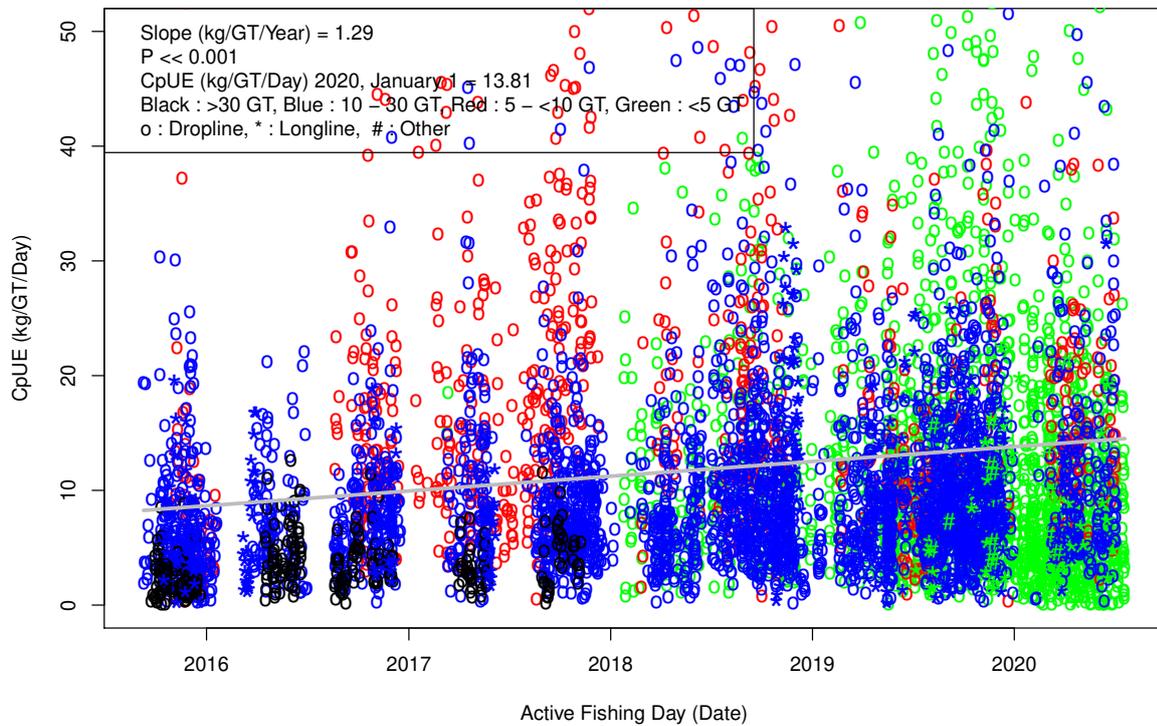


Figure 2.4: Catch per Unit of Effort in WPP 573.

Table 2.1: Number of CODRS deployed by gear type and boat size category in WPP 573

N	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano	11	0	0	NA	3	14
Small	7	NA	0	NA	NA	7
Medium	14	0	NA	NA	NA	14
Large	NA	NA	NA	NA	NA	0
Total	32	0	0	0	3	35

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.2: CpUE by fishing gear and boat size category in WPP 573 for the most recent 365 days

kg/GT/Day	Dropline	Longline	Gillnet	Trap	Mix Gear
Nano	17.77	9.58	14.68	NA	8.66
Small	27.12	NA	14.68	NA	NA
Medium	13.05	11.74	NA	NA	NA
Large	NA	NA	NA	NA	NA

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.3: Number of CODRS observations that contribute to CpUE value in WPP 573 for the most recent 365 days

N	Dropline	Longline	Gillnet	Trap	Mix Gear
Nano	1114	41	2213	NA	19
Small	169	NA	2213	NA	NA
Medium	772	98	NA	NA	NA
Large	NA	NA	NA	NA	NA

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.4: Average active-fishing days per year by fishing gear and boat size category in all WPP

Days / Year	Dropline	Longline	Gillnet	Trap	Mix Gear
Nano Dedicated	201	235	224	194	265
Nano Seasonal	100	118	112	97	133
Small Dedicated	213	258	247	277	241
Small Seasonal	107	129	124	139	121
Medium Dedicated	204	213	258	219	202
Medium Seasonal	102	107	129	110	101
Large Dedicated	166	237	151	185	185
Large Seasonal	83	119	75	92	92

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.5: Current number of boats in the fleet by fishing gear and boat size category in WPP 573

Number of Boat	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	193	11	0	0	109	313
Nano Seasonal	537	250	3	0	50	840
Small Dedicated	22	0	2	0	0	24
Small Seasonal	12	0	6	0	0	18
Medium Dedicated	35	4	0	0	0	39
Medium Seasonal	0	0	0	0	0	0
Large Dedicated	0	0	0	0	0	0
Large Seasonal	0	0	0	0	0	0
Total	799	265	11	0	159	1234

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.6: Current total gross tonnage of all boats in the fleet by fishing gear and boat size category in WPP 573

Total GT	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	270	6	0	0	267	543
Nano Seasonal	557	262	13	0	69	902
Small Dedicated	174	0	14	0	0	188
Small Seasonal	102	0	36	0	0	138
Medium Dedicated	682	104	0	0	0	786
Medium Seasonal	0	0	0	0	0	0
Large Dedicated	0	0	0	0	0	0
Large Seasonal	0	0	0	0	0	0
Total	1786	372	63	0	336	2557

Table 2.7: Total catch in metric tons per year by fishing gear and boat size category in WPP 573 for the most recent 365 days

Total Catch	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	964	14	0	0	613	1591
Nano Seasonal	990	296	22	0	80	1388
Small Dedicated	1008	0	51	0	0	1058
Small Seasonal	296	0	66	0	0	362
Medium Dedicated	1816	259	0	0	0	2076
Medium Seasonal	0	0	0	0	0	0
Large Dedicated	0	0	0	0	0	0
Large Seasonal	0	0	0	0	0	0
Total	5074	569	138	0	693	6475

Nano less than 5 GT. **Small** 5 - <10 GT. **Medium** 10 - 30 GT. **Large** >30 GT.

Table 2.8: Top 20 species by volume in deepwater demersal fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidens	1702	26	26	45	23	High
Pristipomoides typus	664	10	37	41	22	High
Lutjanus malabaricus	588	9	46	36	18	High
Aphareus rutilans	414	6	52	36	12	High
Etelis radius	380	6	58	50	23	High
Seriola rivoliana	225	3	61	9	2	Low
Pristipomoides sieboldii	214	3	65	33	20	High
Pristipomoides filamentosus	161	2	67	77	48	High
Lutjanus argentimaculatus	146	2	69	8	3	Low
Epinephelus coioides	126	2	71	4	1	Low
Lutjanus bohar	120	2	73	30	6	Med
Lutjanus erythropterus	102	2	75	0	0	Low
Caranx sexfasciatus	96	1	76	16	3	Med
Etelis coruscans	91	1	78	80	42	High
Epinephelus areolatus	90	1	79	1	0	Low
Lutjanus sebae	86	1	80	55	33	High
Lethrinus olivaceus	85	1	82	8	1	Low
Paracaesio kusakarii	83	1	83	22	7	Med
Caranx tille	82	1	84	13	7	Med
Caranx ignobilis	68	1	85	27	9	Med
Total Top 20 Species	5523	85	85	38	20	High
Total Top 100 Species	6475	100	100	32	18	High

Table 2.9: Top 20 species by volume in Dropline fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidens	1485	29	29	46	24	High
Pristipomoides typus	621	12	42	42	23	High
Lutjanus malabaricus	489	10	51	37	19	High
Etelis radiusus	369	7	58	50	23	High
Aphareus rutilans	342	7	65	36	12	High
Pristipomoides sieboldii	209	4	69	33	20	High
Seriola rivoliana	156	3	72	9	2	Low
Pristipomoides filamentosus	137	3	75	77	48	High
Lutjanus erythropterus	100	2	77	0	0	Low
Etelis coruscans	89	2	79	80	42	High
Paracaesio kusakarii	81	2	80	22	7	Med
Epinephelus areolatus	81	2	82	1	0	Low
Lutjanus sebae	76	2	83	57	34	High
Lutjanus bohar	53	1	85	30	6	Med
Lutjanus timorensis	50	1	85	24	12	Med
Etelis sp.	49	1	86	74	49	High
Paracaesio xanthura	42	1	87	0	0	Low
Lutjanus gibbus	35	1	88	11	4	Med
Parascolopsis eriomma	30	1	89	0	0	Low
Caranx ignobilis	29	1	89	27	9	Med
Total Top 20 Species	4522	89	89	36	21	High
Total Top 100 Species	5074	100	100	33	19	High

Table 2.10: Top 20 species by volume in Longline fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidens	159	28	28	26	13	Med
Lutjanus malabaricus	64	11	39	23	9	Med
Caranx tille	61	11	50	12	6	Med
Caranx sexfasciatus	30	5	55	NA	NA	
Pristipomoides typus	29	5	60	8	3	Low
Seriola rivoliana	23	4	64	NA	NA	
Diagramma pictum	23	4	68	NA	NA	
Lutjanus bohar	21	4	72	NA	NA	
Lutjanus argentimaculatus	18	3	75	NA	NA	
Lethrinus olivaceus	16	3	78	NA	NA	
Lutjanus boutton	16	3	81	0	0	Low
Caranx ignobilis	14	3	83	NA	NA	
Epinephelus coioides	10	2	85	NA	NA	
Lutjanus sebae	8	1	86	37	21	High
Aphareus rutilans	8	1	88	NA	NA	
Pristipomoides filamentosus	8	1	89	NA	NA	
Epinephelus areolatus	6	1	90	0	0	Low
Lutjanus gibbus	5	1	91	NA	NA	
Lutjanus timorensis	5	1	92	9	2	Low
Lethrinus nebulosus	5	1	93	NA	NA	
Total Top 20 Species	529	93	93	16	10	Medium
Total Top 100 Species	569	100	100	16	10	Medium

Table 2.11: Top 20 species by volume in Gillnet fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidentis	36	26	26	NA	NA	
Pristipomoides typus	14	10	37	NA	NA	
Lutjanus malabaricus	13	9	46	NA	NA	
Aphareus rutilans	9	6	52	NA	NA	
Etelis radiusus	8	6	58	NA	NA	
Seriola rivoliana	5	3	61	NA	NA	
Pristipomoides sieboldii	5	3	65	NA	NA	
Pristipomoides filamentosus	3	2	67	NA	NA	
Lutjanus argentimaculatus	3	2	69	NA	NA	
Epinephelus coioides	3	2	71	NA	NA	
Lutjanus bohar	3	2	73	NA	NA	
Lutjanus erythropterus	2	2	75	NA	NA	
Caranx sexfasciatus	2	1	76	NA	NA	
Etelis coruscans	2	1	78	NA	NA	
Epinephelus areolatus	2	1	79	NA	NA	
Lutjanus sebae	2	1	80	NA	NA	
Lethrinus olivaceus	2	1	82	NA	NA	
Paracaesio kusakarii	2	1	83	NA	NA	
Caranx tille	2	1	84	NA	NA	
Caranx ignobilis	1	1	85	NA	NA	
Total Top 20 Species	118	85	85	NA	NA	NA
Total Top 100 Species	138	100	100	NA	NA	NA

Table 2.12: Top 20 species by volume in Trap fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
Total Top 20 Species	0	0	0	NA	NA	NA
Total Top 100 Species	0	0	0	NA	NA	NA

Table 2.13: Top 20 species by volume in Mixgears fisheries with % immature fish in the catch in WPP 573 for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus argentimaculatus	98	14	14	NA	NA	
Epinephelus coioides	95	14	28	NA	NA	
Aphareus rutilans	55	8	36	NA	NA	
Lutjanus bohar	44	6	42	NA	NA	
Lethrinus olivaceus	41	6	48	NA	NA	
Seriola rivoliana	41	6	54	NA	NA	
Caranx sexfasciatus	40	6	60	NA	NA	
Lethrinus nebulosus	30	4	64	NA	NA	
Caranx ignobilis	24	3	67	NA	NA	
Lutjanus malabaricus	22	3	71	NA	NA	
Paracaesio xanthura	22	3	74	NA	NA	
Lutjanus gibbus	21	3	77	NA	NA	
Pristipomoides multidens	21	3	80	NA	NA	
Sphyraena barracuda	19	3	83	NA	NA	
Lutjanus boutton	18	3	85	NA	NA	
Lethrinus rubrioperculatus	17	2	88	NA	NA	
Variola albimarginata	13	2	90	NA	NA	
Pristipomoides filamentosus	13	2	91	NA	NA	
Gymnocranius griseus	13	2	93	NA	NA	
Cephalopholis miniata	12	2	95	NA	NA	
Total Top 20 Species	659	95	95	NA	NA	NA
Total Top 100 Species	693	100	100	NA	NA	NA

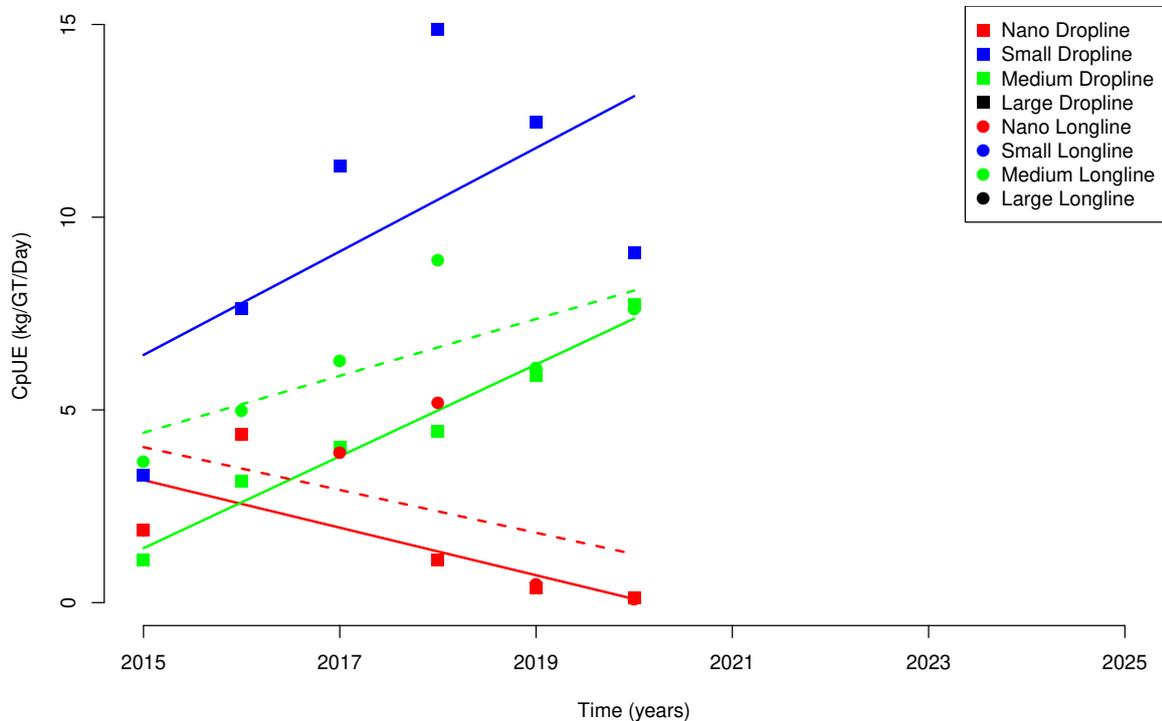


Figure 2.5: Catch per Unit of Effort per calendar year for *Pristipomoides multidens* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

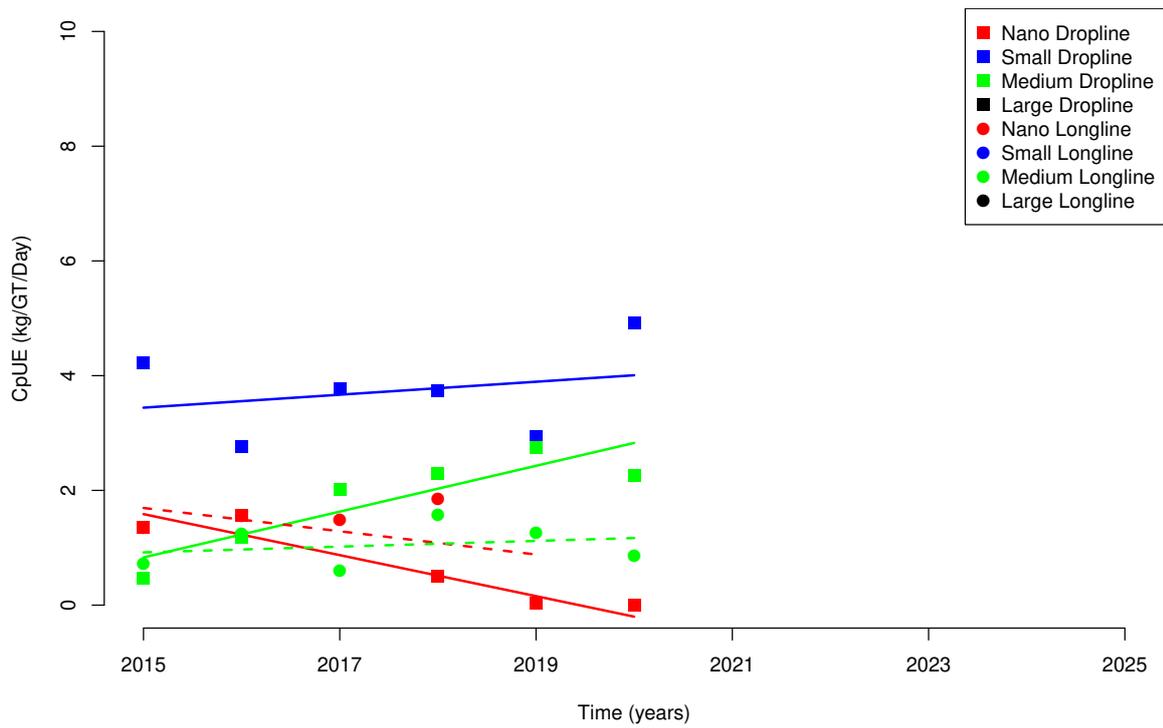


Figure 2.6: Catch per Unit of Effort per calendar year for *Pristipomoides typus* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

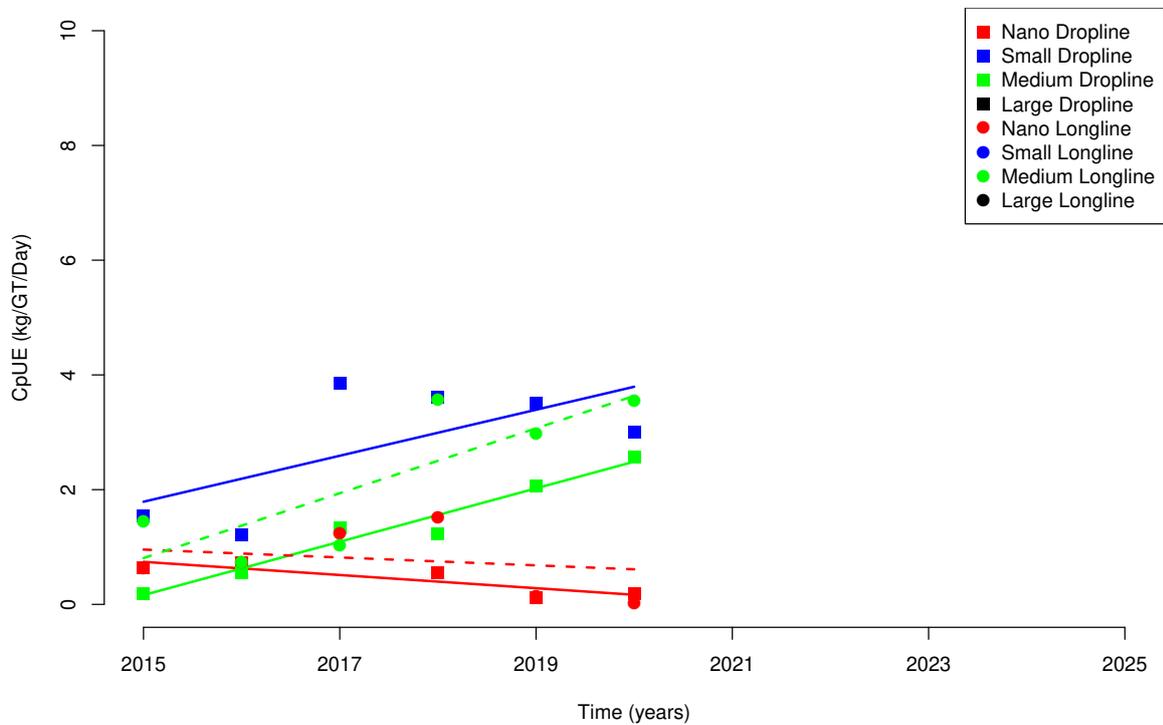


Figure 2.7: Catch per Unit of Effort per calendar year for *Lutjanus malabaricus* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

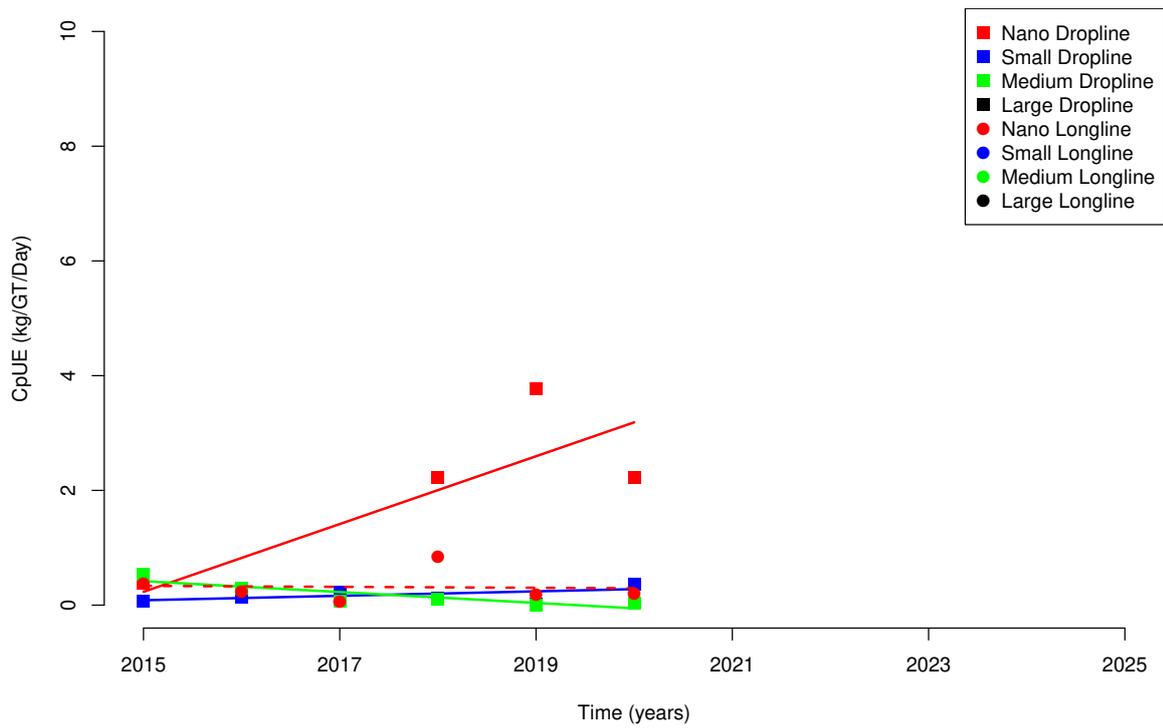


Figure 2.8: Catch per Unit of Effort per calendar year for *Aphareus rutilans* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

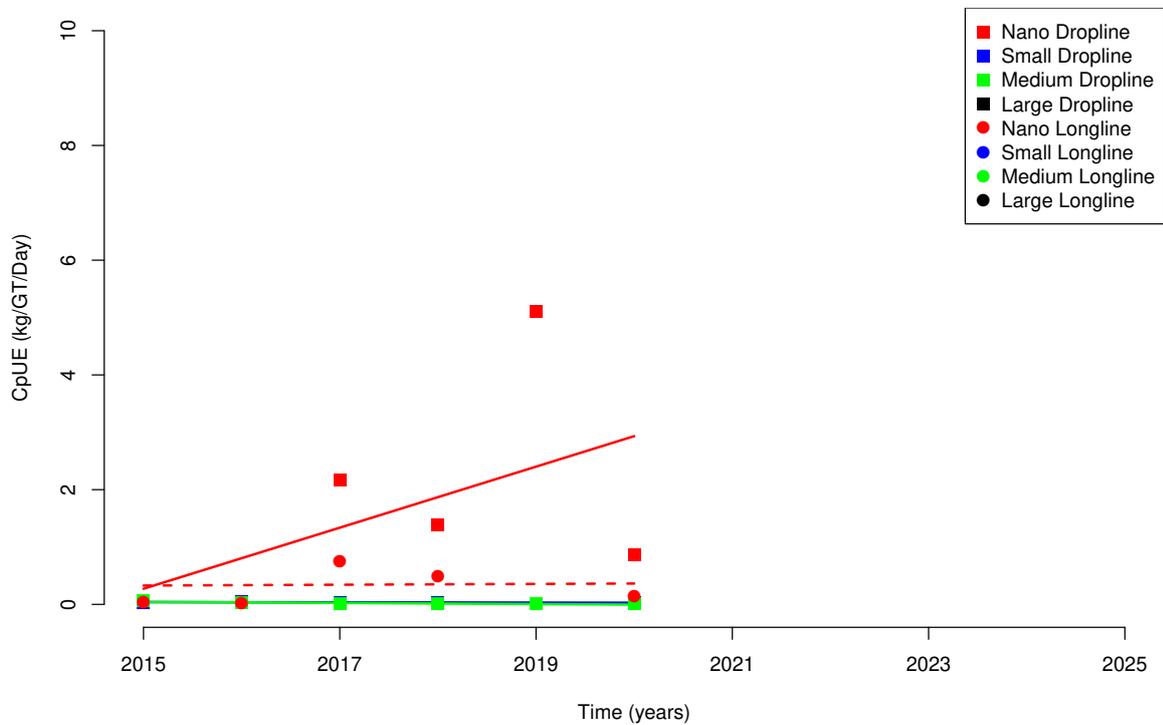


Figure 2.9: Catch per Unit of Effort per calendar year for *Etelis radiusus* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

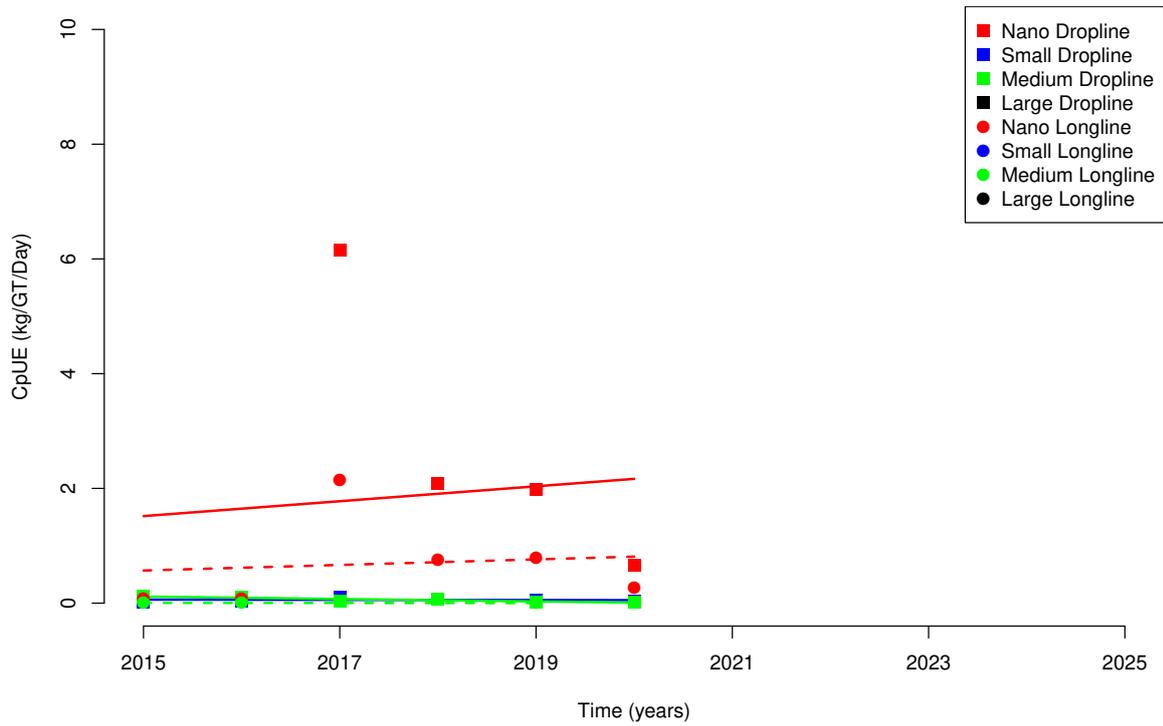


Figure 2.10: Catch per Unit of Effort per calendar year for *Seriola rivoliana* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

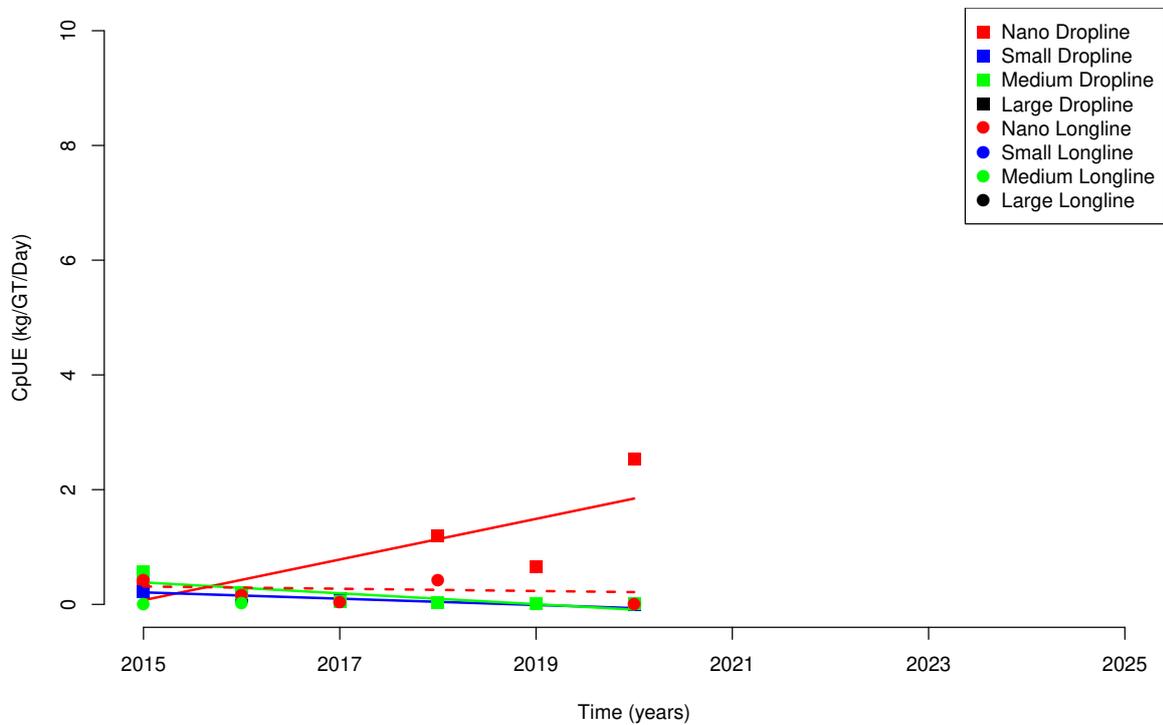


Figure 2.11: Catch per Unit of Effort per calendar year for *Pristipomoides sieboldii* in WPP 573 for Dropline and Longline catches by fleet segment. Solid lines and dashed lines for trends in Dropline CpUE and Longline CpUE respectively.

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
1	571	Desa Sungai Kuruk III	Aceh Tamiang	Nano	Mixgears	2	6
2	571	Desa Sungai Kuruk III	Aceh Tamiang	Small	Mixgears	6	34
3	571	PP. Kuala Cangkoi	Aceh Utara	Nano	Dropline	1	2
4	571	PP. Kuala Cangkoi	Aceh Utara	Nano	Trap	5	10
5	571	PP. Pasiran	Kota Sabang	Nano	Dropline	3	4
6	571	Pangkalan Susu	Langkat	Nano	Mixgears	38	114
7	571	Pelabuhan Ujung Kampung	Langkat	Medium	Mixgears	3	39
8	571	Pelabuhan Ujung Kampung	Langkat	Nano	Mixgears	5	23
9	571	Pelabuhan Ujung Kampung	Langkat	Nano	Trap	1	4
10	571	Pelabuhan Ujung Kampung	Langkat	Small	Mixgears	2	15
11	571	PPI. Pangkalan Brandan	Langkat	Medium	Mixgears	1	10
12	571	PPI. Pangkalan Brandan	Langkat	Nano	Mixgears	33	135
13	571	PPI. Pangkalan Brandan	Langkat	Small	Mixgears	7	42
14	571	PP. Ujung Blang	Lhokseumawe	Nano	Longline	7	11
15	571	Belawan	Medan	Small	Mixgears	10	50
16	571	Teluk Mengkudu	Serdang Bedagai	Small	Longline	5	48
17	571	TPI. Sialang Buah	Serdang Bedagai	Small	Longline	5	48
18	572	Kuala Bubon	Aceh Barat	Medium	Mixgears	2	21
19	572	Kuala Bubon	Aceh Barat	Small	Mixgears	2	14
20	572	PP. Meulaboh	Aceh Barat	Nano	Mixgears	5	17
21	572	PP. Ujoeng Baroh	Aceh Barat	Medium	Mixgears	1	10
22	572	PP. Ujoeng Baroh	Aceh Barat	Nano	Mixgears	1	3
23	572	PP. Ujong Baroeh	Aceh Barat	Nano	Mixgears	3	10
24	572	PP. Ujong Baroeh	Aceh Barat	Small	Dropline	2	13
25	572	PP. Ujong Baroeh	Aceh Barat	Small	Mixgears	18	107
26	572	Susoh	Aceh Barat Daya	Medium	Dropline	1	11
27	572	Susoh	Aceh Barat Daya	Small	Dropline	2	12
28	572	Desa Lampuyang	Aceh Besar	Nano	Dropline	15	22
29	572	PP. Lhok Bengkuang	Aceh Selatan	Nano	Mixgears	10	36
30	572	PP. Lhok Bengkuang	Aceh Selatan	Small	Mixgears	37	236
31	572	PP. Lampulo	Banda Aceh	Nano	Dropline	1	4
32	572	PP. Lampulo	Banda Aceh	Nano	Longline	2	6
33	572	PP. Lampulo	Banda Aceh	Small	Dropline	8	49
34	572	PP. Lampulo	Banda Aceh	Small	Longline	1	6
35	572	PPS Lampulo	Banda Aceh	Small	Dropline	9	63
36	572	PP. Pulau Baai	Bengkulu	Large	Trap	1	31
37	572	PP. Pulau Baai	Bengkulu	Medium	Dropline	2	34
38	572	PP. Pulau Baai	Bengkulu	Medium	Gillnet	7	153
39	572	PP. Pulau Baai	Bengkulu	Medium	Mixgears	5	61
40	572	PP. Pulau Baai	Bengkulu	Nano	Dropline	5	21
41	572	PP. Pulau Baai	Bengkulu	Nano	Mixgears	2	8
42	572	PP. Pulau Baai	Bengkulu	Small	Dropline	23	130
43	572	PP. Pulau Baai	Bengkulu	Small	Gillnet	1	6
44	572	PP. Pulau Baai	Bengkulu	Small	Mixgears	2	12
45	572	PP. Muara Angke	Jakarta	Large	Dropline	1	158
46	572	PP. Sikakap	Kepulauan Mentawai	Nano	Dropline	1	3
47	572	PP. Tuapejat	Kepulauan Mentawai	Medium	Dropline	2	24
48	572	PP. Tuapejat	Kepulauan Mentawai	Small	Dropline	2	18
49	572	PP. Muara Piluk Bakauheni	Lampung	Nano	Longline	14	39
50	572	PP. Muara Piluk Bakauheni	Lampung	Small	Longline	1	5
51	572	Botolakha	Nias	Small	Dropline	25	197
52	572	Helera	Nias	Nano	Mixgears	13	21
53	572	Helera	Nias	Small	Mixgears	2	11
54	572	Teluk Dalam	Nias	Nano	Dropline	5	18
55	572	Muara Padang	Padang	Medium	Dropline	1	12
56	572	Muara Padang	Padang	Medium	Longline	1	11
57	572	Muara Padang	Padang	Nano	Dropline	2	7
58	572	Muara Padang	Padang	Small	Dropline	12	70

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
59	572	PP. Bungus	Padang	Medium	Mixgears	1	15
60	572	PP. Bungus	Padang	Small	Longline	1	8
61	572	PP. Muaro	Padang	Medium	Dropline	2	23
62	572	PP. Muaro	Padang	Medium	Longline	1	11
63	572	PP. Muaro	Padang	Medium	Mixgears	2	24
64	572	PP. Muaro	Padang	Small	Dropline	1	5
65	572	PP. Muaro	Padang	Small	Longline	2	19
66	572	PP. Muaro	Padang	Small	Mixgears	4	29
67	572	PP. Labuan	Pandeglang	Small	Dropline	29	152
68	572	PP. Sibolga	Sibolga	Medium	Trap	4	64
69	572	PP. Sibolga	Sibolga	Nano	Dropline	4	14
70	572	PP. Sibolga	Sibolga	Nano	Trap	12	47
71	572	PP. Sibolga	Sibolga	Small	Dropline	3	18
72	572	PP. Sibolga	Sibolga	Small	Trap	6	35
73	573	Desa Alor Kecil	Alor	Nano	Dropline	25	17
74	573	Kedonganan	Badung	Nano	Mixgears	30	56
75	573	PP. Pancer	Banyuwangi	Nano	Dropline	300	306
76	573	Atapupu	Belu	Nano	Dropline	5	6
77	573	PP. Rompo	Bima	Nano	Dropline	50	50
78	573	PP. Sape	Bima	Nano	Dropline	103	170
79	573	PP. Sape	Bima	Nano	Mixgears	109	267
80	573	Jetis	Cilacap	Nano	Longline	30	26
81	573	Pelabuhan Benoa	Denpasar	Medium	Dropline	12	268
82	573	Pelabuhan Benoa	Denpasar	Medium	Longline	1	27
83	573	PP. Tenau Kupang	Denpasar	Medium	Dropline	1	22
84	573	PP. Soroadu	Dompu	Nano	Dropline	27	15
85	573	PP. Soroadu	Dompu	Nano	Longline	11	6
86	573	Pengambangan	Jembrana	Nano	Longline	20	40
87	573	Yeh Kuning	Jembrana	Nano	Longline	150	126
88	573	Pelabuhan Benoa	Kupang	Medium	Dropline	1	27
89	573	PP. Mayangan	Kupang	Medium	Longline	1	29
90	573	PP. Oeba Kupang	Kupang	Nano	Dropline	5	5
91	573	PP. Tenau Kupang	Kupang	Medium	Dropline	21	365
92	573	PP. Tenau Kupang	Kupang	Medium	Longline	2	48
93	573	PP. Tenau Kupang	Kupang	Nano	Dropline	6	22
94	573	PP. Tenau Kupang	Kupang	Small	Dropline	22	174
95	573	Tablolong Kupang	Kupang	Nano	Dropline	11	22
96	573	Desa waijarang	Lembata	Nano	Dropline	20	14
97	573	Tapolango	Lembata	Nano	Mixgears	20	14
98	573	PP. Tanjung Luar	Lombok Timur	Nano	Dropline	30	30
99	573	PP. Tanjung Luar	Lombok Timur	Nano	Longline	50	70
100	573	PP. Tanjung Luar	Lombok Timur	Small	Dropline	1	9
101	573	Pulau Maringkik	Lombok Timur	Small	Dropline	11	93
102	573	TPI Kampung Ujung	Manggarai Barat	Nano	Dropline	60	74
103	573	PP Cikidang	Pangandaran	Small	Gillnet	8	50
104	573	PP. Cikidang	Pangandaran	Nano	Gillnet	3	13
105	573	Batutua Rote	Rote	Nano	Dropline	8	8
106	573	Oesely Rote	Rote	Nano	Dropline	1	1
107	573	Papela Darat	Rote	Nano	Dropline	9	9
108	573	Papela Tanjung	Rote	Nano	Dropline	9	9
109	573	Rote	Rote	Nano	Dropline	4	7
110	573	Sukabumi	Sukabumi	Nano	Dropline	50	50
111	573	Wini	Timor Tengah Utara	Nano	Dropline	7	12
112	711	PP Baturusa Pangkal Batam	Bangka	Small	Trap	4	24
113	711	PP. Sungailiat	Bangka	Small	Dropline	1	6
114	711	PP. Sungailiat	Bangka	Small	Gillnet	11	67
115	711	PP. Sungailiat	Bangka	Small	Mixgears	2	12
116	711	PP. Sungailiat	Bangka	Small	Trap	1	6

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
117	711	Batam	Batam	Large	Trap	1	34
118	711	Batam	Batam	Medium	Trap	2	56
119	711	Batam	Batam	Small	Dropline	2	12
120	711	Batam	Batam	Small	Trap	2	13
121	711	PP. Tanjung Pandan	Belitung	Medium	Mixgears	2	36
122	711	PP. Tanjung Pandan	Belitung	Medium	Trap	3	63
123	711	PP. Tanjung Pandan	Belitung	Nano	Dropline	77	157
124	711	PP. Tanjung Pandan	Belitung	Nano	Mixgears	75	225
125	711	PP. Tanjung Pandan	Belitung	Nano	Trap	20	71
126	711	PP. Tanjung Pandan	Belitung	Small	Dropline	5	27
127	711	PP. Tanjung Pandan	Belitung	Small	Gillnet	3	16
128	711	PP. Tanjung Pandan	Belitung	Small	Longline	2	11
129	711	PP. Tanjung Pandan	Belitung	Small	Mixgears	10	65
130	711	PP. Tanjung Pandan	Belitung	Small	Trap	46	248
131	711	PP. Manggar Belitung Timur	Belitung Timur	Medium	Dropline	2	21
132	711	PP. Manggar Belitung Timur	Belitung Timur	Medium	Mixgears	1	20
133	711	PP. Manggar Belitung Timur	Belitung Timur	Nano	Dropline	3	11
134	711	PP. Manggar Belitung Timur	Belitung Timur	Nano	Mixgears	1	4
135	711	PP. Manggar Belitung Timur	Belitung Timur	Small	Dropline	4	22
136	711	PP. Manggar Belitung Timur	Belitung Timur	Small	Mixgears	87	481
137	711	PP. Kijang	Bintan	Large	Longline	2	69
138	711	PP. Kijang	Bintan	Medium	Dropline	3	47
139	711	PP. Kijang	Bintan	Medium	Longline	4	78
140	711	PP. Kijang	Bintan	Medium	Trap	245	4709
141	711	PP. Kijang	Bintan	Nano	Mixgears	2	8
142	711	PP. Kijang	Bintan	Nano	Trap	7	29
143	711	PP. Kijang	Bintan	Small	Dropline	10	66
144	711	PP. Kijang	Bintan	Small	Longline	5	36
145	711	PP. Kijang	Bintan	Small	Mixgears	9	58
146	711	PP. Kijang	Bintan	Small	Trap	210	1425
147	711	Moro	Karimun	Small	Trap	1	7
148	711	Tanjung Balai Karimun	Karimun	Medium	Longline	7	163
149	711	PP. Tarempa	Kepulauan Anambas	Nano	Dropline	202	298
150	711	PP. Tarempa	Kepulauan Anambas	Nano	Trap	19	24
151	711	PP. Tarempa	Kepulauan Anambas	Small	Dropline	11	63
152	711	PPI Ladan	Kepulauan Anambas	Nano	Dropline	73	182
153	711	PPI Ladan	Kepulauan Anambas	Small	Dropline	1	5
154	711	Bunguran	Natuna	Nano	Dropline	22	79
155	711	Dermaga Kayu Sededap	Natuna	Nano	Dropline	1	5
156	711	Lagong	Natuna	Nano	Dropline	23	69
157	711	Natuna	Natuna	Large	Longline	3	94
158	711	Natuna	Natuna	Medium	Longline	1	28
159	711	Pelabuhan Midai	Natuna	Medium	Mixgears	4	48
160	711	Pelabuhan Midai	Natuna	Small	Mixgears	1	6
161	711	Pelabuhan Pasir Putih	Natuna	Nano	Dropline	1	2
162	711	Pelabuhan Pering	Natuna	Medium	Dropline	2	30
163	711	Pelabuhan Pering	Natuna	Nano	Dropline	21	78
164	711	Pelabuhan Pering	Natuna	Small	Dropline	1	8
165	711	Pelabuhan Sabang Barat-Midai	Natuna	Medium	Mixgears	1	12
166	711	Pelabuhan Sabang Barat-Midai	Natuna	Small	Mixgears	2	12
167	711	Pelabuhan Tanjung	Natuna	Nano	Dropline	30	59
168	711	Pering	Natuna	Nano	Dropline	1	4
169	711	PP. Pering	Natuna	Small	Dropline	1	5
170	711	PP. Tarempa	Natuna	Medium	Longline	1	18
171	711	Pulau Tiga Natuna	Natuna	Small	Dropline	28	170
172	711	Sepempang	Natuna	Small	Dropline	22	132
173	711	Subi-besar	Natuna	Nano	Dropline	23	69
174	711	Tanjung Balai Karimun	Natuna	Medium	Longline	57	1579

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
175	711	Teluk Buton	Natuna	Nano	Dropline	26	78
176	711	Pangkal Balam	Pangkal Pinang	Nano	Dropline	2	7
177	711	Pangkal Balam	Pangkal Pinang	Nano	Mixgears	3	12
178	711	Pangkal Balam	Pangkal Pinang	Nano	Trap	1	4
179	711	Pangkal Balam	Pangkal Pinang	Small	Gillnet	1	6
180	711	Pangkal Balam	Pangkal Pinang	Small	Mixgears	5	27
181	711	Pangkal Balam	Pangkal Pinang	Small	Trap	12	67
182	711	PP. Bajomulyo	Pati	Large	Longline	2	125
183	711	PP. Kuala Mempawah	Pontianak	Medium	Trap	2	20
184	711	PP. Kuala Mempawah	Pontianak	Small	Trap	3	19
185	712	PP. Tanjung Pandan	Belitung	Nano	Trap	2	7
186	712	PP. Tanjung Pandan	Belitung	Small	Trap	12	63
187	712	PP. Karangsong	Indramayu	Medium	Longline	11	165
188	712	PP. Karangsong	Indramayu	Small	Longline	1	9
189	712	PP. Cituis	Jakarta	Nano	Mixgears	8	32
190	712	Jepara	Jepara	Medium	Mixgears	4	55
191	712	Jepara	Jepara	Small	Mixgears	1	6
192	712	PP. Karimun Jawa	Jepara	Medium	Mixgears	28	395
193	712	PP. Karimun Jawa	Jepara	Nano	Mixgears	6	21
194	712	PP. Karimun Jawa	Jepara	Small	Mixgears	68	491
195	712	Pulau Parang	Jepara	Medium	Mixgears	5	99
196	712	Pulau Parang	Jepara	Small	Trap	1	7
197	712	PP. Brondong	Lamongan	Medium	Dropline	43	575
198	712	PP. Brondong	Lamongan	Medium	Mixgears	18	314
199	712	PP. Brondong	Lamongan	Nano	Dropline	8	32
200	712	PP. Brondong	Lamongan	Small	Dropline	118	902
201	712	PP. Brondong	Lamongan	Small	Mixgears	2	14
202	712	PP. Paciran	Lamongan	Medium	Dropline	1	16
203	712	PP. Paciran	Lamongan	Medium	Mixgears	22	343
204	712	PP. Bajomulyo	Pati	Large	Longline	42	2117
205	712	PP. Bajomulyo	Pati	Medium	Longline	36	956
206	712	PP. Bajomulyo	Pati	Small	Longline	2	16
207	712	PP. Asem Doyong	Pemalang	Small	Dropline	24	132
208	712	PP. Mayangan	Probolinggo	Medium	Longline	1	29
209	712	Probolinggo	Probolinggo	Large	Longline	1	85
210	712	Situbondo	Situbondo	Nano	Dropline	20	60
211	712	Situbondo	Situbondo	Nano	Longline	20	60
212	712	Desa Masalima	Sumenep	Small	Dropline	10	68
213	712	Desa Masalima	Sumenep	Small	Mixgears	2	16
214	712	Dungkek	Sumenep	Medium	Dropline	1	12
215	712	Dungkek	Sumenep	Small	Dropline	3	22
216	712	Gili Iyang	Sumenep	Small	Dropline	7	51
217	712	Pagerungan Besar	Sumenep	Nano	Longline	1	4
218	712	Pagerungan Besar	Sumenep	Small	Longline	4	25
219	712	Sumenep	Sumenep	Medium	Dropline	2	28
220	712	Sumenep	Sumenep	Nano	Dropline	1	4
221	712	Sumenep	Sumenep	Nano	Longline	1	3
222	712	Sumenep	Sumenep	Small	Dropline	401	3398
223	712	Sumenep	Sumenep	Small	Longline	49	392
224	712	Pagatan	Tanah Bumbu	Small	Dropline	2	10
225	713	PP. Filial Klandasan	Balikpapan	Nano	Dropline	2	8
226	713	PP. Filial Klandasan	Balikpapan	Small	Dropline	23	132
227	713	PP. Klandasan	Balikpapan	Small	Dropline	3	21
228	713	PP. Manggar Baru	Balikpapan	Medium	Dropline	17	303
229	713	PP. Manggar Baru	Balikpapan	Small	Longline	8	44
230	713	PP. Tanjung Pandan	Belitung	Nano	Trap	1	3
231	713	PP. Tanjung Pandan	Belitung	Small	Dropline	1	5
232	713	PP. Tanjung Pandan	Belitung	Small	Trap	4	21

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
233	713	Lok Tuan	Bontang	Nano	Dropline	1	1
234	713	Lok Tuan	Bontang	Nano	Mixgears	3	12
235	713	PP. Tanjung Limau	Bontang	Nano	Dropline	5	11
236	713	PP. Tanjung Limau	Bontang	Small	Dropline	4	24
237	713	Tanjung Laut	Bontang	Nano	Dropline	1	1
238	713	Dannuang	Bulukumba	Nano	Mixgears	20	20
239	713	Kalumeme	Bulukumba	Nano	Mixgears	20	20
240	713	Kota Bulukumba	Bulukumba	Nano	Mixgears	300	300
241	713	Para-para	Bulukumba	Small	Dropline	20	120
242	713	PP. Soro Kempo	Dompu	Nano	Longline	300	300
243	713	PP. Labean	Donggala	Nano	Dropline	27	24
244	713	Anawoi	Kolaka	Medium	Trap	5	64
245	713	Gang Kakap, Muara Jawa	Kutai Kartanegara	Nano	Longline	20	60
246	713	Kampung Terusan	Kutai Kartanegara	Small	Longline	10	85
247	713	Kuala Samboja	Kutai Kartanegara	Small	Longline	3	15
248	713	Pantai Biru Kersik	Kutai Kartanegara	Nano	Dropline	16	48
249	713	Semangkok	Kutai Kartanegara	Nano	Dropline	10	31
250	713	Gang Mulia, Kampung Kajang	Kutai Timur	Small	Dropline	1	5
251	713	Maloy	Kutai Timur	Small	Dropline	1	5
252	713	Muara Selangkau	Kutai Timur	Nano	Dropline	40	120
253	713	Majene	Majene	Nano	Mixgears	52	156
254	713	Majene	Majene	Small	Dropline	1	7
255	713	Majene	Majene	Small	Longline	12	84
256	713	Mamuju	Mamuju	Nano	Dropline	31	93
257	713	Mamuju	Mamuju	Small	Dropline	4	20
258	713	PP. Labuhan Bajo	Manggarai Barat	Nano	Dropline	40	15
259	713	PP. Konge	Nagekeo	Nano	Dropline	50	16
260	713	Muara Pasir	Paser	Nano	Longline	10	20
261	713	PP. Bajomulyo	Pati	Large	Longline	3	130
262	713	Kampung Pejala	Penajam Paser Utara	Small	Mixgears	17	85
263	713	Logpond CV. Alas	Penajam Paser Utara	Nano	Dropline	26	78
264	713	Logpond CV. Alas	Penajam Paser Utara	Small	Dropline	4	20
265	713	Logpond SDR	Penajam Paser Utara	Nano	Dropline	14	42
266	713	Muara Tunan	Penajam Paser Utara	Nano	Dropline	40	120
267	713	Nenang	Penajam Paser Utara	Small	Trap	50	253
268	713	PP. Mayangan	Probolinggo	Medium	Longline	1	27
269	713	PP. Kenyamukan	Sangatta	Medium	Dropline	3	32
270	713	PP. Kenyamukan	Sangatta	Nano	Dropline	40	40
271	713	PP. Kenyamukan	Sangatta	Small	Dropline	11	75
272	713	PP. Sangatta	Sangatta	Medium	Dropline	1	10
273	713	PP. Sangatta	Sangatta	Small	Dropline	5	31
274	713	Labuan Sangoro	Sumbawa	Nano	Longline	20	37
275	713	Labuan Sumbawa	Sumbawa	Large	Dropline	1	34
276	713	Labuan Terata	Sumbawa	Nano	Dropline	4	7
277	713	Labuhan Sumbawa	Sumbawa	Medium	Dropline	1	12
278	713	Labuhan Sumbawa	Sumbawa	Small	Dropline	7	36
279	713	Sumbawa	Sumbawa	Nano	Longline	50	50
280	713	PP. Beba	Takalar	Medium	Dropline	26	362
281	713	PP. Beba	Takalar	Medium	Gillnet	14	215
282	713	PP. Beba	Takalar	Medium	Longline	82	1003
283	713	PP. Beba	Takalar	Nano	Longline	1	3
284	713	PP. Paotere	Takalar	Medium	Dropline	1	12
285	713	PP. Paotere	Takalar	Small	Dropline	1	8
286	713	PP. Paotere	Takalar	Small	Longline	3	24
287	714	Kabola	Alor	Nano	Dropline	15	10
288	714	Kokar	Alor	Nano	Dropline	100	88
289	714	Banggai Kepulauan	Banggai Kepulauan	Nano	Dropline	10	10
290	714	Banggai Laut	Banggai Laut	Nano	Dropline	50	50

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
291	714	Bontosi	Banggai Laut	Nano	Dropline	2	5
292	714	Kasuari	Banggai Laut	Nano	Longline	18	21
293	714	Matanga	Banggai Laut	Nano	Longline	5	4
294	714	Sonit	Banggai Laut	Nano	Longline	3	9
295	714	Tinakin	Banggai Laut	Nano	Dropline	1	1
296	714	PP. Tanjung Pandan	Belitung	Small	Dropline	1	6
297	714	PPI Soropia	Konawe	Medium	Trap	1	12
298	714	PPI Soropia	Konawe	Nano	Trap	2	1
299	714	Labengki	Konawe Utara	Nano	Dropline	4	5
300	714	Labengki	Konawe Utara	Nano	Longline	1	1
301	714	Labengki	Konawe Utara	Nano	Mixgears	5	5
302	714	Batu Lubang	Kota Ambon	Nano	Dropline	30	53
303	714	Asilulu	Maluku Tengah	Nano	Dropline	30	56
304	714	PP. Tulehu	Maluku Tengah	Large	Dropline	1	34
305	714	Kampung Barbar	Maluku Tenggara Barat	Nano	Dropline	6	12
306	714	Pasar Baru Omele Saumlaki	Maluku Tenggara Barat	Nano	Dropline	6	13
307	714	Pasar Baru Omele Saumlaki	Maluku Tenggara Barat	Nano	Longline	1	3
308	714	Pasar Lama Saumlaki	Maluku Tenggara Barat	Nano	Dropline	1	2
309	714	Saumlaki	Maluku Tenggara Barat	Nano	Dropline	3	8
310	714	PP. Kema	Minahasa Utara	Large	Dropline	1	30
311	714	Desa Bahonsuai	Morowali	Nano	Dropline	2	2
312	714	Desa Umbele	Morowali	Nano	Dropline	2	2
313	714	Desa Umbele	Morowali	Nano	Longline	1	1
314	714	Limbo	Pulau Taliabu	Nano	Mixgears	30	18
315	714	Dusun Anauni	Seram Bagian Barat	Nano	Dropline	15	15
316	714	Dusun Anauni	Seram Bagian Barat	Nano	Longline	35	44
317	714	Dusun Huaroa	Seram Bagian Barat	Nano	Dropline	50	74
318	714	Dusun Huhua	Seram Bagian Barat	Nano	Mixgears	20	27
319	714	Dusun Naeselan	Seram Bagian Barat	Nano	Mixgears	20	33
320	714	Dusun Pattinea	Seram Bagian Barat	Nano	Mixgears	50	67
321	714	Dusun Pohon Batu	Seram Bagian Barat	Nano	Dropline	30	43
322	714	Dusun Waisela	Seram Bagian Barat	Nano	Dropline	5	7
323	714	Dusun Waisela	Seram Bagian Barat	Nano	Longline	10	14
324	714	Dusun Wayohong	Seram Bagian Barat	Nano	Dropline	10	12
325	714	Langgur Tual	Tual	Medium	Longline	1	15
326	714	Langgur Tual	Tual	Small	Longline	2	13
327	714	Mangon Tual	Tual	Small	Dropline	1	7
328	714	PP. Tual	Tual	Large	Dropline	1	36
329	714	PP. Tual	Tual	Medium	Dropline	2	47
330	714	PP. Tual	Tual	Medium	Longline	3	62
331	714	PP. Tual	Tual	Nano	Dropline	1	2
332	714	PP. Tual	Tual	Nano	Longline	1	4
333	714	PP. Tual	Tual	Small	Dropline	2	13
334	714	PP. Tual	Tual	Small	Longline	3	18
335	714	Watdek	Tual	Small	Mixgears	5	32
336	714	Binongko	Wakatobi	Medium	Dropline	1	13
337	714	Binongko	Wakatobi	Nano	Dropline	28	16
338	714	Dermaga Desa Wali	Wakatobi	Small	Dropline	1	5
339	714	Desa Lagongga	Wakatobi	Nano	Dropline	7	26
340	714	Desa Lagongga	Wakatobi	Small	Dropline	1	6
341	714	Desa Wali	Wakatobi	Nano	Dropline	2	8
342	714	Pelabuhan Lagelewa	Wakatobi	Nano	Dropline	1	3
343	715	Pagimana	Banggai	Nano	Dropline	3	4
344	715	Pagimana	Banggai	Nano	Mixgears	60	48
345	715	Pangkalaseang	Banggai	Nano	Dropline	10	10
346	715	Kampung Sekar	Fakfak	Nano	Dropline	7	7
347	715	Kampung Sosar, Kokas	Fakfak	Nano	Dropline	7	7
348	715	Kampung Ugar	Fakfak	Nano	Dropline	17	11

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
349	715	Pasar Sorpeha	Fakfak	Nano	Dropline	7	17
350	715	PP. Dulan Pokpok	Fakfak	Nano	Dropline	215	206
351	715	PP. Fakfak	Fakfak	Medium	Longline	3	46
352	715	PP. Fakfak	Fakfak	Small	Longline	2	19
353	715	Bacan	Halmahera Selatan	Nano	Dropline	39	18
354	715	Bacan	Halmahera Selatan	Nano	Mixgears	1	0
355	715	Bacan Barat	Halmahera Selatan	Nano	Dropline	6	2
356	715	Bacan Tengah	Halmahera Selatan	Nano	Dropline	35	11
357	715	Bacan Timur	Halmahera Selatan	Nano	Dropline	4	1
358	715	Bacan Utara	Halmahera Selatan	Nano	Dropline	5	2
359	715	Desa Lalei	Halmahera Selatan	Nano	Dropline	29	17
360	715	Gane Barat	Halmahera Selatan	Nano	Dropline	15	5
361	715	Gane Timur Selatan	Halmahera Selatan	Nano	Dropline	40	13
362	715	Kep. Batang Lomang	Halmahera Selatan	Nano	Dropline	12	4
363	715	Kepulauan Joronga	Halmahera Selatan	Nano	Dropline	7	2
364	715	Mandioli Selatan	Halmahera Selatan	Nano	Dropline	13	4
365	715	Mandioli Utara	Halmahera Selatan	Nano	Dropline	17	5
366	715	Puau Obilatu	Halmahera Selatan	Nano	Dropline	10	3
367	715	Pulau Obi	Halmahera Selatan	Nano	Dropline	137	44
368	715	Buli	Halmahera Timur	Nano	Dropline	7	7
369	715	Halmahera Timur	Halmahera Timur	Nano	Dropline	48	78
370	715	Kaimana	Kaimana	Nano	Dropline	53	53
371	715	PU. Kaimana	Kaimana	Large	Longline	2	61
372	715	PU. Kaimana	Kaimana	Medium	Longline	6	101
373	715	PP. Kema	Minahasa Utara	Large	Dropline	8	339
374	715	PP. Kema	Minahasa Utara	Medium	Dropline	12	349
375	715	Desa Pantai Pos, Bula	Seram Bagian Timur	Nano	Dropline	30	50
376	715	Desa Sesar, Bula	Seram Bagian Timur	Nano	Dropline	10	20
377	715	Desa Waru	Seram Bagian Timur	Nano	Dropline	50	90
378	715	Pulau Parang	Seram Bagian Timur	Nano	Dropline	50	92
379	715	Soffi	Soffi	Nano	Dropline	10	10
380	715	Jembatan Puri Sorong	Sorong	Medium	Dropline	5	94
381	715	Jembatan Puri Sorong	Sorong	Medium	Mixgears	2	26
382	715	PP. Sorong	Sorong	Medium	Dropline	8	145
383	715	PP. Sorong	Sorong	Medium	Longline	1	17
384	715	PP. Sorong	Sorong	Medium	Trap	9	136
385	715	PP. Sorong	Sorong	Nano	Dropline	7	22
386	715	PP. Sorong	Sorong	Nano	Mixgears	2	6
387	715	PP. Sorong	Sorong	Small	Dropline	4	26
388	715	PP. Sorong	Sorong	Small	Trap	2	18
389	715	Bajugan	Tolitoli	Nano	Dropline	10	6
390	716	Biduk-biduk	Berau	Medium	Dropline	1	22
391	716	Biduk-biduk	Berau	Nano	Dropline	23	69
392	716	Desa Tanjung Batu	Berau	Nano	Dropline	67	201
393	716	Desa Tanjung Batu	Berau	Nano	Trap	1	3
394	716	Giring-giring	Berau	Nano	Dropline	22	66
395	716	Labuan Cermin	Berau	Nano	Dropline	1	3
396	716	Logpond, Batu Putih	Berau	Nano	Dropline	10	16
397	716	P. Derawan	Berau	Nano	Trap	4	7
398	716	Pantai Harapan	Berau	Nano	Dropline	20	60
399	716	Pulau Balikukup, Batu Putih	Berau	Nano	Longline	5	20
400	716	Tanjung Batu	Berau	Nano	Trap	6	18
401	716	Tanjung Batu	Berau	Small	Trap	1	8
402	716	Tanjung Perepat	Berau	Nano	Dropline	5	13
403	716	Teluk Sulaiman	Berau	Nano	Dropline	29	87
404	716	Desa Sampiro	Bolaang Mongondow Utara	Nano	Mixgears	11	4
405	716	Desa Bulontio	Gorontalo Utara	Nano	Dropline	11	5
406	716	Desa Buluwatu	Gorontalo Utara	Nano	Dropline	21	16

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
407	716	Desa Huntokalo	Gorontalo Utara	Nano	Dropline	10	3
408	716	Desa Tihengo	Gorontalo Utara	Nano	Dropline	26	7
409	716	Desa Dalako Bembanehe	Kepulauan Sangihe	Nano	Dropline	4	2
410	716	Desa Lipang	Kepulauan Sangihe	Nano	Dropline	5	2
411	716	Desa Paruruang	Kepulauan Sangihe	Nano	Dropline	16	8
412	716	Desa Parururung	Kepulauan Sangihe	Nano	Dropline	5	2
413	716	Kampung Lipang	Kepulauan Sangihe	Nano	Dropline	5	1
414	716	Sangihe	Kepulauan Sangihe	Nano	Dropline	2	0
415	716	Tariang Baru	Kepulauan Sangihe	Nano	Longline	4	3
416	716	Buhias	Kepulauan Sitaro	Nano	Dropline	153	124
417	716	Mahongsawang Tagulandang	Kepulauan Sitaro	Nano	Dropline	8	4
418	716	Mongsawang	Kepulauan Sitaro	Nano	Dropline	16	6
419	716	Pulau Biaro	Kepulauan Sitaro	Nano	Dropline	29	7
420	716	Desa Damau	Talaud	Nano	Dropline	8	3
421	716	Desa Makatara	Talaud	Nano	Dropline	20	24
422	716	Desa Makatara, Dusun Bawunia	Talaud	Nano	Dropline	1	1
423	716	Desa Makatara, Dusun Bawunian	Talaud	Nano	Dropline	4	3
424	716	Belakang BRI, Selumit Pantai	Tarakan	Nano	Longline	46	138
425	716	Belakang BRI, Selumit Pantai	Tarakan	Small	Longline	4	20
426	716	Mamburungan Dalam	Tarakan	Nano	Mixgears	48	144
427	717	Biak	Biak	Nano	Dropline	1796	1793
428	717	Desa Nikakamp	Biak	Nano	Dropline	4	7
429	717	Desa Tanjung Barari	Biak	Nano	Dropline	5	4
430	717	Fanindi Pantai	Manokwari	Nano	Dropline	4	10
431	717	Kampung Fanindi	Manokwari	Nano	Dropline	20	21
432	717	Manokwari	Manokwari	Nano	Dropline	6	16
433	717	PP. Sanoba	Nabire	Nano	Dropline	12	30
434	717	Wasior	Teluk Wondama	Nano	Dropline	19	23
435	718	PP. Muara Angke	Jakarta	Large	Dropline	2	97
436	718	PP. Muara Angke	Jakarta	Medium	Dropline	1	30
437	718	PP. Nizam Zachman	Jakarta	Large	Longline	4	205
438	718	Namatota	Kaimana	Large	Longline	6	379
439	718	PP. Kaimana	Kaimana	Large	Longline	1	45
440	718	Dusun Wamar Desa Durjela	Kepulauan Aru	Medium	Longline	4	73
441	718	PP. Bajomulyo	Kepulauan Aru	Large	Gillnet	1	82
442	718	PP. Benjina	Kepulauan Aru	Large	Longline	2	92
443	718	PP. Dobo	Kepulauan Aru	Large	Gillnet	8	527
444	718	PP. Dobo	Kepulauan Aru	Large	Longline	10	596
445	718	PP. Dobo	Kepulauan Aru	Medium	Dropline	93	1658
446	718	PP. Dobo	Kepulauan Aru	Medium	Gillnet	5	121
447	718	PP. Dobo	Kepulauan Aru	Medium	Longline	10	185
448	718	PP. Dobo	Kepulauan Aru	Nano	Dropline	11	30
449	718	PP. Dobo	Kepulauan Aru	Nano	Longline	8	23
450	718	PP. Dobo	Kepulauan Aru	Small	Dropline	7	56
451	718	PP. Dobo	Kepulauan Aru	Small	Longline	1	7
452	718	PP. Kaimana	Kepulauan Aru	Large	Longline	1	51
453	718	PP. Klidang Lor	Kepulauan Aru	Large	Gillnet	1	73
454	718	PP. Mayangan	Kepulauan Aru	Large	Longline	19	1405
455	718	PP. Merauke	Kepulauan Aru	Large	Longline	4	397
456	718	PP. Nizam Zachman	Kepulauan Aru	Large	Gillnet	1	92
457	718	PP. Pekalongan	Kepulauan Aru	Large	Gillnet	1	115
458	718	PU. Dobo	Kepulauan Aru	Large	Gillnet	3	285
459	718	PU. Dobo	Kepulauan Aru	Large	Longline	36	2670
460	718	Saumlaki	Maluku Tenggara Barat	Nano	Dropline	37	109
461	718	Saumlaki	Maluku Tenggara Barat	Small	Dropline	1	5
462	718	Saumlaki	Maluku Tenggara Barat	Small	Longline	5	37
463	718	PP. Bajomulyo	Merauke	Large	Gillnet	1	91
464	718	PP. Merauke	Merauke	Large	Dropline	1	106

Table 2.14: Total Number and Gross Tonnage of Snapper Fishing Boats by Main Target WPP, Registration Port, Home District (Kabupaten), Boat Size Category and Type of Fishing Gear. (Nano < 5 GT, Small 5-<10 GT, Medium 10-30 GT, Large >30 GT)

Row	WPP	Registration Port	Home District	Boat Size	Gear	N	Total GT
465	718	PP. Merauke	Merauke	Large	Gillnet	48	3873
466	718	PP. Merauke	Merauke	Large	Longline	2	213
467	718	PP. Merauke	Merauke	Medium	Gillnet	5	138
468	718	PP. Nizam Zachman	Merauke	Large	Dropline	5	455
469	718	PP. Nizam Zachman	Merauke	Large	Gillnet	13	841
470	718	PP. Nizam Zachman	Merauke	Large	Longline	1	60
471	718	PP. Poumako	Merauke	Medium	Gillnet	3	88
472	718	PP. Tegal	Merauke	Large	Gillnet	1	148
473	718	PP. Bajomulyo	Mimika	Large	Longline	1	82
474	718	PP. Dobo	Mimika	Large	Gillnet	1	75
475	718	PP. Mayangan	Mimika	Large	Gillnet	1	129
476	718	PP. Merauke	Mimika	Large	Gillnet	2	123
477	718	PP. Merauke	Mimika	Medium	Gillnet	2	49
478	718	PP. Muara Angke	Mimika	Large	Gillnet	1	92
479	718	PP. Nizam Zachman	Mimika	Large	Gillnet	1	88
480	718	PP. Paumako	Mimika	Large	Gillnet	2	60
481	718	PP. Paumako	Mimika	Medium	Gillnet	2	58
482	718	PP. Pekalongan	Mimika	Large	Gillnet	1	112
483	718	PP. Pomako	Mimika	Medium	Gillnet	1	16
484	718	PP. Poumako	Mimika	Large	Gillnet	3	90
485	718	PP. Poumako	Mimika	Medium	Gillnet	15	387
486	718	PP. Poumako	Mimika	Small	Gillnet	1	8
487	718	PP. Bajomulyo	Pati	Large	Longline	2	217
488	718	Bagansiapiapi	Probolinggo	Large	Longline	1	40
489	718	PP. Dobo	Probolinggo	Large	Longline	2	142
490	718	PP. Mayangan	Probolinggo	Large	Gillnet	3	124
491	718	PP. Mayangan	Probolinggo	Large	Longline	33	2095
492	718	PP. Mayangan	Probolinggo	Medium	Longline	7	199
493	718	Probolinggo	Probolinggo	Large	Longline	19	1408
494	718	PP. Lappa	Sinjai	Large	Dropline	1	35
495	718	PP. Lappa	Sinjai	Medium	Dropline	10	233
496	718	Timika	Timika	Medium	Longline	3	88
497	718	PP. Bajomulyo	Tual	Large	Longline	1	87
498	718	PP. Tual	Tual	Medium	Dropline	1	28
499	718	PP. Tual	Tual	Nano	Longline	1	4
500	718	PP. Tual	Tual	Small	Dropline	1	6
TOTAL						10329	61081

2.5 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}). Procedures for estimation of these length based life history characteristics are explained in the "Guide to Length Based Stock Assessment" (Mous et al., 2019). The data base also includes 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 the instantaneous total mortality (Z) from the equilibrium Beverton-Holt estimator from length data using Ehrhardt and Ault (1992) bias-correction, implemented through the function `bheq2` of the R Fishmethods package.

We estimated the natural rate of mortality (M) using Froese and Pauly (2000) empirical formula with asymptotic length as estimated by species and an ambient water temperature at fishing depth estimated at about 20 degrees Celcius. With an asymptotic length for a snapper of about 80cm this results in an M of about 0.4, which aligns well with the mean of reported values from the literature (Martinez-Andrade, 2003). The fishing mortality F follows as the difference between total and natural mortality. We estimated K from L_{opt} and M and L_{inf} , using the equation presented in Froese and Binohlan 2000: $K = M * L_{opt} / 3 * (L_{inf} - L_{opt})$.

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 Timor Sea is arguably the most important snapper fishing ground in WPP 573 and fishing boats from far away are attracted to this area (Figures 3.1, 3.3 and 3.4). Several drop line and long line vessels have been observed repeatedly to illegally fish in Timor Leste waters (Figure 3.2). 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 still frequently targeted illegally by Indonesian vessels. SPOT trace data leave no doubt about this IUU issue in WPP 573.

The SPOT trace data from the Timor Sea drop line and long line fisheries also illustrate a classic “fishing the line” phenomenon (Figure 3.5 hingga 3.7) in the area of the Sahul Banks. Fishing vessels concentrate here right at the Indonesia - Australia border, on the edge of better managed fishing grounds on the Australian side, where fish densities are higher and where spill over effects can be expected. Additional fishing takes place near Rote Island and a few other locations on the boundary of the Savu and Timor Seas. Several drop line fishers were also observed to operate illegally in Australian waters and some of these have been arrested by Australian patrol boats in 2015.

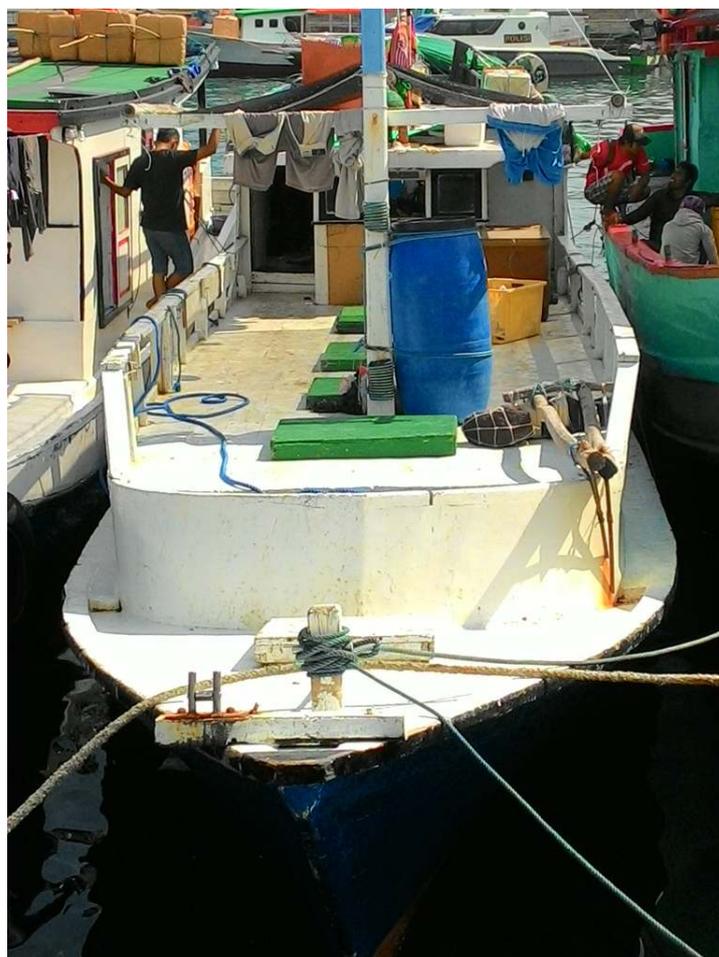


Figure 3.1: A typical snapper fishing boat from Sapeken, Sumenep, Jawa Timur, operating from Kupang in the Timor Sea (WPP 573) and on nearby fishing grounds.

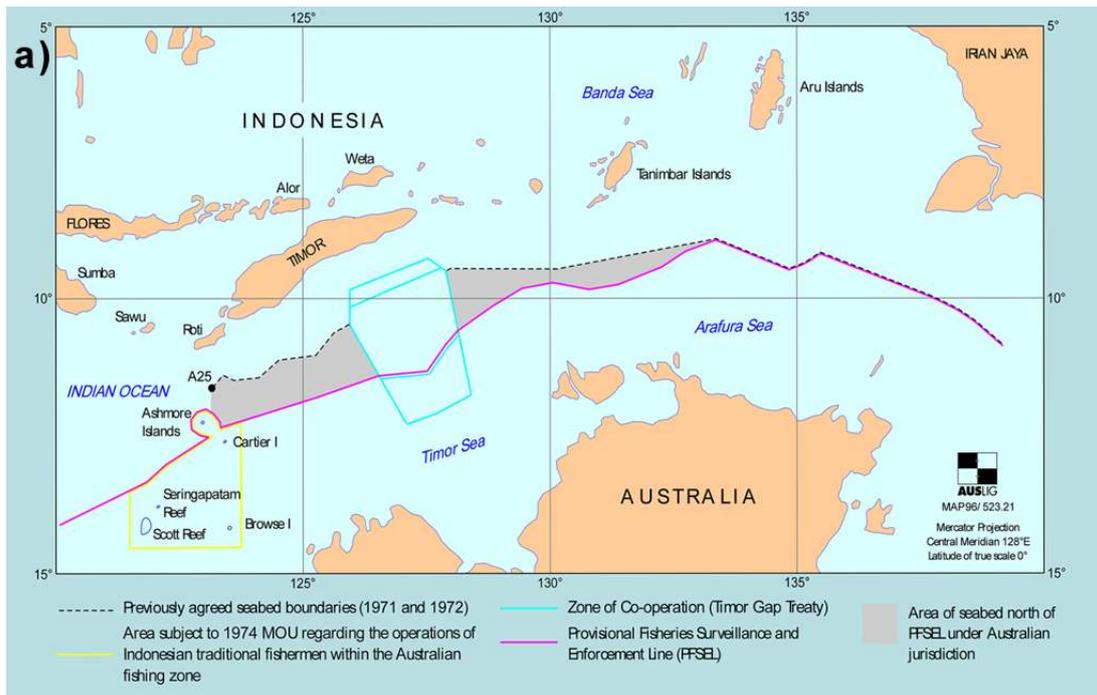
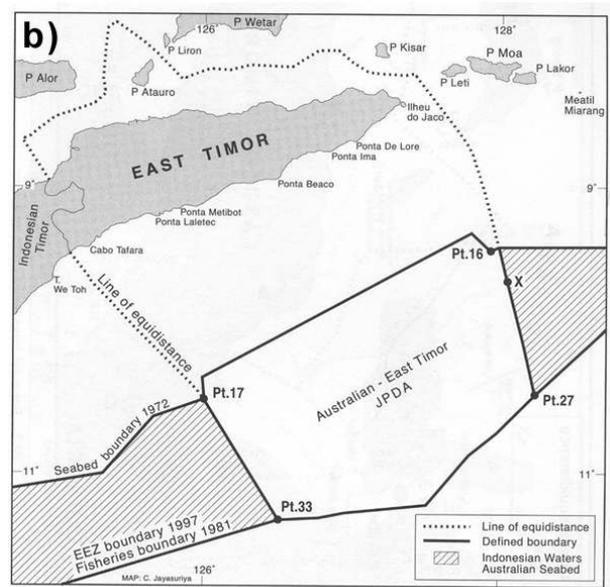


Figure 3.2: Timor Sea fishing grounds with current boundaries between Indonesia, East Timor and Australia.

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.



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



Figure 3.3: A typical snapper fishing boat used for drop line fishing from Benoa Denpasar, Bali, operating in the Timor Sea (WPP 573) and on nearby fishing grounds.



Figure 3.4: A typical snapper fishing boat used for long line fishing from Benoa Denpasar, Bali, operating in the Timor Sea (WPP 573) and on nearby fishing grounds.

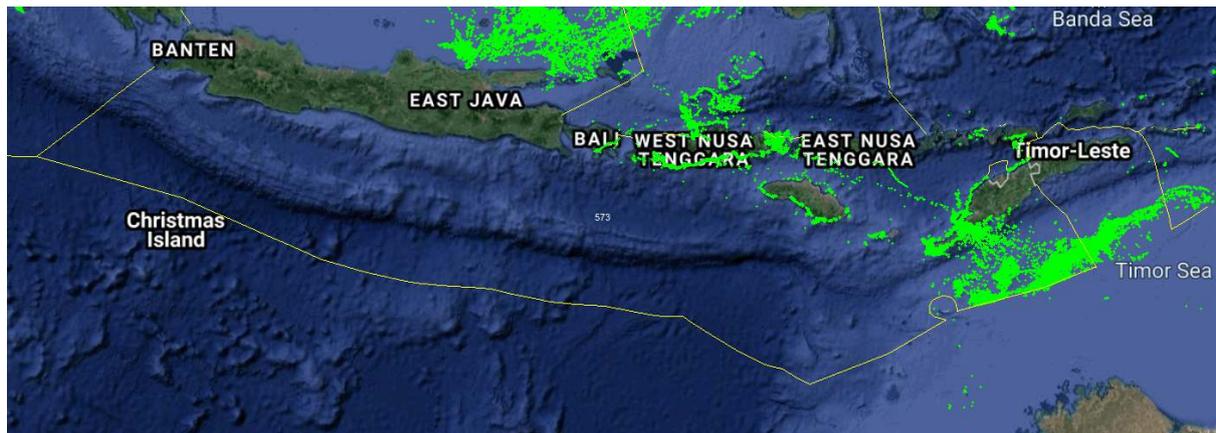


Figure 3.5: Fishing positions of dropliners participating in the CODRS program over the years 2014 - 2019 in WPP 573, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

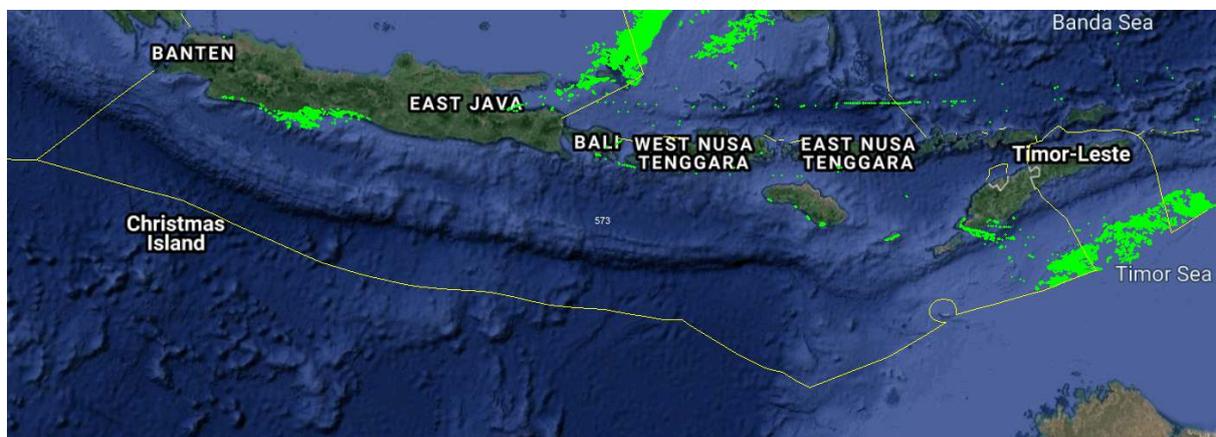
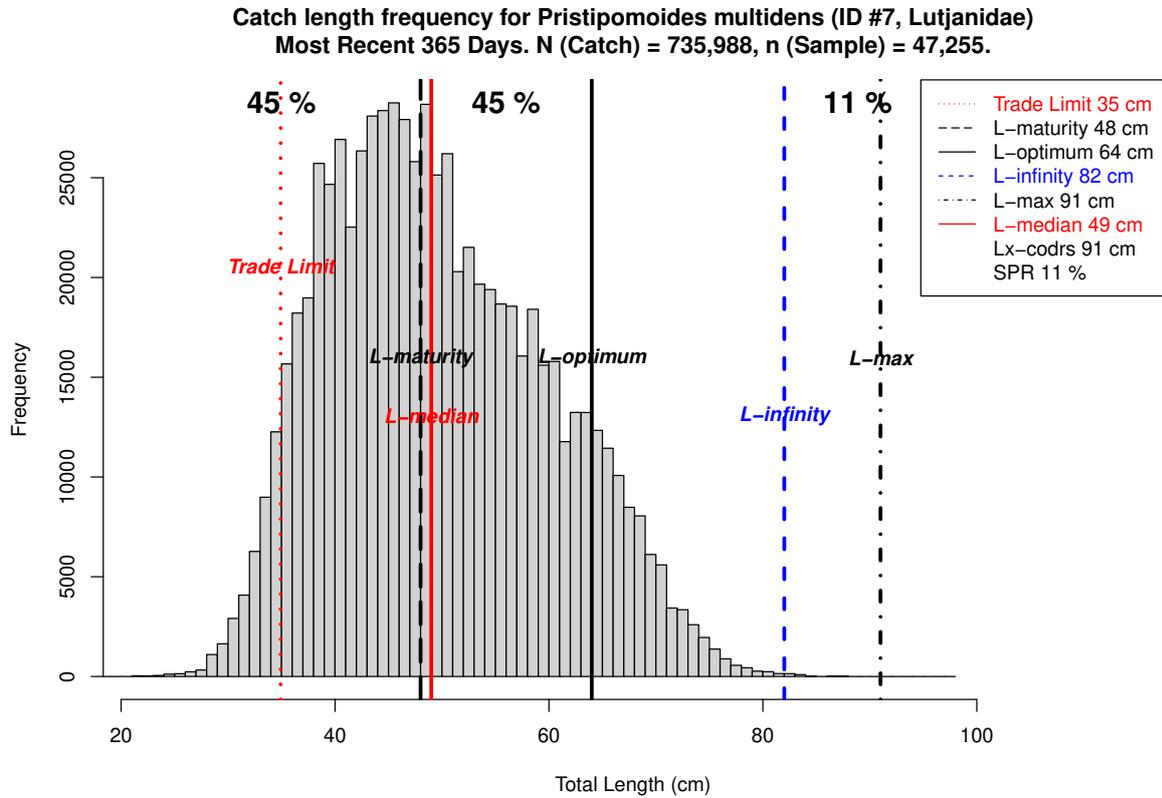


Figure 3.6: Fishing positions of longliners participating in the CODRS program over the years 2014 - 2019 in WPP 573, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

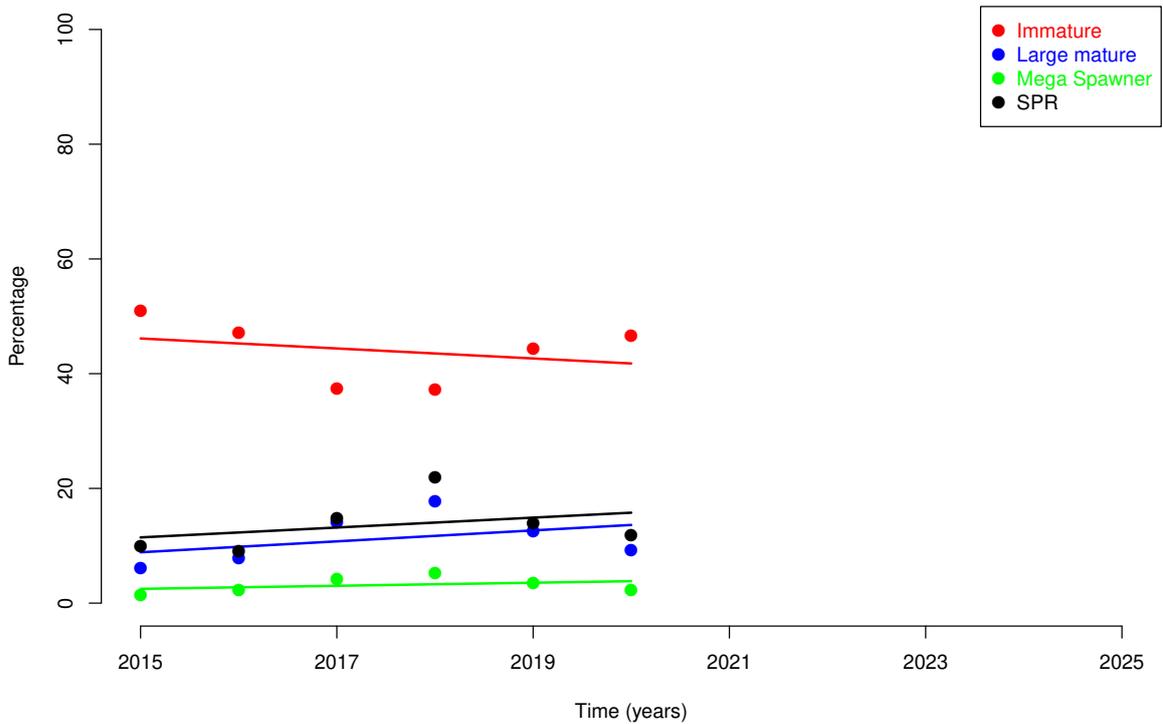


Figure 3.7: Fishing positions of vessels applying more than one gear, participating in the CODRS program over the years 2014 - 2019 in WPP 573, as reported by Spot Trace. Gears used by the vessels in this group are a combination of droplines, longlines, traps, and gillnets. Reported positions during steaming, anchoring, or docking are excluded from this map.

4 Length-based assessments of Top 20 most abundant species in CODRS samples including all years in WPP 573



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 (Catch) = 735,988, n (Sample) = 47,255
Immature (< 48cm): 45%
Small mature (>= 48cm, < 64cm): 45%
Large mature (>= 64cm): 11%
Mega spawner (>= 70.4cm): 3% (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.

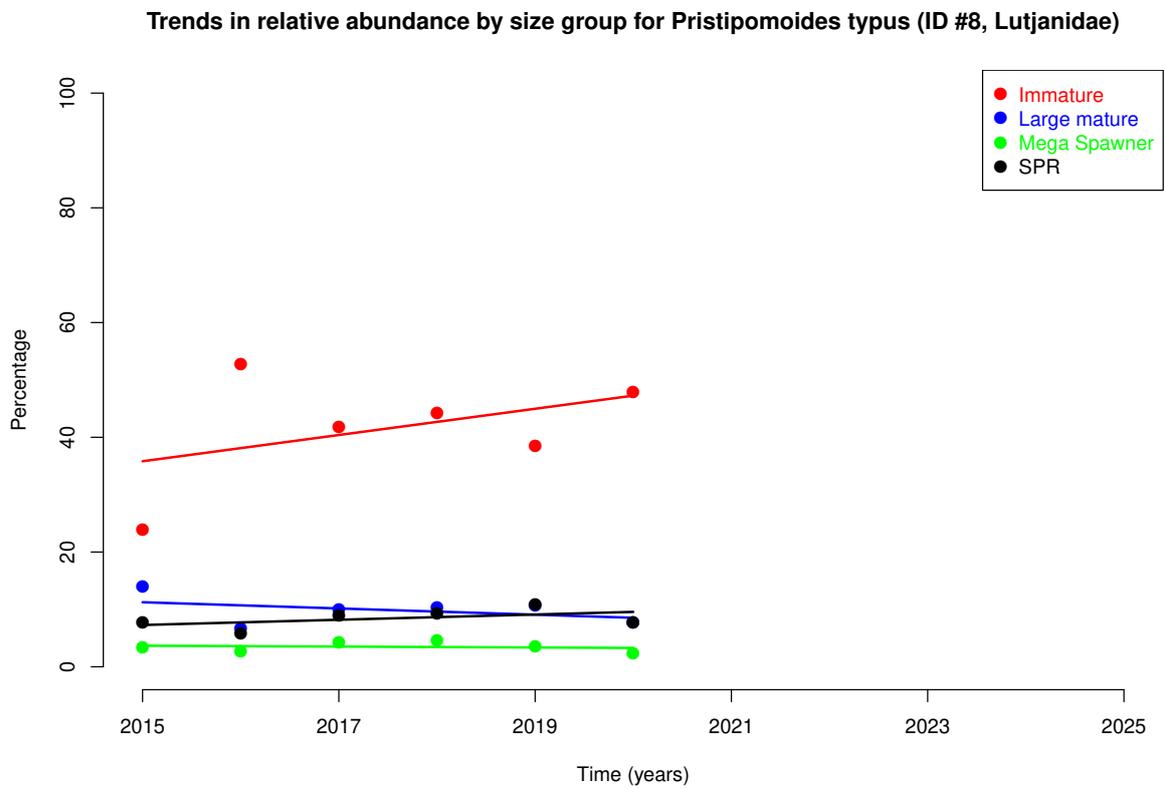
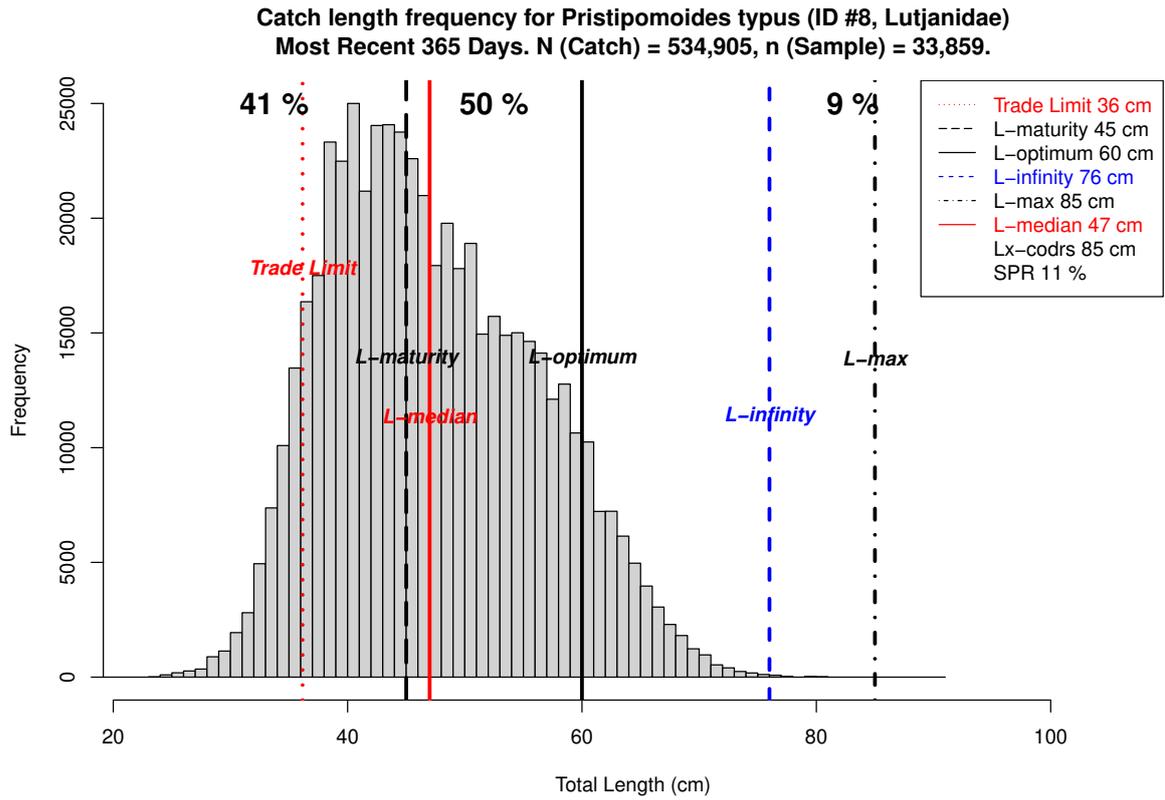
Trends in relative abundance by size group for *Pristipomoides multidens* (ID #7, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.574

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

% Mega Spawner rising over recent years, situation improving. P: 0.492

% SPR rising over recent years, situation improving. P: 0.499



The percentages of *Pristipomoides typus* (ID #8, Lutjanidae) in most recent 365 days.
N (Catch) = 534,905, n (Sample) = 33,859
Immature (< 45cm): 41%
Small mature (>= 45cm, < 60cm): 50%
Large mature (>= 60cm): 9%
Mega spawner (>= 66cm): 3% (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.

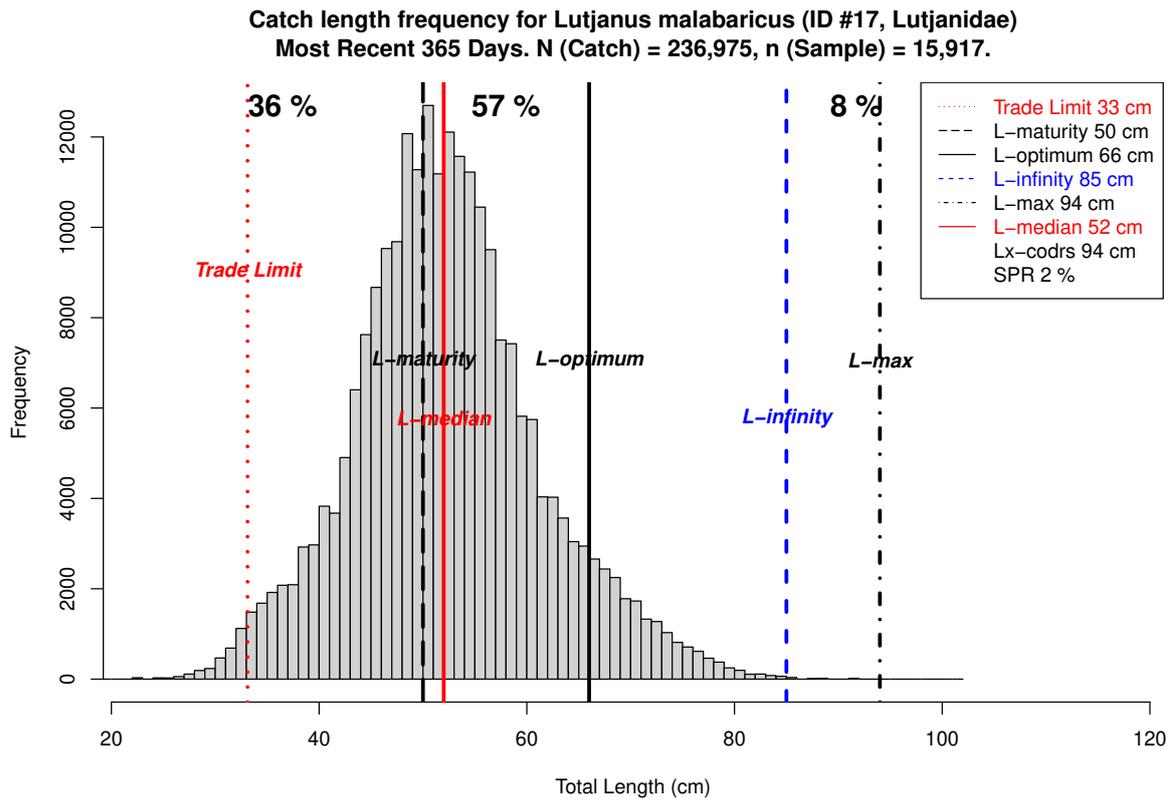
Trends in relative abundance by size group for *Pristipomoides typus* (ID #8, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.396

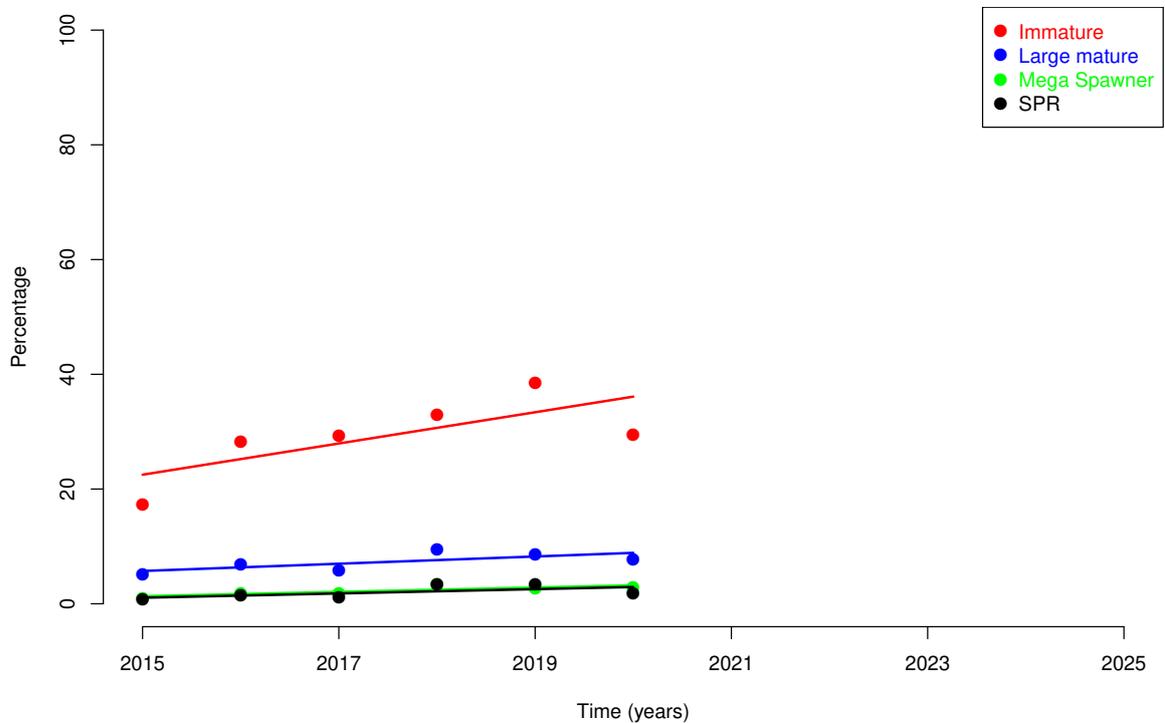
% Large Mature falling over recent years, situation deteriorating. P: 0.437

% Mega Spawner no trend over recent years, situation stable. P: 0.747

% SPR rising over recent years, situation improving. P: 0.322



Trends in relative abundance by size group for *Lutjanus malabaricus* (ID #17, Lutjanidae)



The percentages of *Lutjanus malabaricus* (ID #17, Lutjanidae) in most recent 365 days.
N (Catch) = 236,975, n (Sample) = 15,917
Immature (< 50cm): 36%
Small mature (>= 50cm, < 66cm): 57%
Large mature (>= 66cm): 8%
Mega spawner (>= 72.6cm): 3% (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.

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.

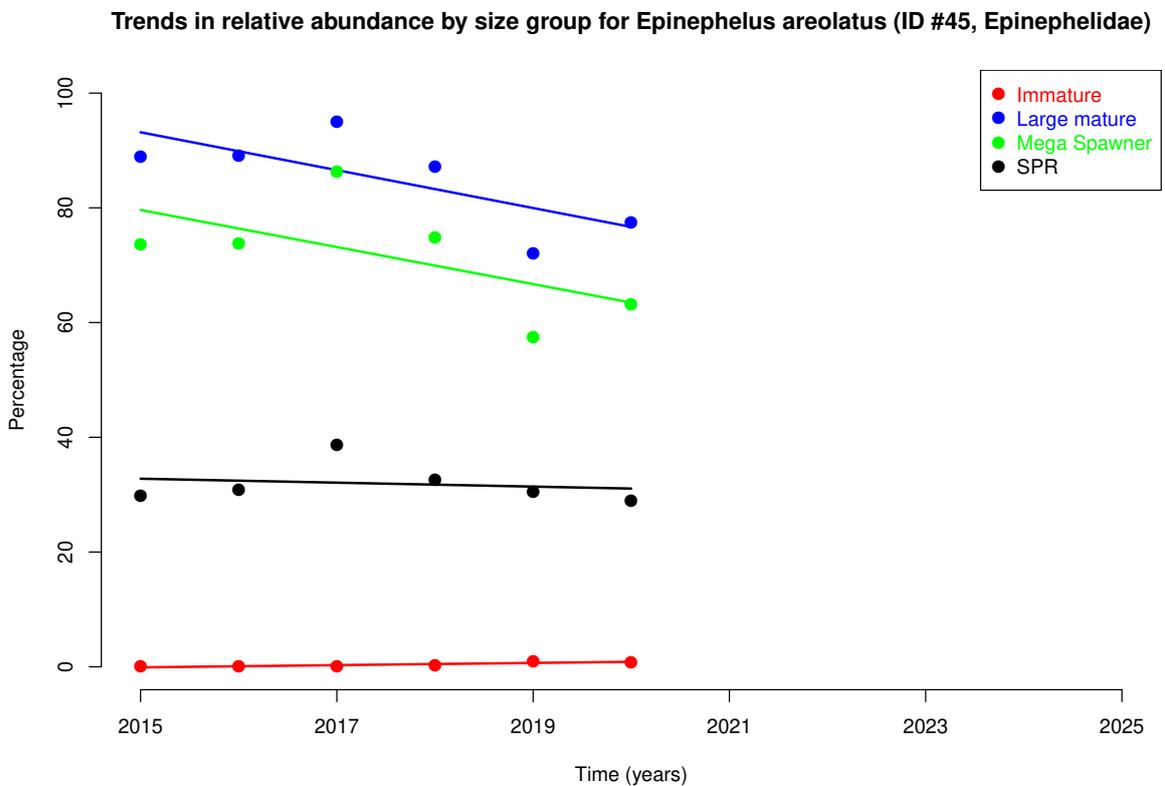
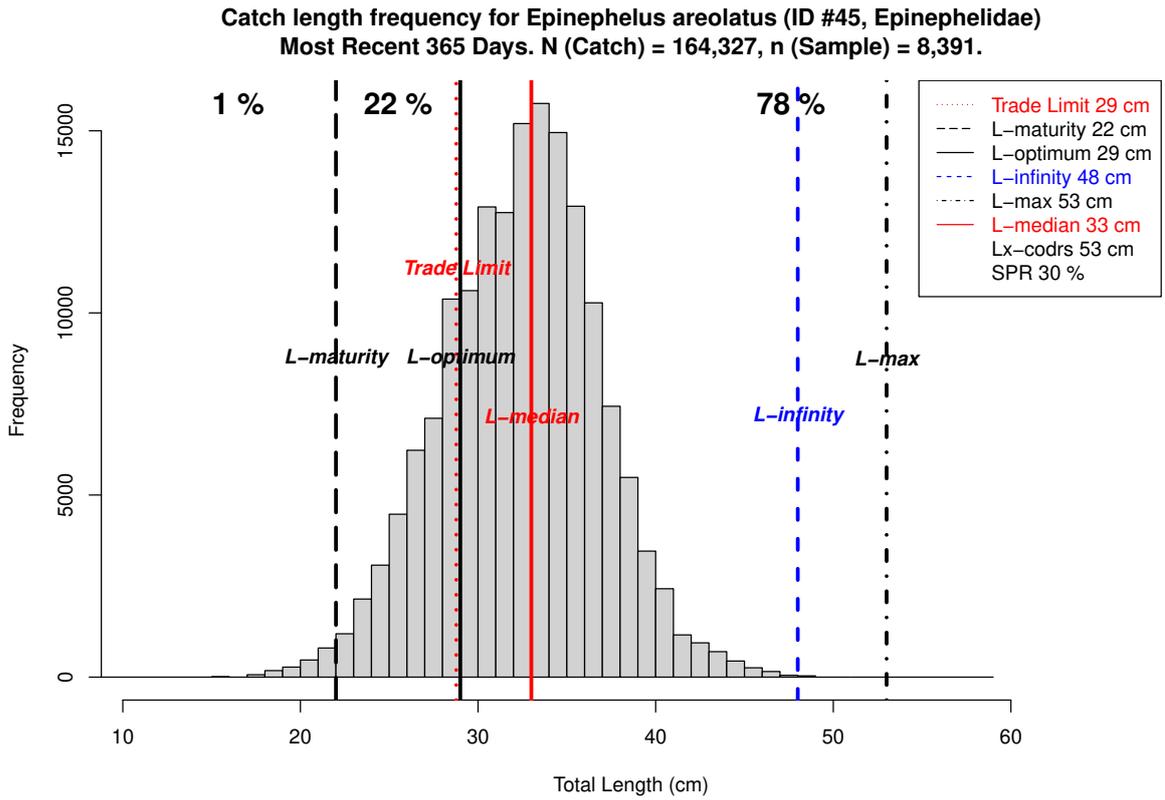
Trends in relative abundance by size group for *Lutjanus malabaricus* (ID #17, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.103

% Large Mature rising over recent years, situation improving. P: 0.116

% Mega Spawner rising over recent years, situation improving. P: 0.049

% SPR rising over recent years, situation improving. P: 0.197



The percentages of *Epinephelus areolatus* (ID #45, Epinephelidae) in most recent 365 days.

N (Catch) =164,327, n (Sample) = 8,391

Immature (< 22cm): 1%

Small mature (>= 22cm, < 29cm): 22%

Large mature (>= 29cm): 78%

Mega spawner (>= 31.9cm): 64% (subset of large mature fish)

Spawning Potential Ratio: 30 %

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.

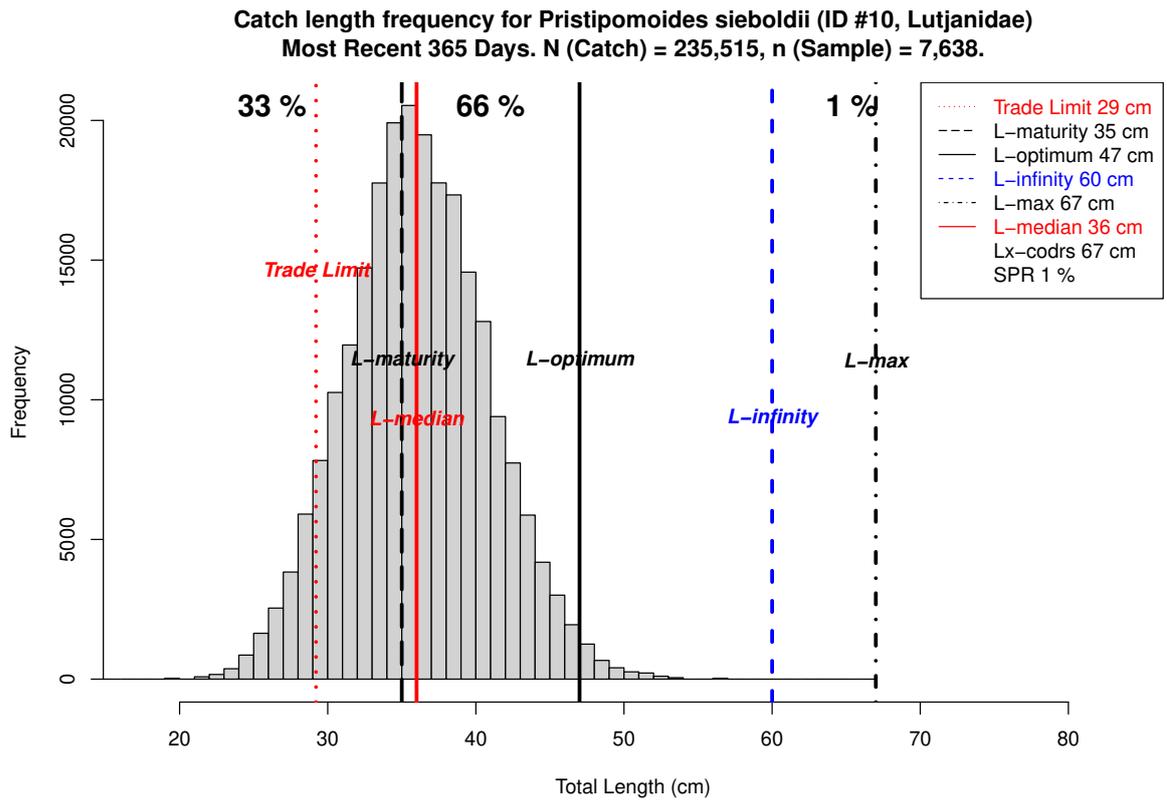
Trends in relative abundance by size group for *Epinephelus areolatus* (ID #45, Epinephelidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.029

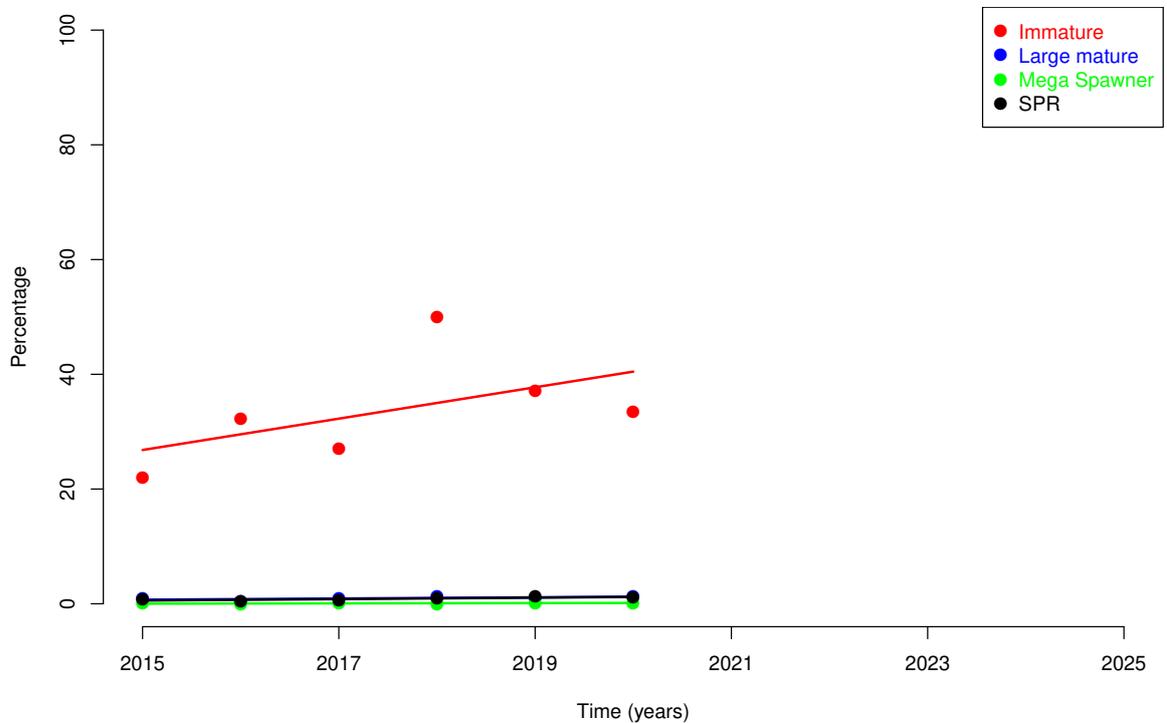
% Large Mature falling over recent years, situation deteriorating. P: 0.100

% Mega Spawner falling over recent years, situation deteriorating. P: 0.211

% SPR falling over recent years, situation deteriorating. P: 0.729



Trends in relative abundance by size group for *Pristipomoides sieboldii* (ID #10, Lutjanidae)



The percentages of *Pristipomoides sieboldii* (ID #10, Lutjanidae) in most recent 365 days.
N (Catch) = 235,515, n (Sample) = 7,638
Immature (< 35cm): 33%
Small mature (>= 35cm, < 47cm): 66%
Large mature (>= 47cm): 1%
Mega spawner (>= 51.7cm): 0% (subset of large mature fish)
Spawning Potential Ratio: 1 %

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.

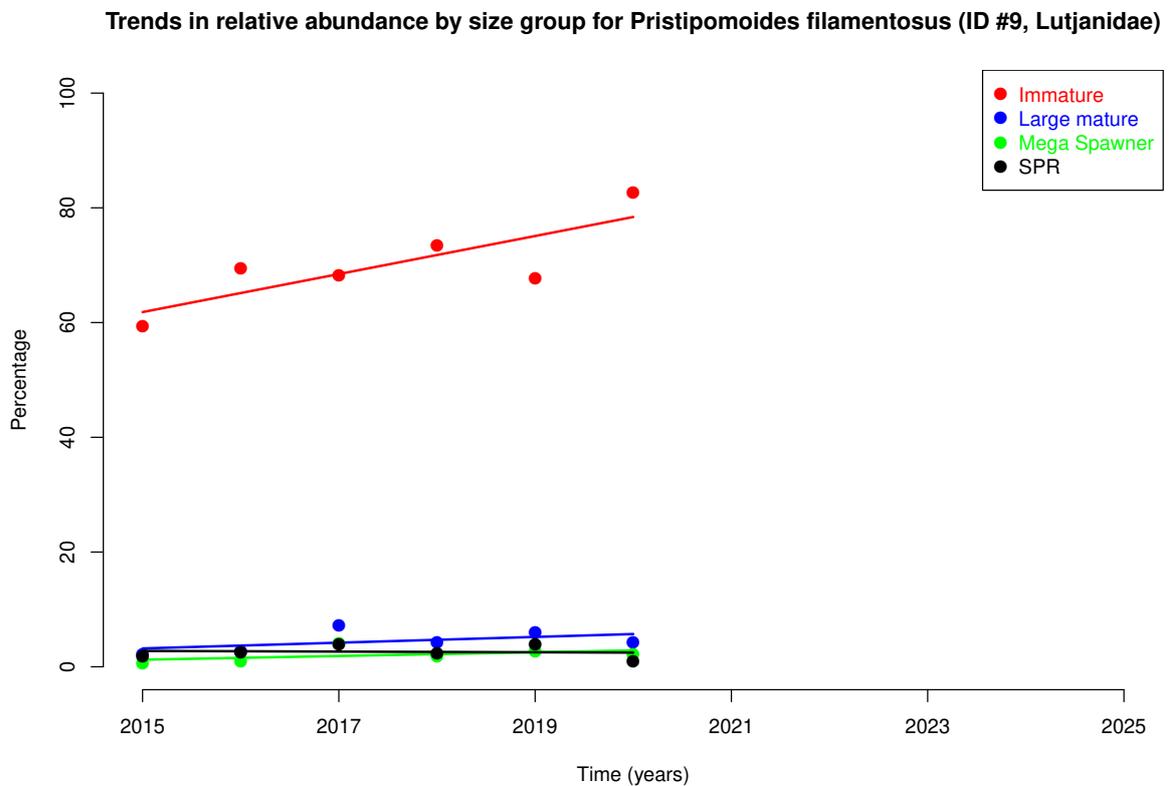
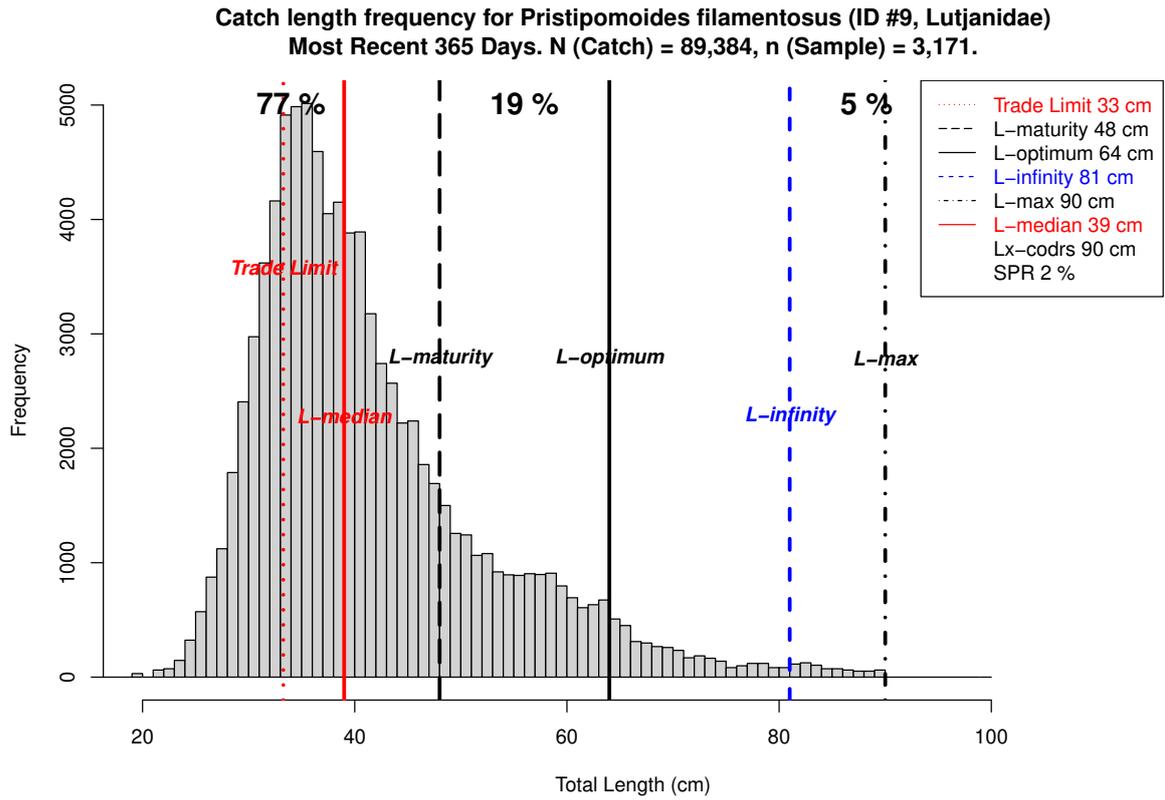
Trends in relative abundance by size group for *Pristipomoides sieboldii* (ID #10, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.278

% Large Mature rising over recent years, situation improving. P: 0.203

% Mega Spawner no trend over recent years, situation stable. P: 0.178

% SPR rising over recent years, situation improving. P: 0.103



The percentages of *Pristipomoides filamentosus* (ID #9, Lutjanidae) in most recent 365 days.
N (Catch) = 89,384, n (Sample) = 3,171
Immature (< 48cm): 77%
Small mature (>= 48cm, < 64cm): 19%
Large mature (>= 64cm): 5%
Mega spawner (>= 70.4cm): 2% (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.

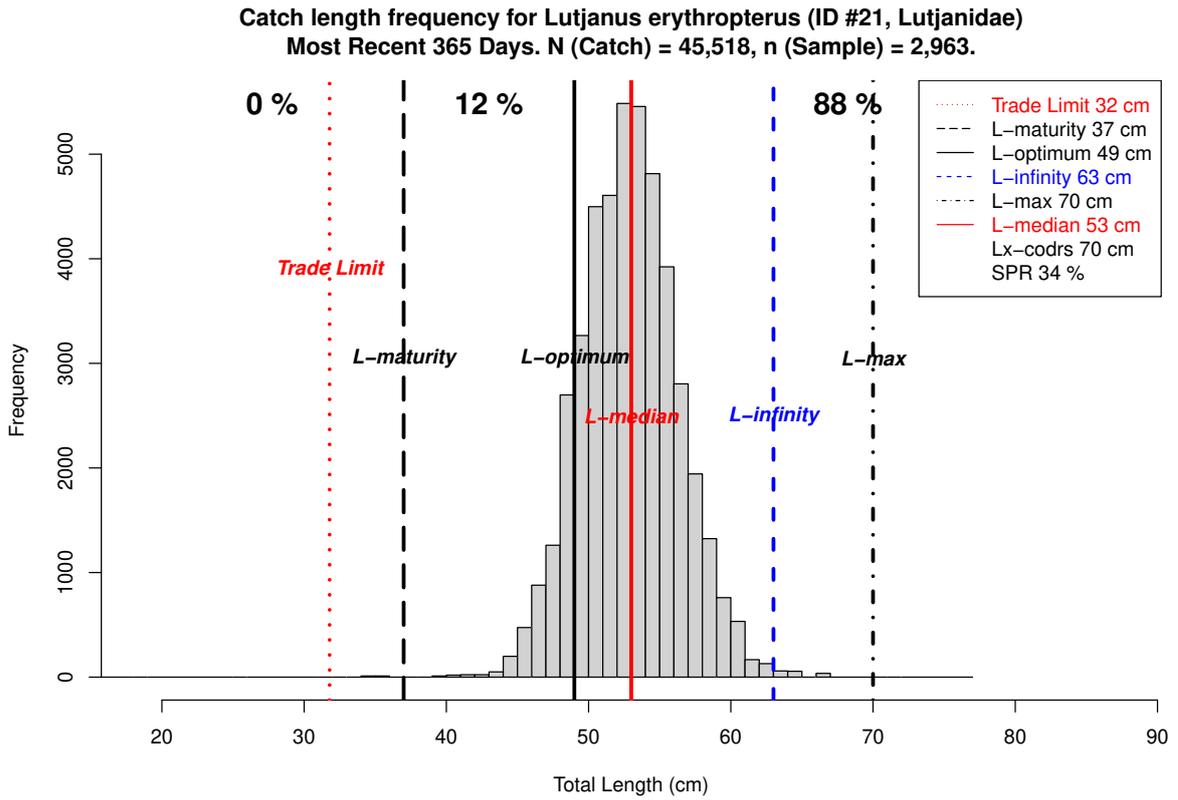
Trends in relative abundance by size group for *Pristipomoides filamentosus* (ID #9, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.050

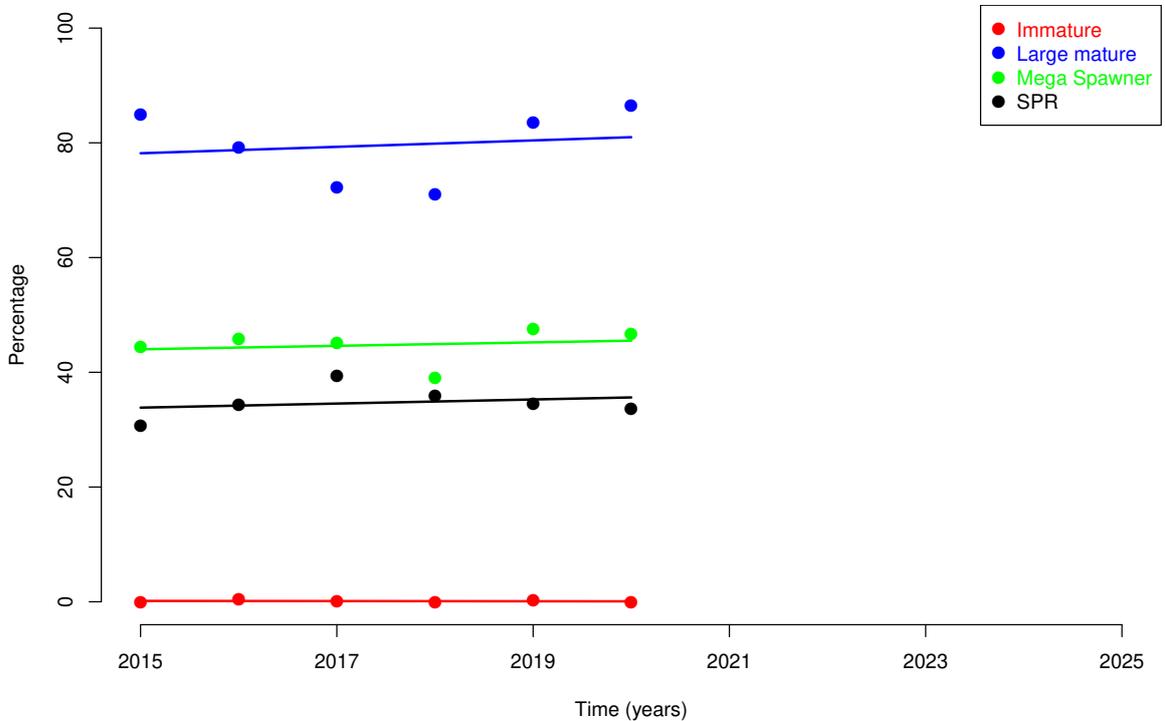
% Large Mature rising over recent years, situation improving. P: 0.336

% Mega Spawner rising over recent years, situation improving. P: 0.347

% SPR no trend over recent years, situation stable. P: 0.856



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 (Catch) = 45,518, n (Sample) = 2,963
Immature (< 37cm): 0%
Small mature (>= 37cm, < 49cm): 12%
Large mature (>= 49cm): 88%
Mega spawner (>= 53.9cm): 48% (subset of large mature fish)
Spawning Potential Ratio: 34 %

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.

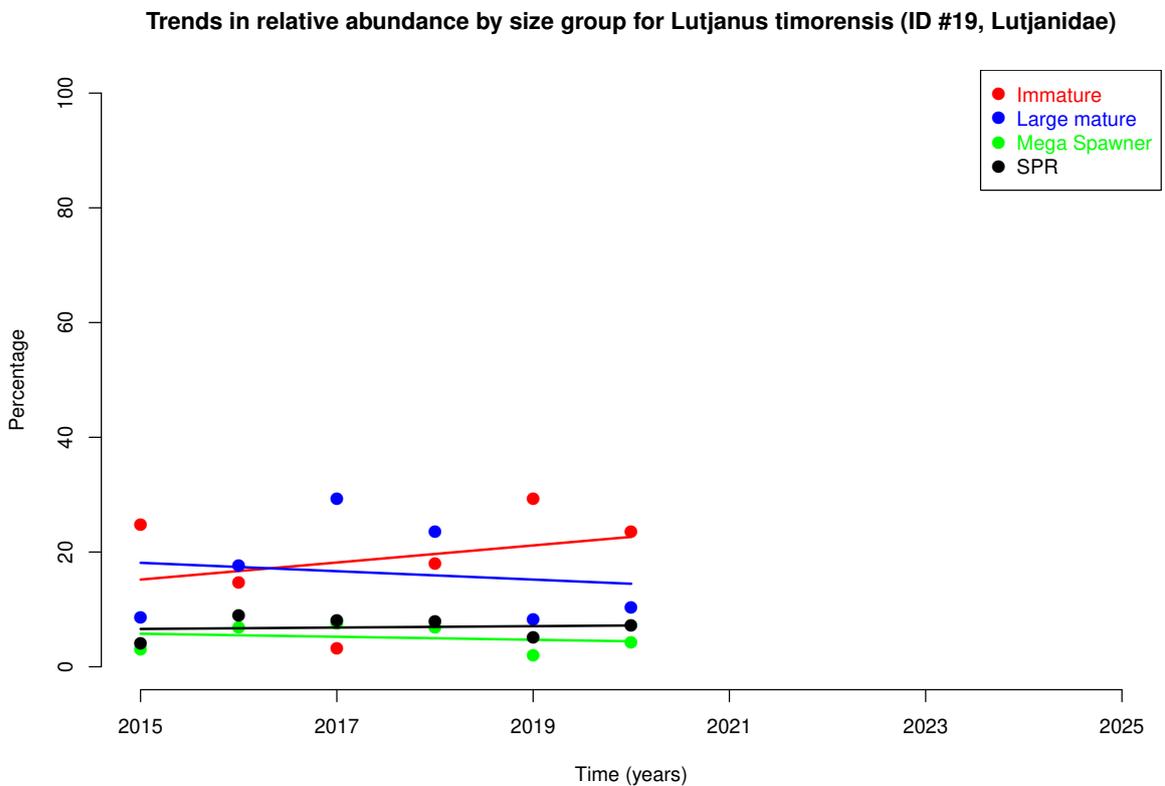
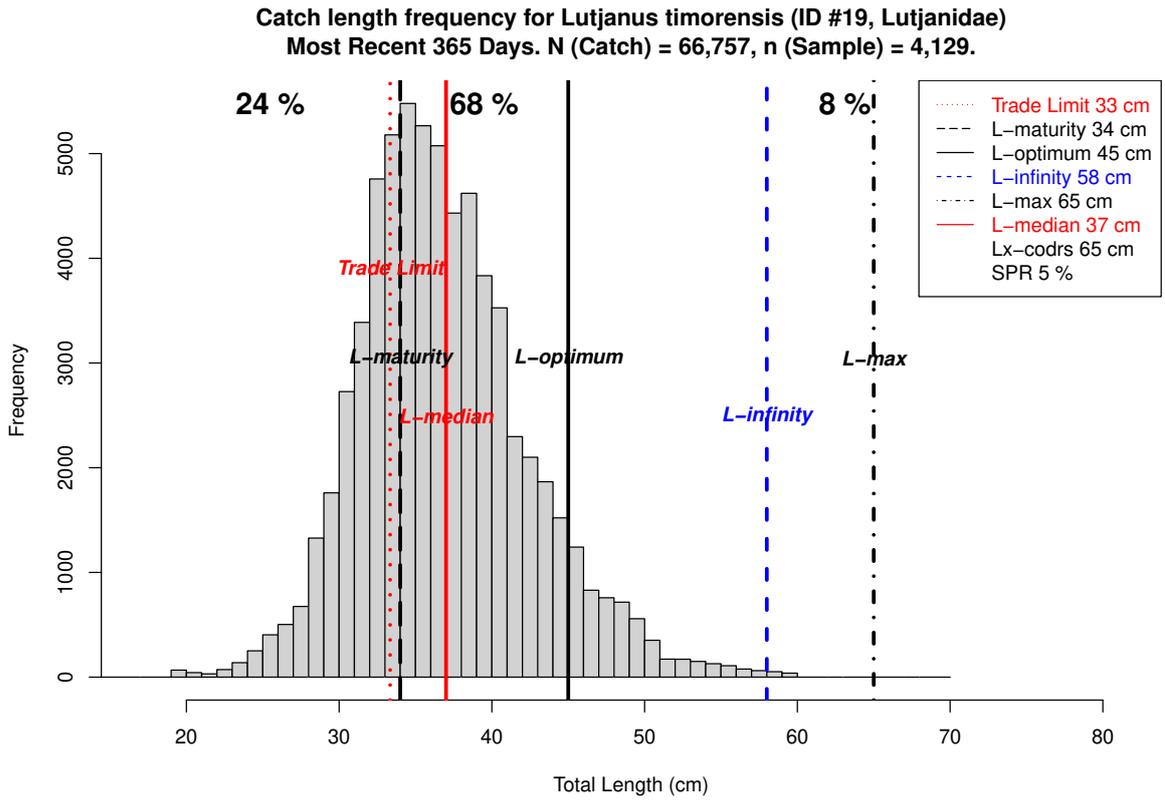
Trends in relative abundance by size group for *Lutjanus erythropterus* (ID #21, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature no trend over recent years, situation stable. P: 0.737

% Large Mature rising over recent years, situation improving. P: 0.764

% Mega Spawner rising over recent years, situation improving. P: 0.721

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



The percentages of *Lutjanus timorensis* (ID #19, Lutjanidae) in most recent 365 days.
N (Catch) = 66,757, n (Sample) = 4,129
Immature (< 34cm): 24%
Small mature (>= 34cm, < 45cm): 68%
Large mature (>= 45cm): 8%
Mega spawner (>= 49.5cm): 3% (subset of large mature fish)
Spawning Potential Ratio: 5 %

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.

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.

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.

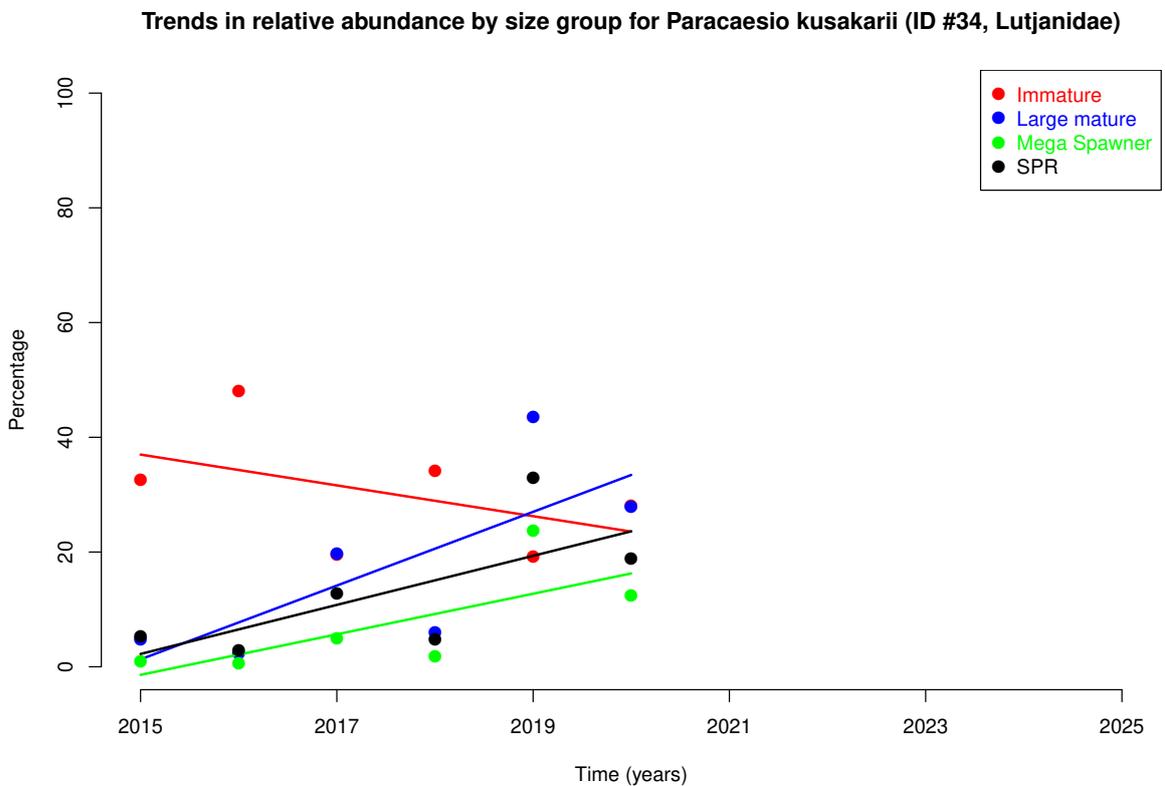
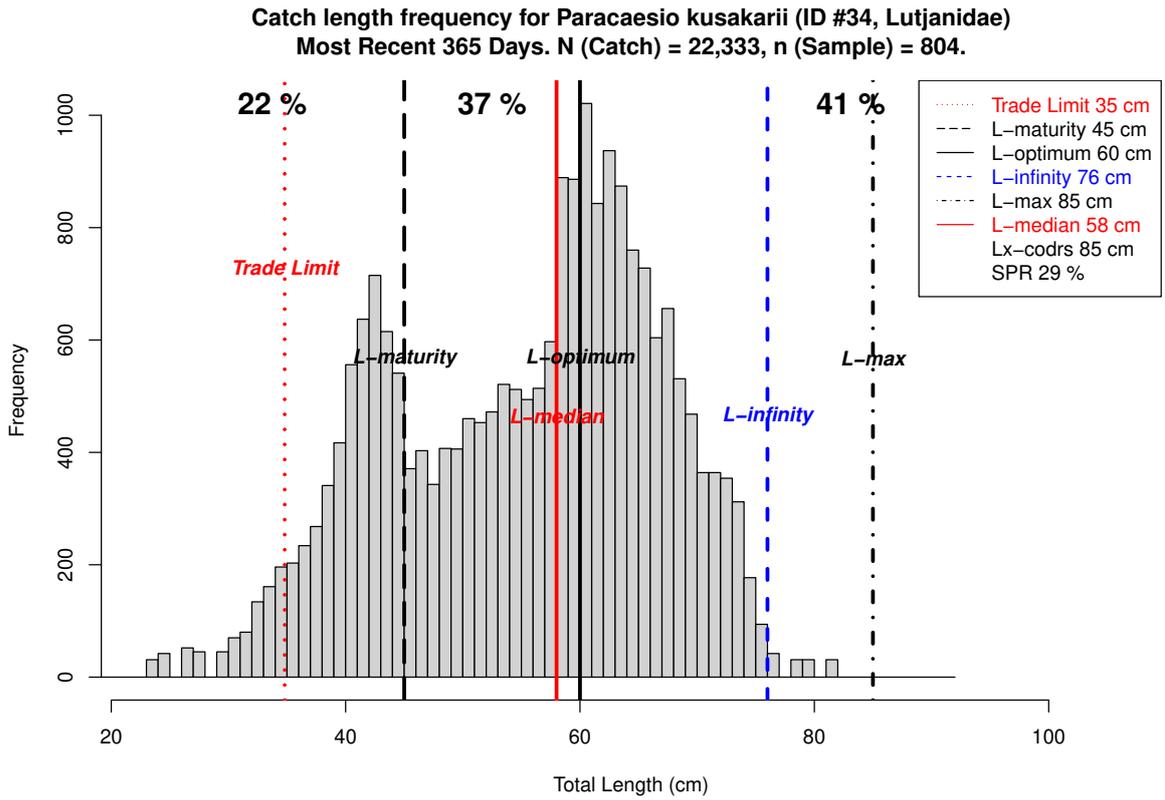
Trends in relative abundance by size group for *Lutjanus timorensis* (ID #19, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.563

% Large Mature falling over recent years, situation deteriorating. P: 0.767

% Mega Spawner falling over recent years, situation deteriorating. P: 0.687

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



The percentages of *Paracaesio kusakarii* (ID #34, Lutjanidae) in most recent 365 days.
N (Catch) = 22,333, n (Sample) = 804
Immature (< 45cm): 22%
Small mature (>= 45cm, < 60cm): 37%
Large mature (>= 60cm): 41%
Mega spawner (>= 66cm): 21% (subset of large mature fish)
Spawning Potential Ratio: 29 %

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 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.

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.

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.

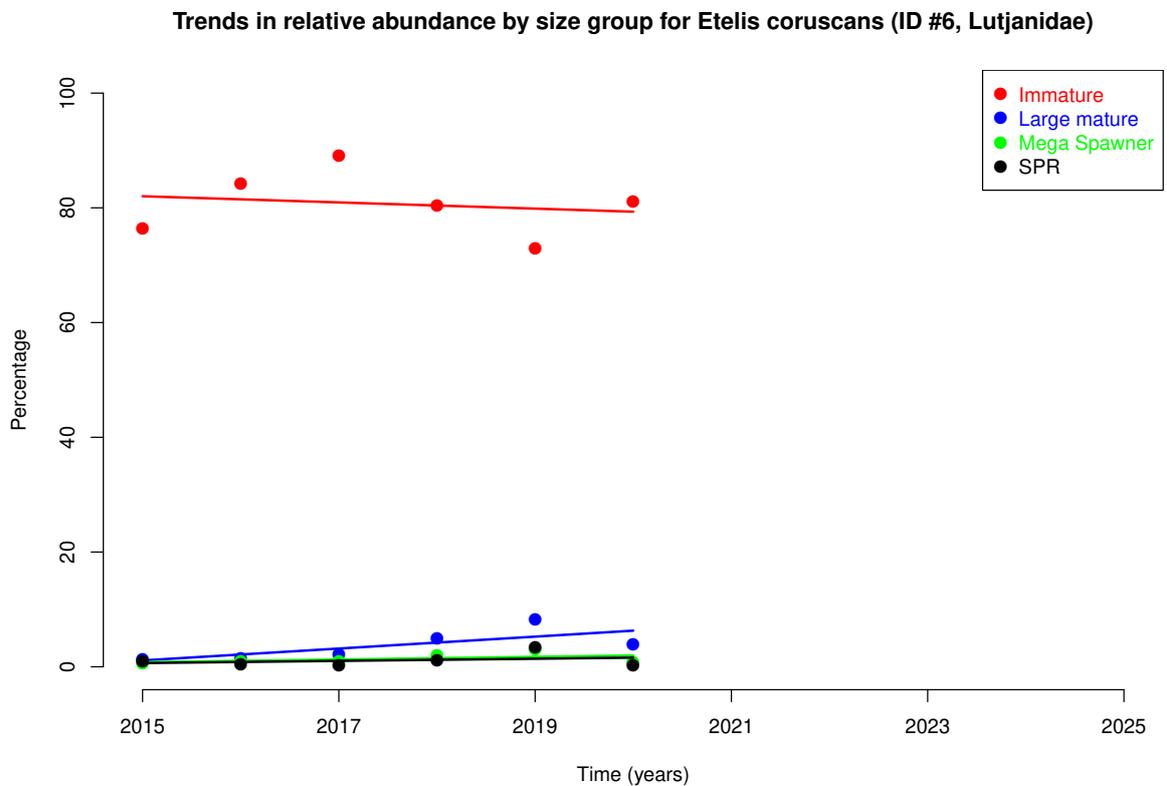
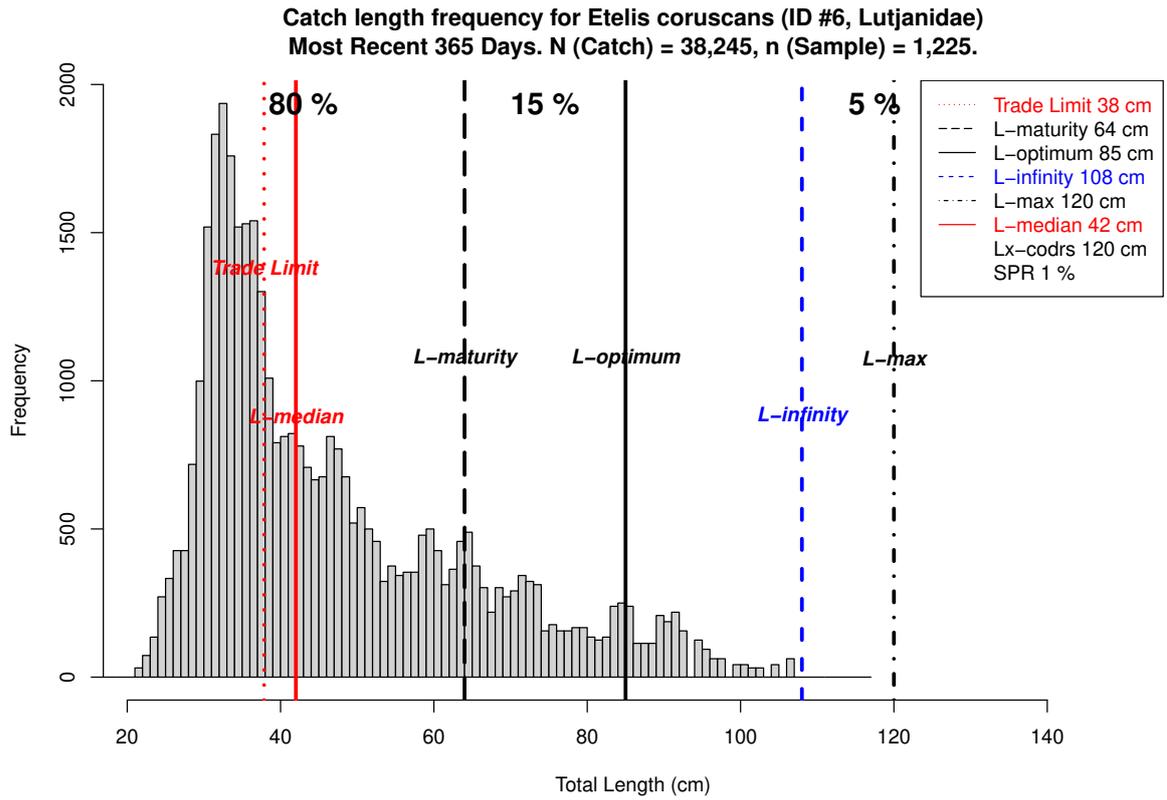
Trends in relative abundance by size group for *Paracaesio kusakarii* (ID #34, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.349

% Large Mature rising over recent years, situation improving. P: 0.092

% Mega Spawner rising over recent years, situation improving. P: 0.104

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



The percentages of *Etelis coruscans* (ID #6, Lutjanidae) in most recent 365 days.
N (Catch) = 38,245, n (Sample) = 1,225
Immature (< 64cm): 80%
Small mature (>= 64cm, < 85cm): 15%
Large mature (>= 85cm): 5%
Mega spawner (>= 93.5cm): 2% (subset of large mature fish)
Spawning Potential Ratio: 1 %

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.

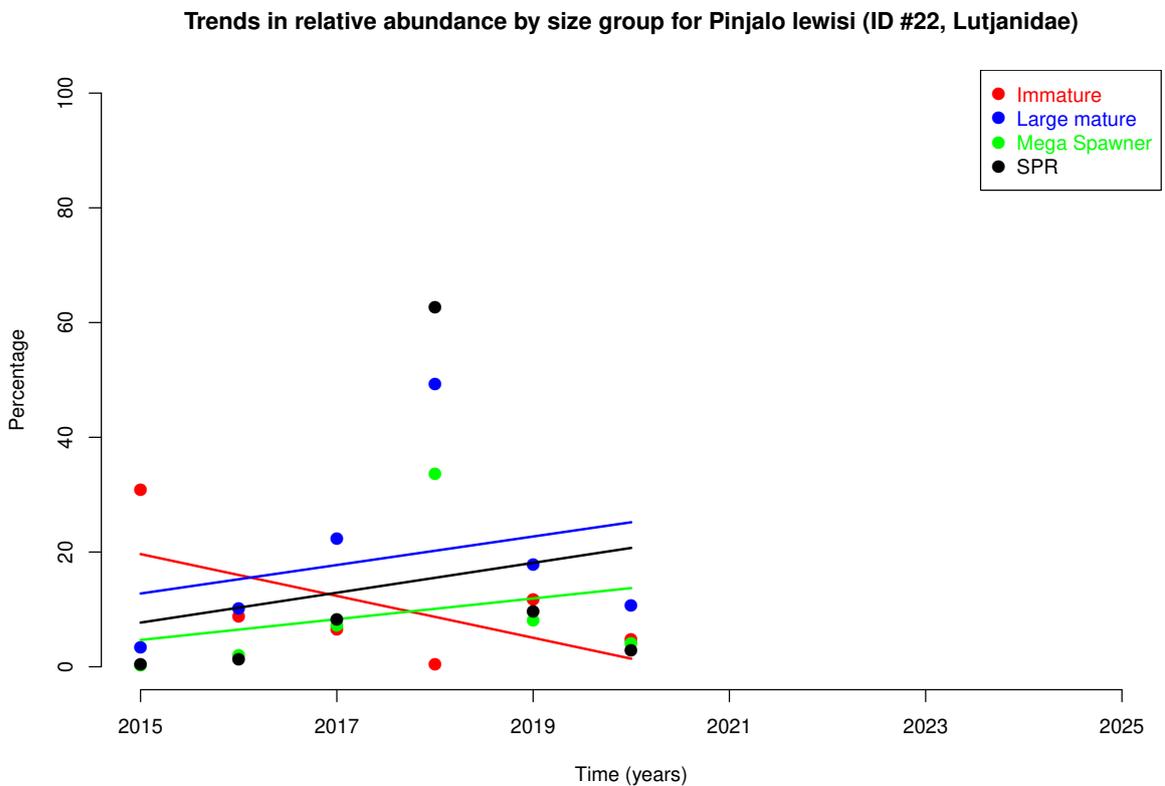
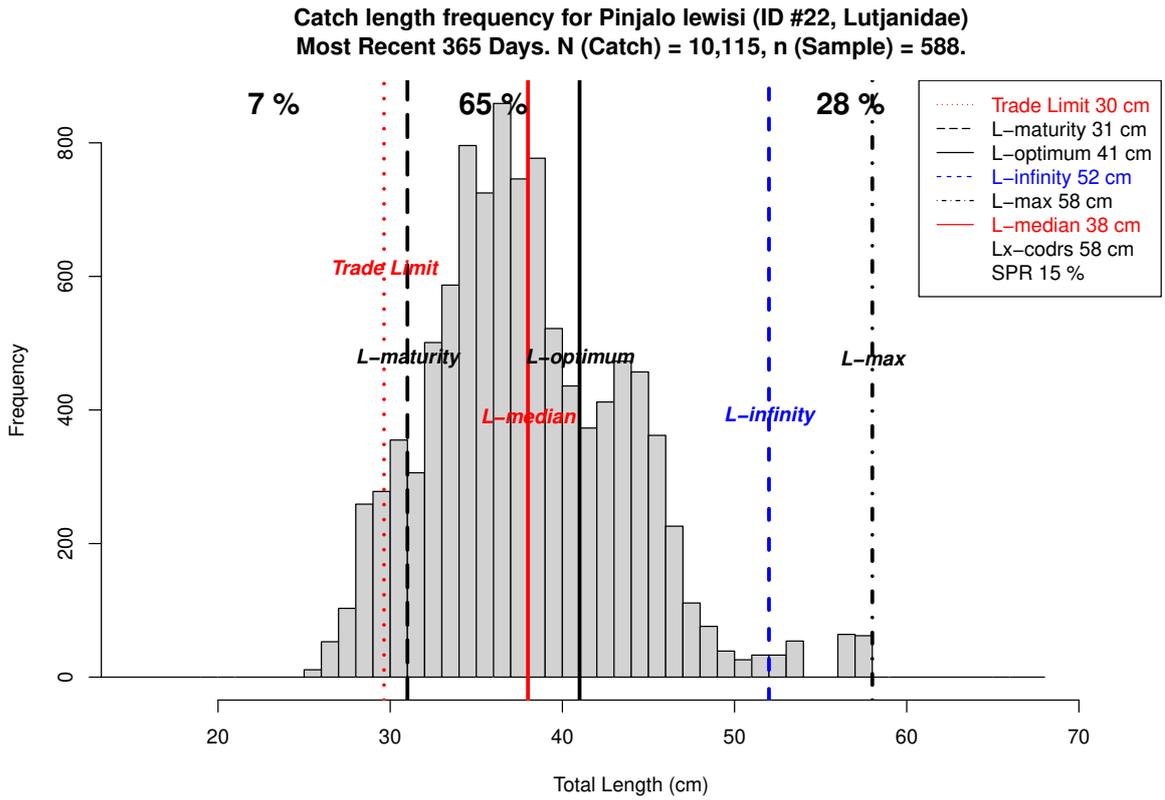
Trends in relative abundance by size group for *Etelis coruscans* (ID #6, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.738

% Large Mature rising over recent years, situation improving. P: 0.104

% Mega Spawner rising over recent years, situation improving. P: 0.371

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



The percentages of Pinjalo lewisi (ID #22, Lutjanidae) in most recent 365 days.

N (Catch) =10,115, n (Sample) = 588

Immature (< 31cm): 7%

Small mature (>= 31cm, < 41cm): 65%

Large mature (>= 41cm): 28%

Mega spawner (>= 45.1cm): 11% (subset of large mature fish)

Spawning Potential Ratio: 15 %

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 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.

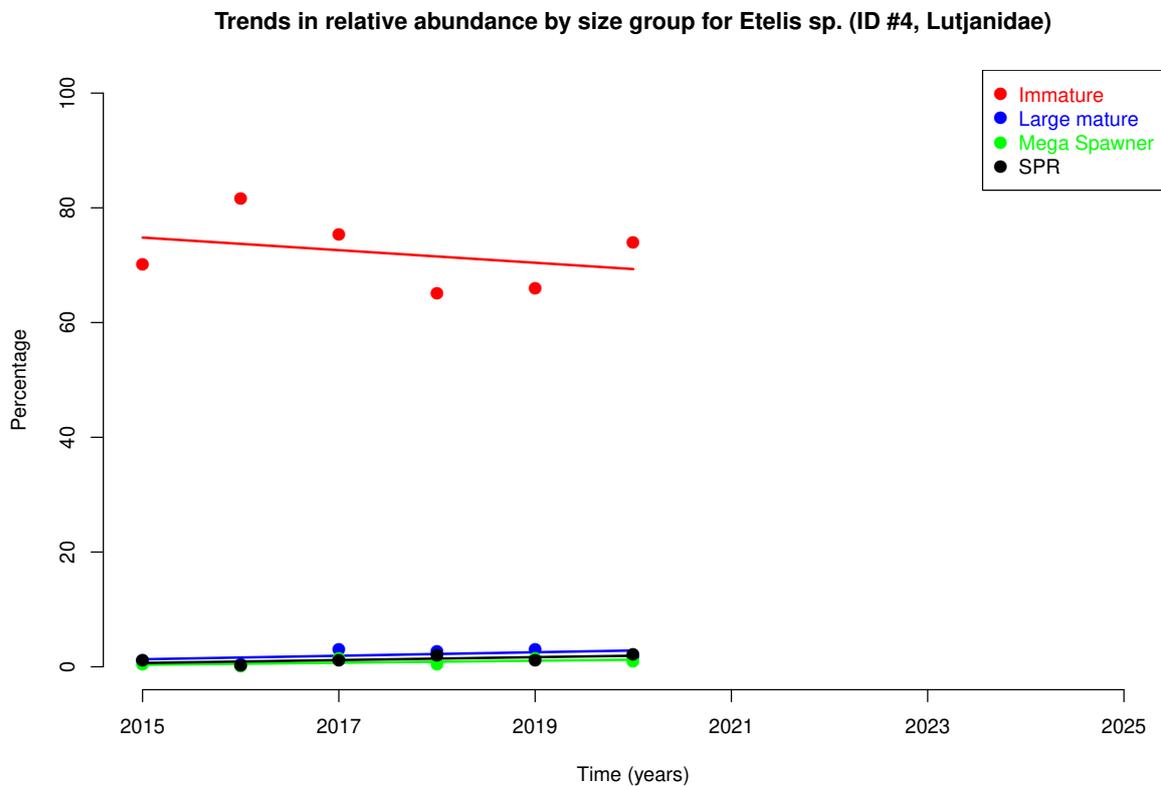
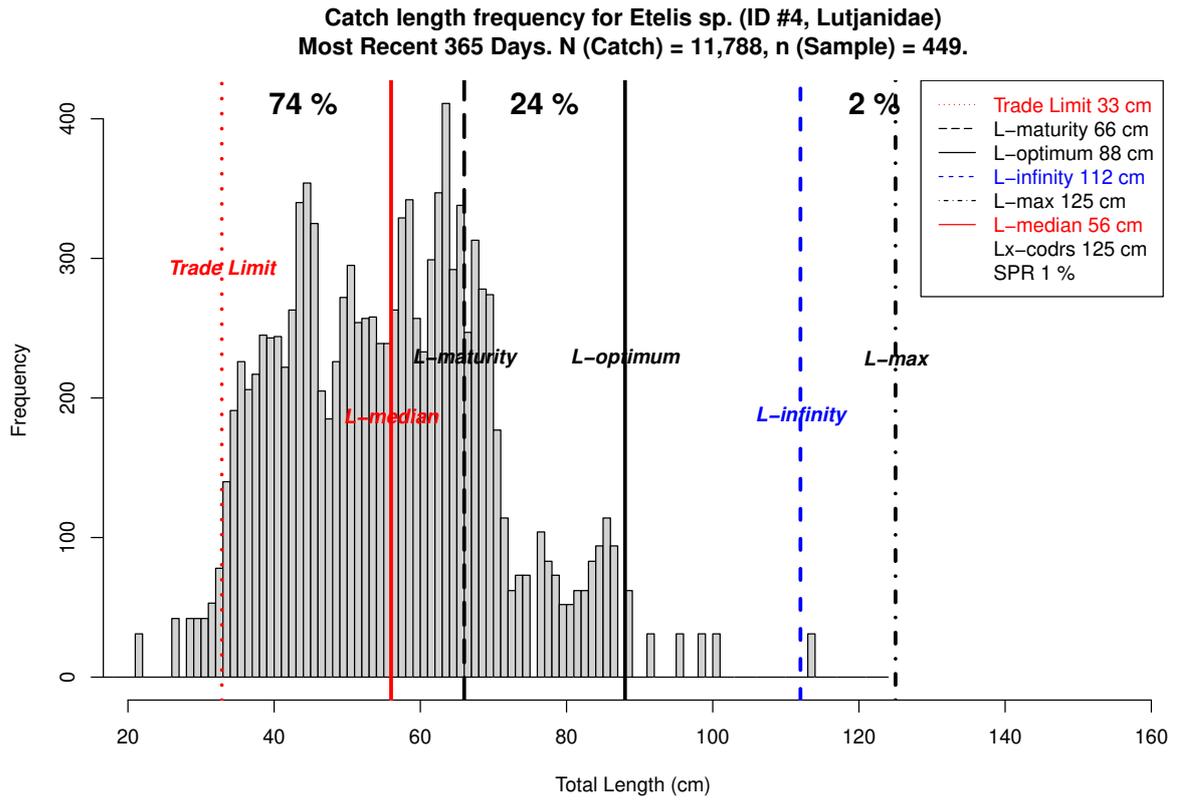
Trends in relative abundance by size group for Pinjalo lewisi (ID #22, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.171

% Large Mature rising over recent years, situation improving. P: 0.582

% Mega Spawner rising over recent years, situation improving. P: 0.598

% SPR rising over recent years, situation improving. P: 0.700



The percentages of *Etelis* sp. (ID #4, Lutjanidae) in most recent 365 days.

N (Catch) = 11,788, n (Sample) = 449

Immature (< 66cm): 74%

Small mature (>= 66cm, < 88cm): 24%

Large mature (>= 88cm): 2%

Mega spawner (>= 96.8cm): 1% (subset of large mature fish)

Spawning Potential Ratio: 1 %

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.

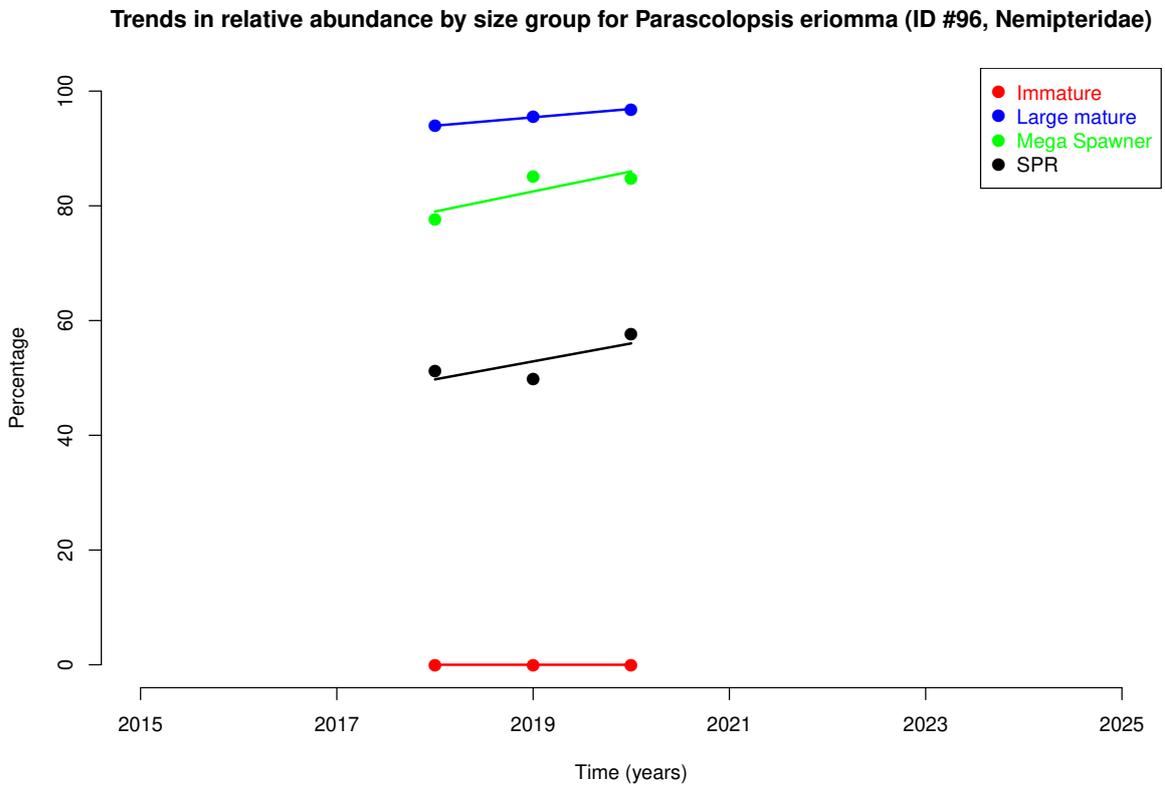
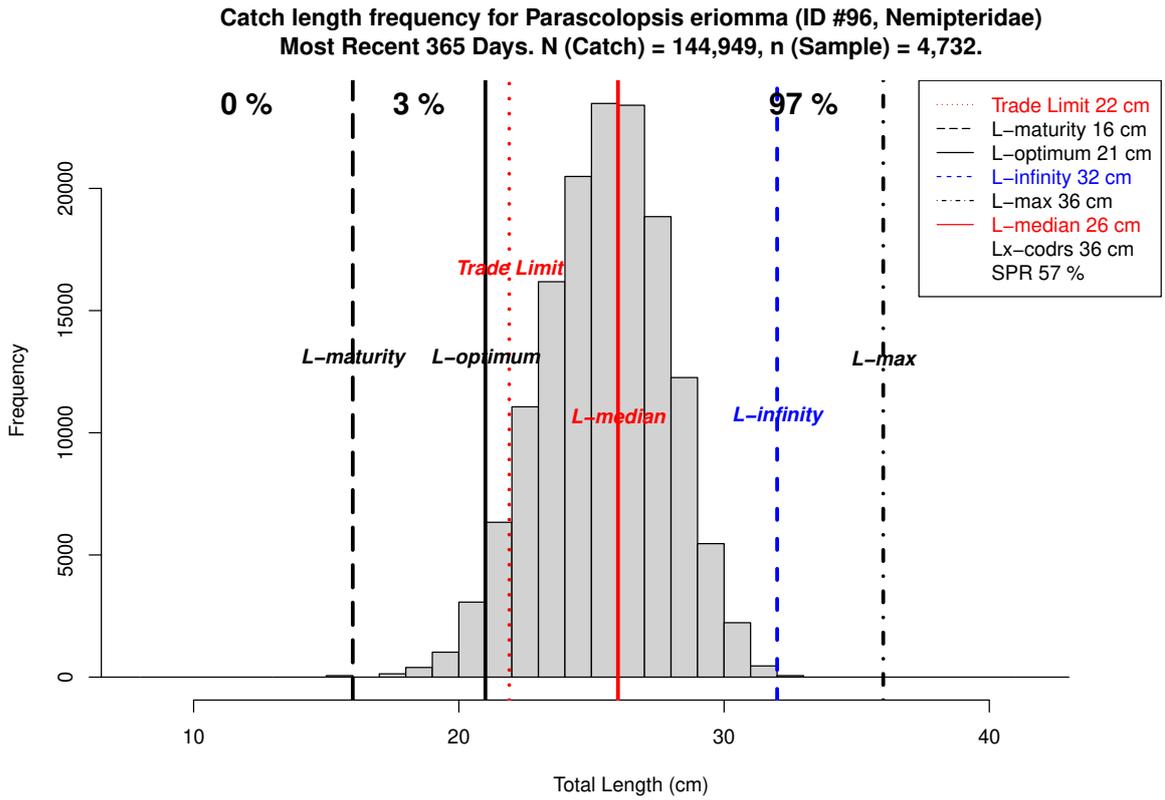
Trends in relative abundance by size group for *Etelis* sp. (ID #4, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.527

% Large Mature rising over recent years, situation improving. P: 0.268

% Mega Spawner rising over recent years, situation improving. P: 0.235

% SPR rising over recent years, situation improving. P: 0.122



The percentages of *Parascolopsis eriomma* (ID #96, Nemipteridae) in most recent 365 days.
N (Catch) =144,949, n (Sample) = 4,732
Immature (< 16cm): 0%
Small mature (>= 16cm, < 21cm): 3%
Large mature (>= 21cm): 97%
Mega spawner (>= 23.1cm): 85% (subset of large mature fish)
Spawning Potential Ratio: 57 %

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.

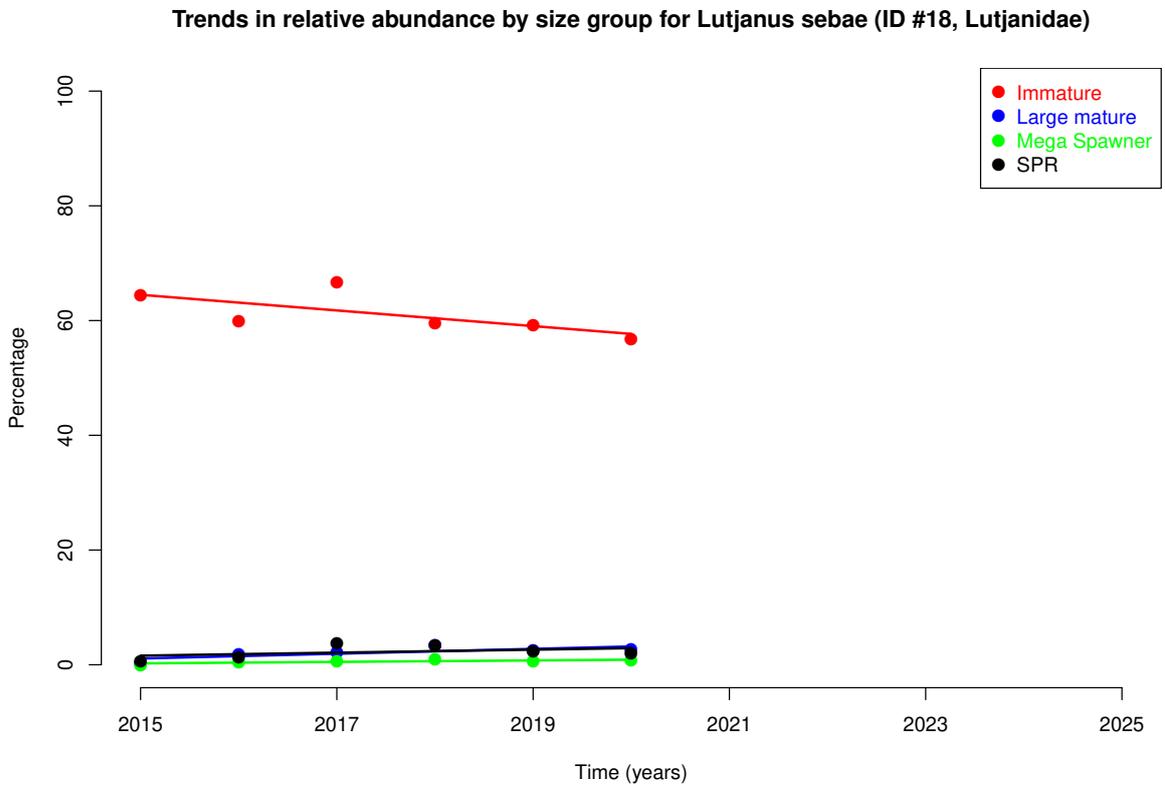
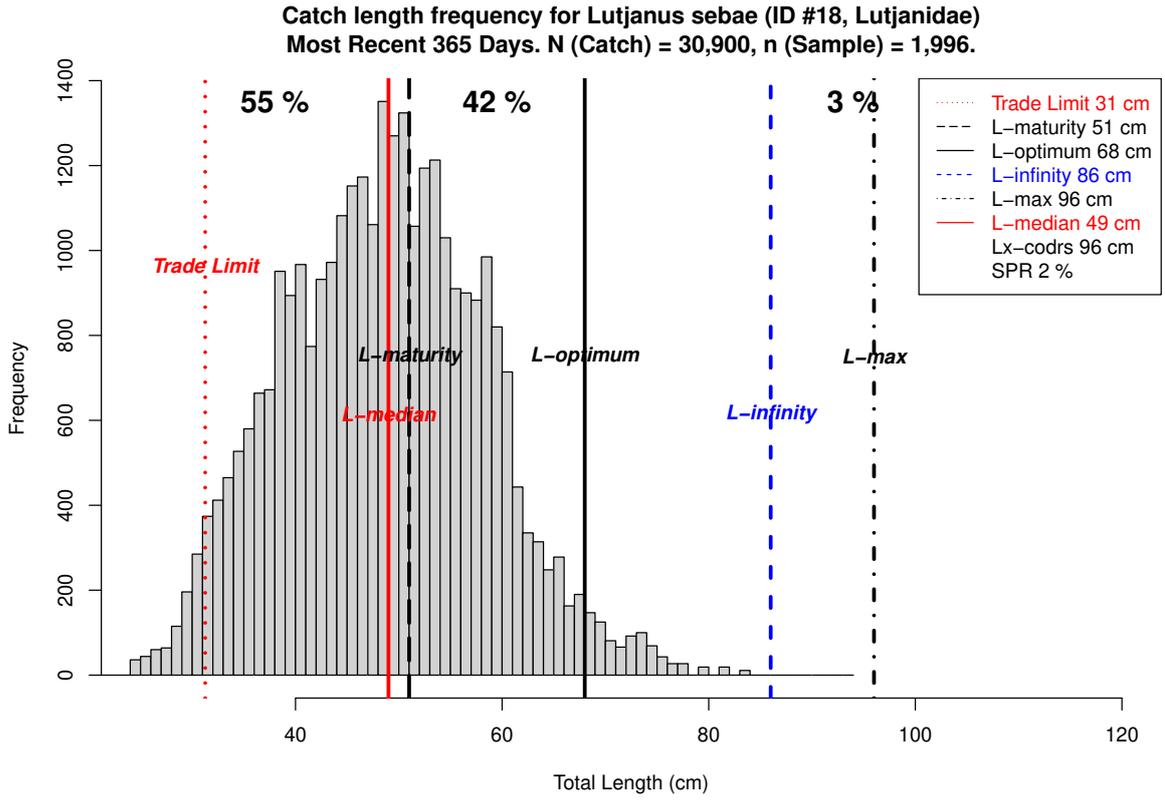
At least 90% of the fish in the catch are mature specimens that have spawned at least once before they were caught. The fishery does not depend on immature size classes for this species and is considered safe for this indicator. This fishery will not be causing overfishing through over harvesting of 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 *Parascolopsis eriomma* (ID #96, Nemipteridae), 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: 0.048
% Mega Spawner rising over recent years, situation improving. P: 0.367
% SPR rising over recent years, situation improving. P: 0.448



The percentages of *Lutjanus sebae* (ID #18, Lutjanidae) in most recent 365 days.
N (Catch) =30,900, n (Sample) = 1,996
Immature (< 51cm): 55%
Small mature (>= 51cm, < 68cm): 42%
Large mature (>= 68cm): 3%
Mega spawner (>= 74.8cm): 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.

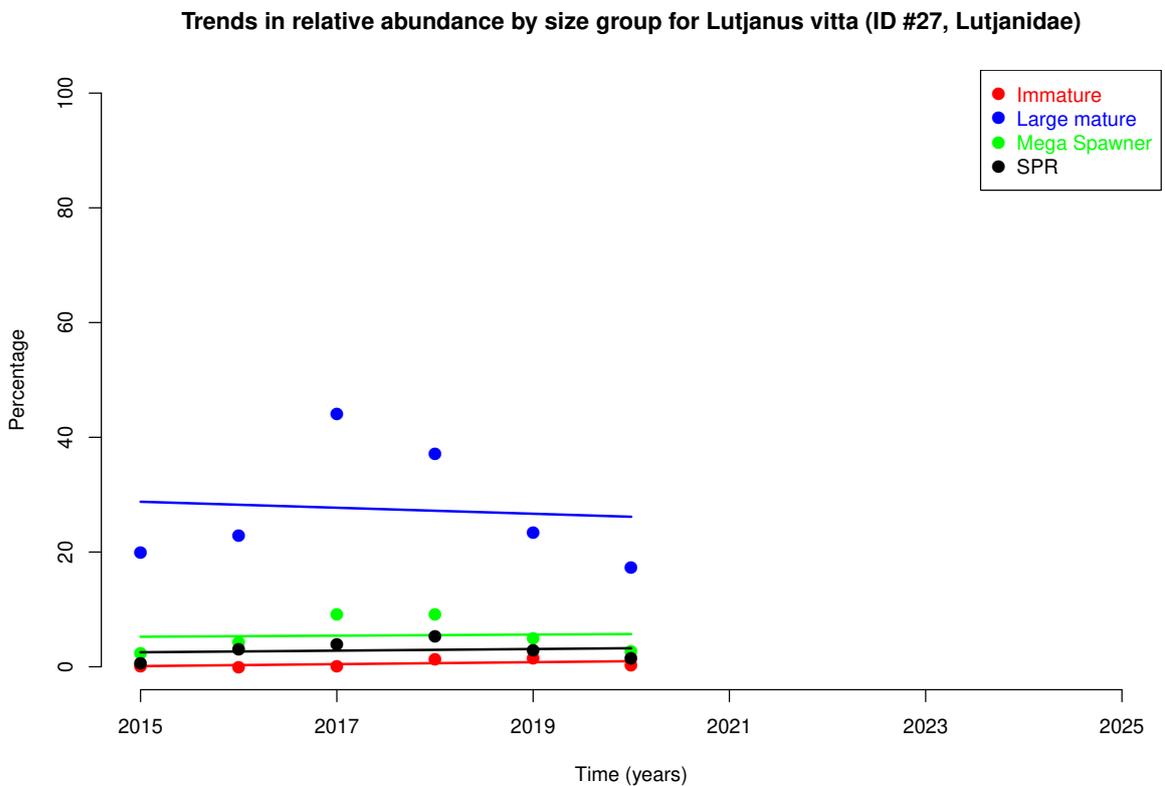
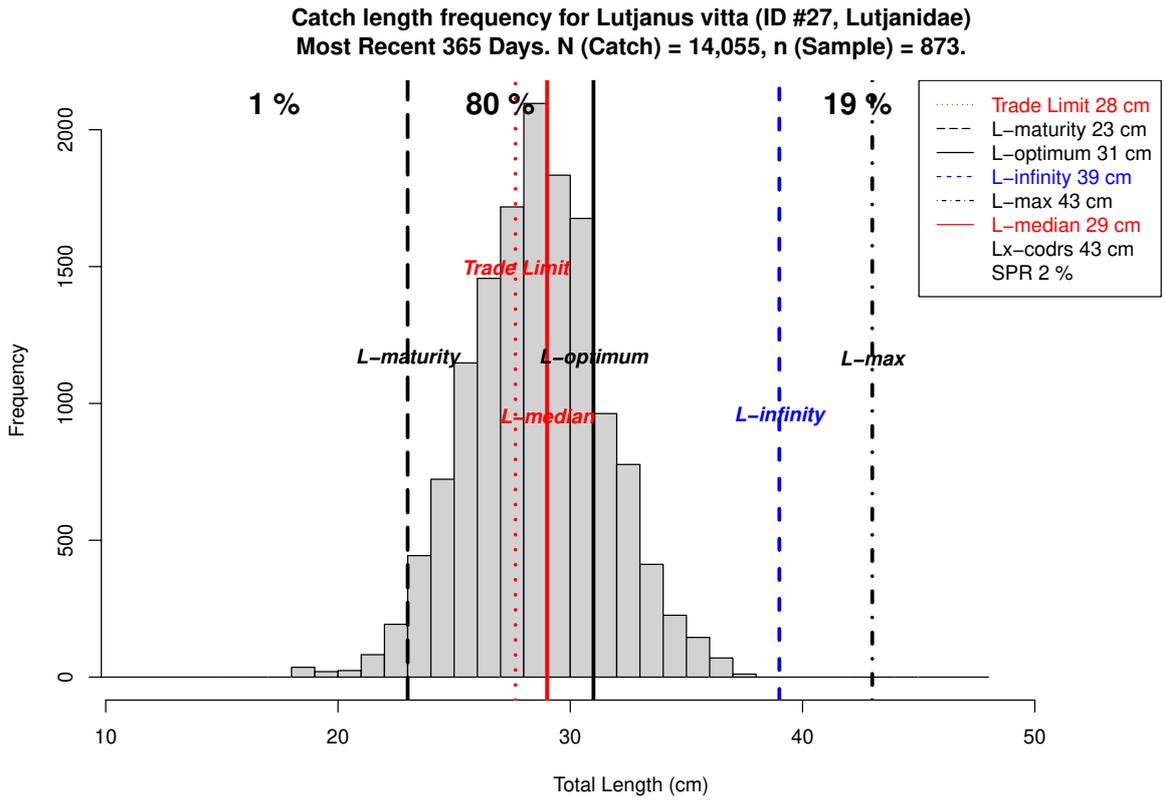
Trends in relative abundance by size group for *Lutjanus sebae* (ID #18, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.125

% Large Mature rising over recent years, situation improving. P: 0.076

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

% SPR rising over recent years, situation improving. P: 0.404



The percentages of *Lutjanus vitta* (ID #27, Lutjanidae) in most recent 365 days.
N (Catch) =14,055, n (Sample) = 873
Immature (< 23cm): 1%
Small mature (>= 23cm, < 31cm): 80%
Large mature (>= 31cm): 19%
Mega spawner (>= 34.1cm): 3% (subset of large mature fish)
Spawning Potential Ratio: 2 %

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.

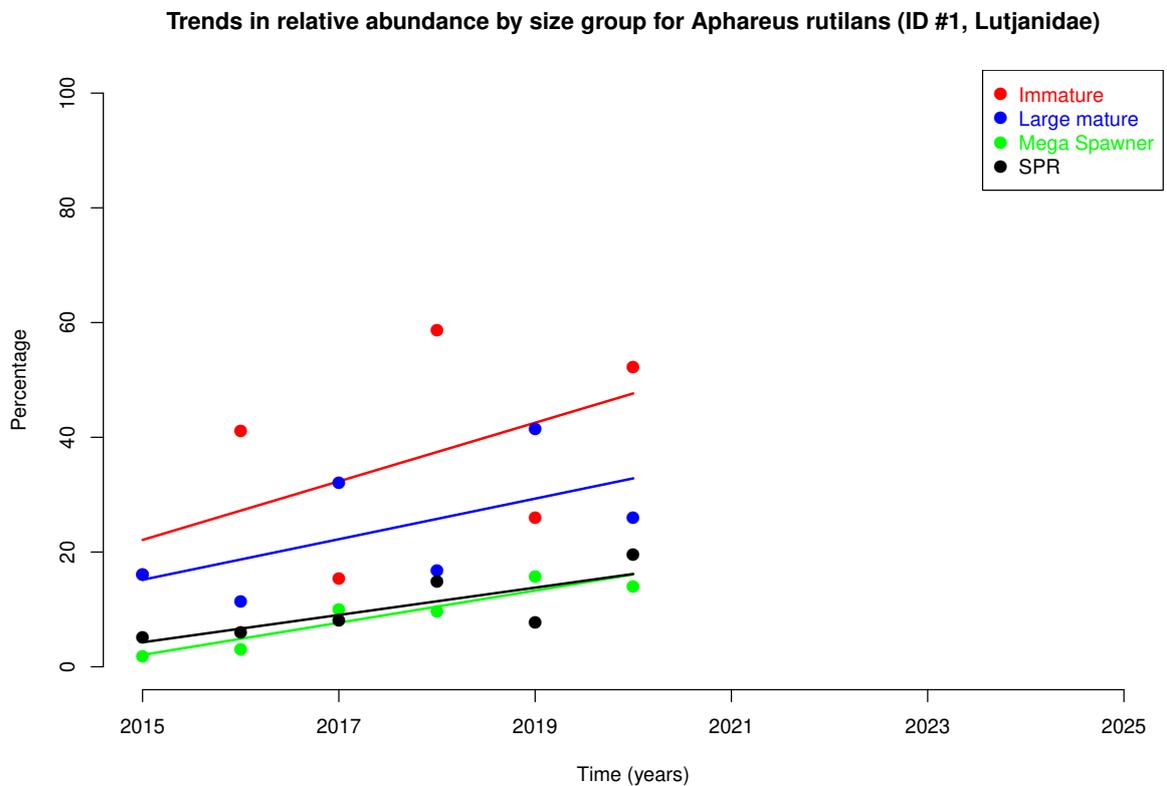
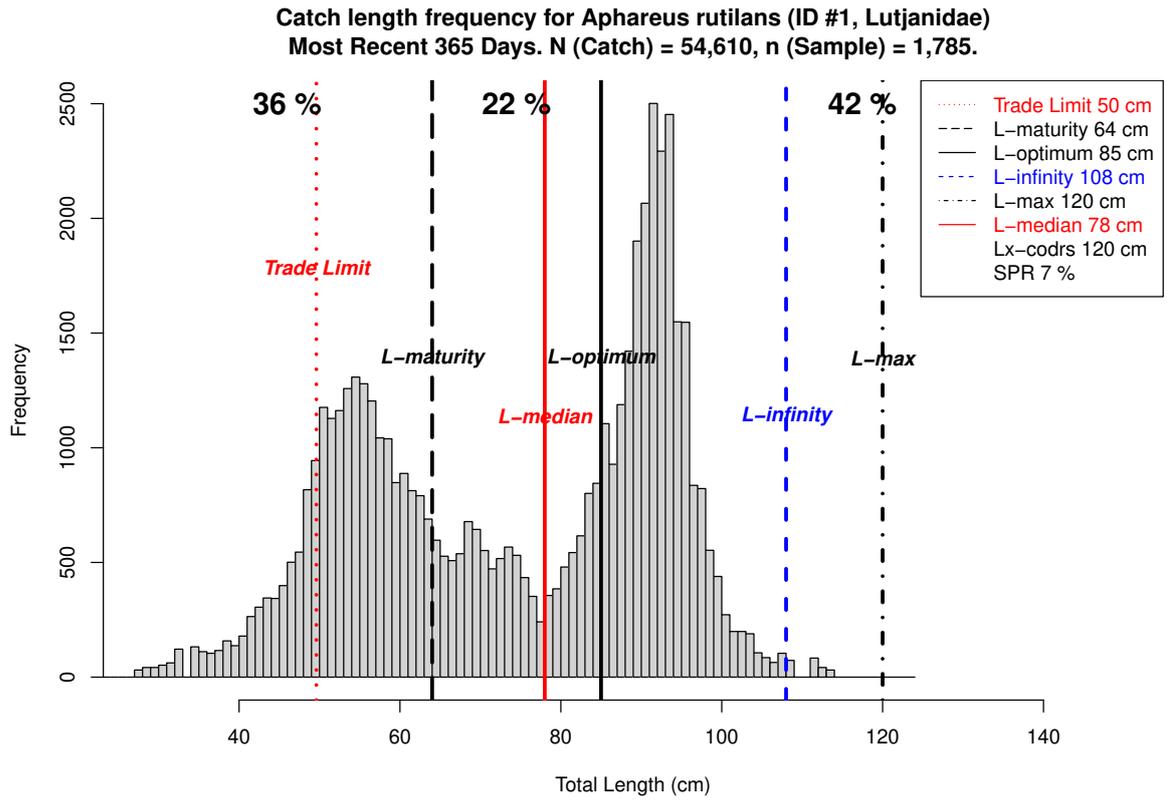
Trends in relative abundance by size group for *Lutjanus vitta* (ID #27, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

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

% Large Mature falling over recent years, situation deteriorating. P: 0.863

% Mega Spawner no trend over recent years, situation stable. P: 0.914

% SPR rising over recent years, situation improving. P: 0.769



The percentages of *Aphareus rutilans* (ID #1, Lutjanidae) in most recent 365 days.
N (Catch) =54,610, n (Sample) = 1,785
Immature (< 64cm): 36%
Small mature (>= 64cm, < 85cm): 22%
Large mature (>= 85cm): 42%
Mega spawner (>= 93.5cm): 18% (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 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 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 *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.

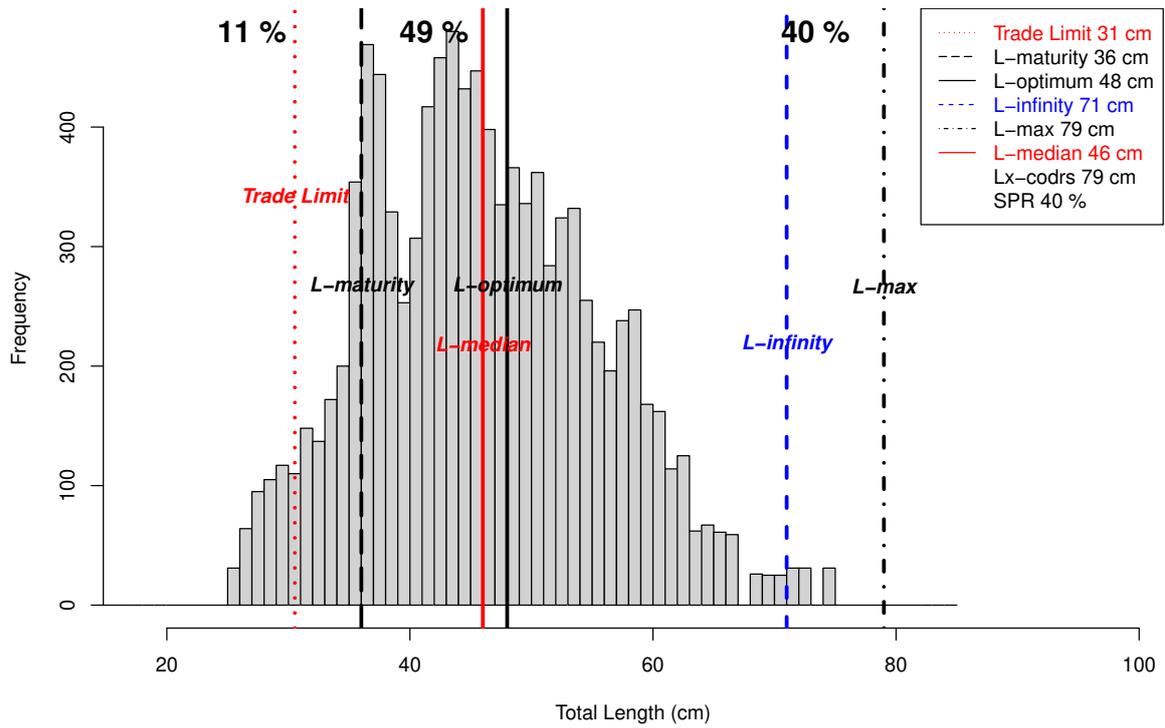
% Immature rising over recent years, situation deteriorating. P: 0.295

% Large Mature rising over recent years, situation improving. P: 0.224

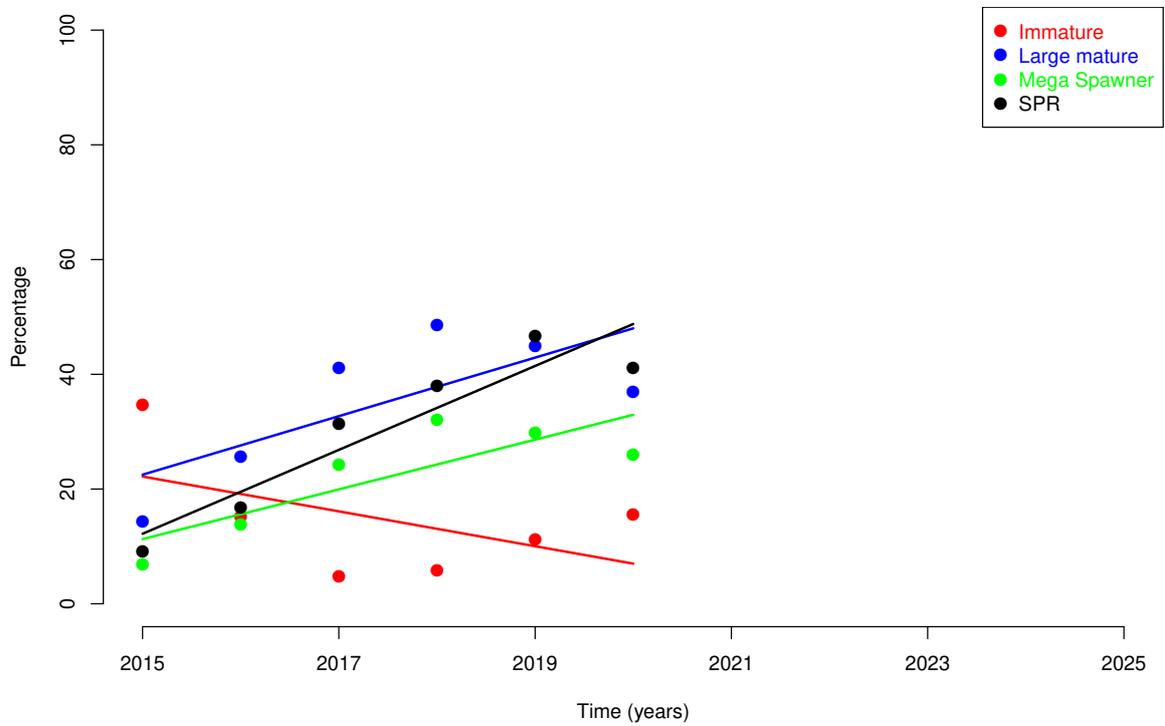
% Mega Spawner rising over recent years, situation improving. P: 0.006

% SPR rising over recent years, situation improving. P: 0.065

Catch length frequency for *Gymnocranius grandoculis* (ID #70, Lethrinidae)
 Most Recent 365 Days. N (Catch) = 10,449, n (Sample) = 467.



Trends in relative abundance by size group for *Gymnocranius grandoculis* (ID #70, Lethrinidae)



The percentages of *Gymnocranius grandoculis* (ID #70, Lethrinidae) in most recent 365 days.
N (Catch) =10,449, n (Sample) = 467
Immature (< 36cm): 11%
Small mature (>= 36cm, < 48cm): 49%
Large mature (>= 48cm): 40%
Mega spawner (>= 52.8cm): 27% (subset of large mature fish)
Spawning Potential Ratio: 40 %

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 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.

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.

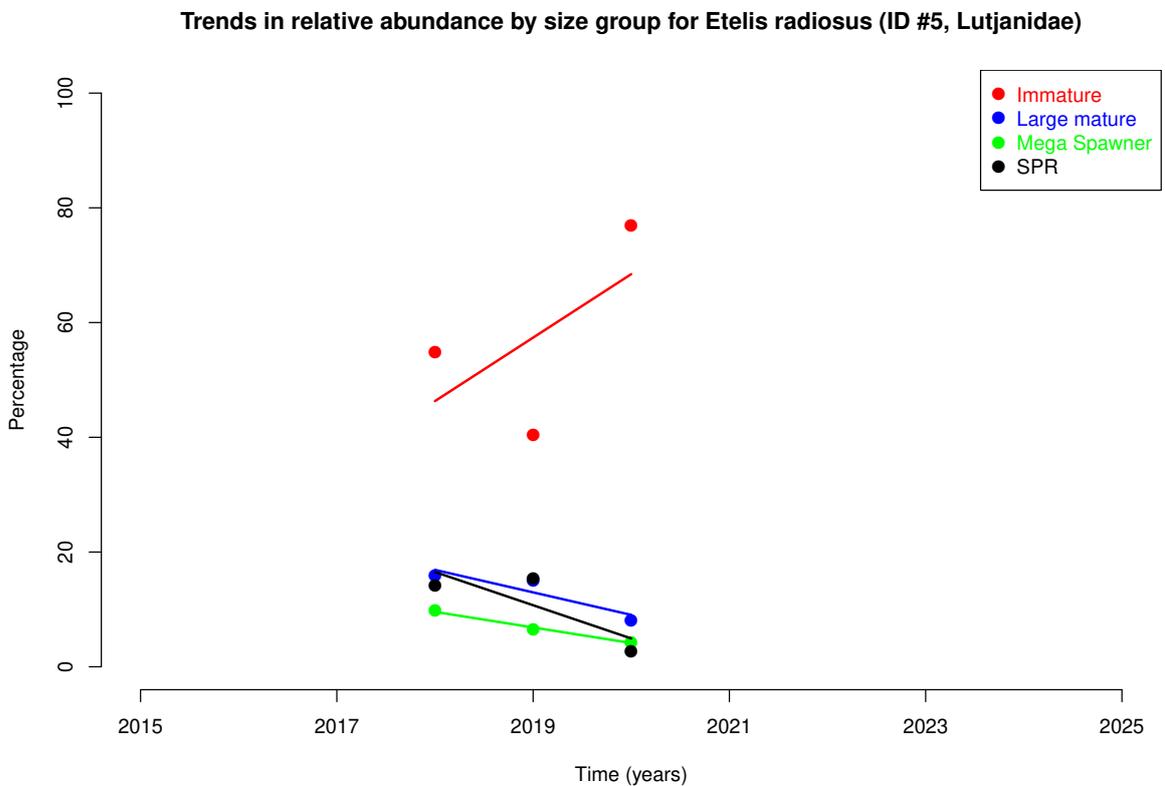
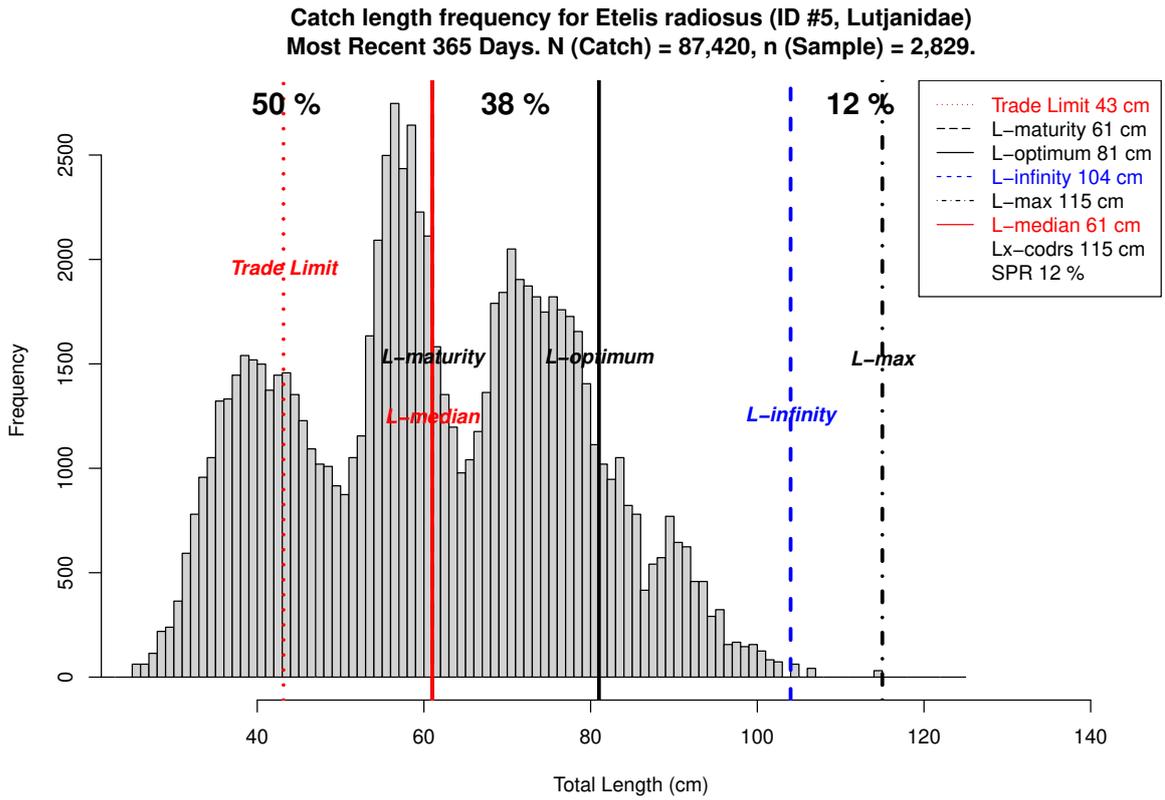
Trends in relative abundance by size group for *Gymnocranius grandoculis* (ID #70, Lethrinidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature falling over recent years, situation improving. P: 0.287

% Large Mature rising over recent years, situation improving. P: 0.094

% Mega Spawner rising over recent years, situation improving. P: 0.042

% SPR rising over recent years, situation improving. P: 0.006



The percentages of *Etelis radiosus* (ID #5, Lutjanidae) in most recent 365 days.

N (Catch) = 87,420, n (Sample) = 2,829

Immature (< 61cm): 50%

Small mature (>= 61cm, < 81cm): 38%

Large mature (>= 81cm): 12%

Mega spawner (>= 89.1cm): 5% (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 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.

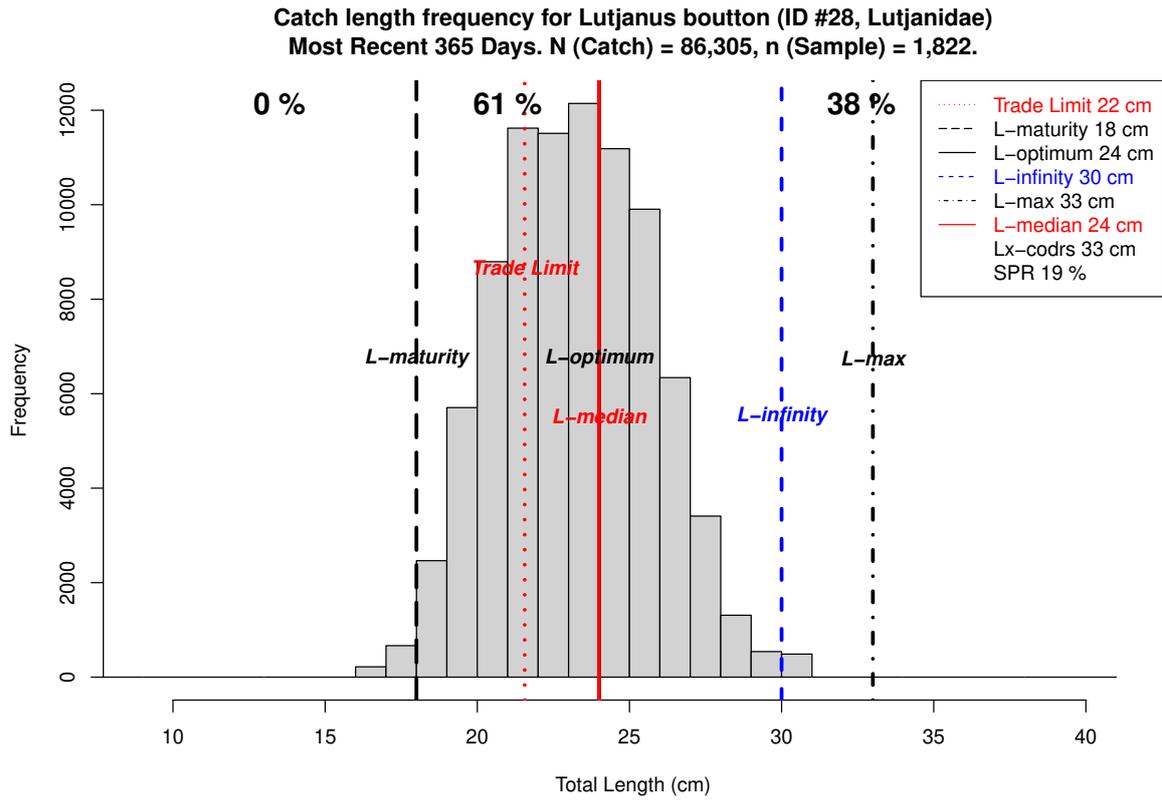
Trends in relative abundance by size group for *Etelis radiosus* (ID #5, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.589

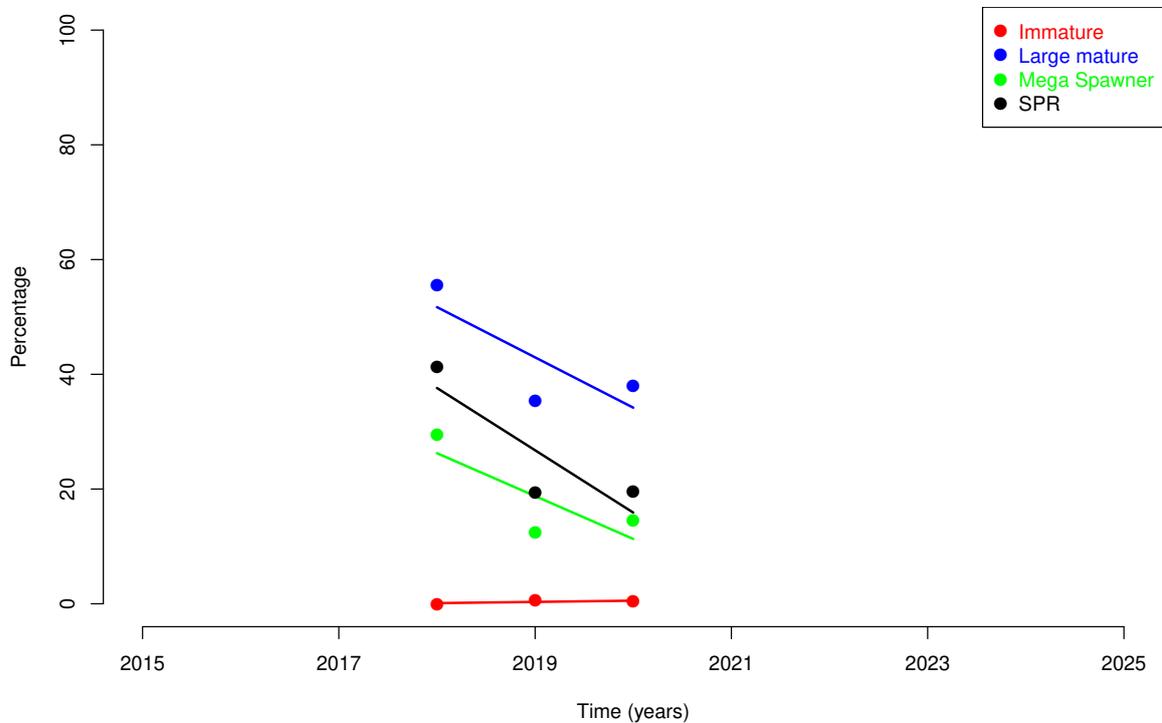
% Large Mature falling over recent years, situation deteriorating. P: 0.272

% Mega Spawner falling over recent years, situation deteriorating. P: 0.070

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



Trends in relative abundance by size group for *Lutjanus boutton* (ID #28, Lutjanidae)



The percentages of *Lutjanus bouton* (ID #28, Lutjanidae) in most recent 365 days.
N (Catch) =86,305, n (Sample) = 1,822
Immature (< 18cm): 0%
Small mature (>= 18cm, < 24cm): 61%
Large mature (>= 24cm): 38%
Mega spawner (>= 26.4cm): 14% (subset of large mature fish)
Spawning Potential Ratio: 19 %

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.

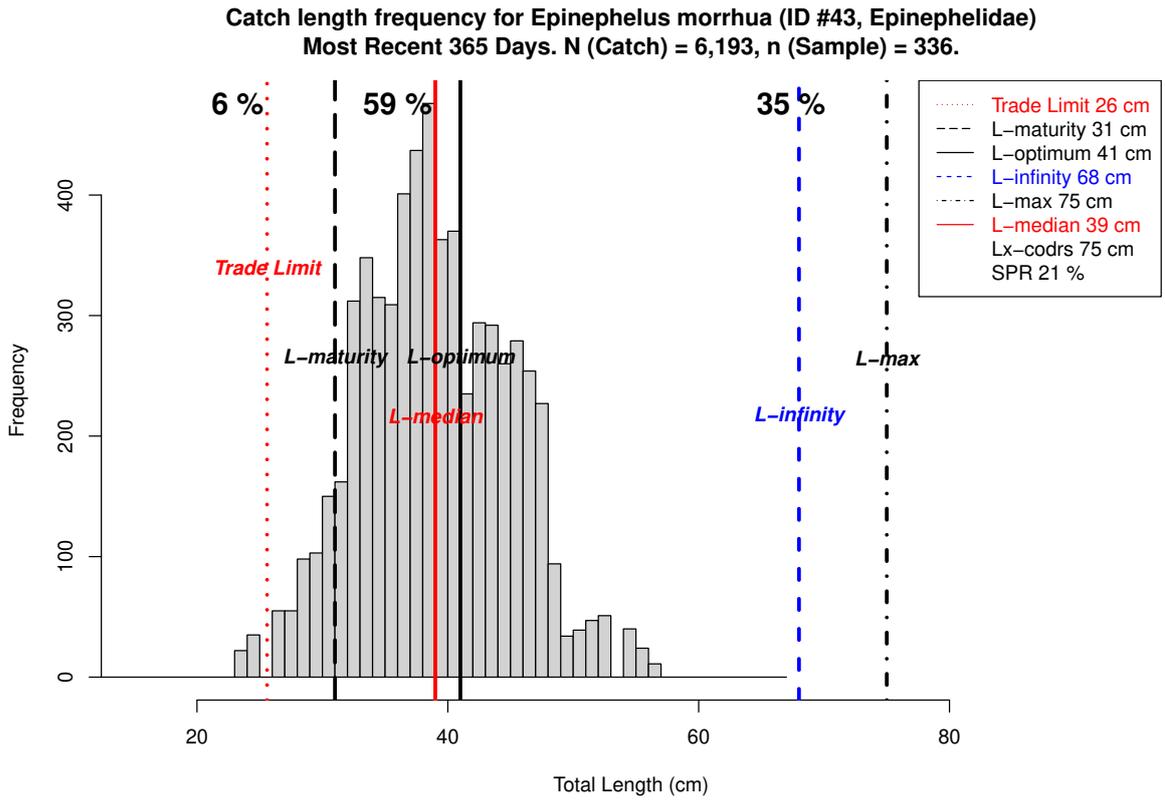
Trends in relative abundance by size group for *Lutjanus bouton* (ID #28, Lutjanidae), as calculated from linear regressions. The P value indicates the chance that this calculated trend is merely a result of stochastic variance.

% Immature rising over recent years, situation deteriorating. P: 0.470

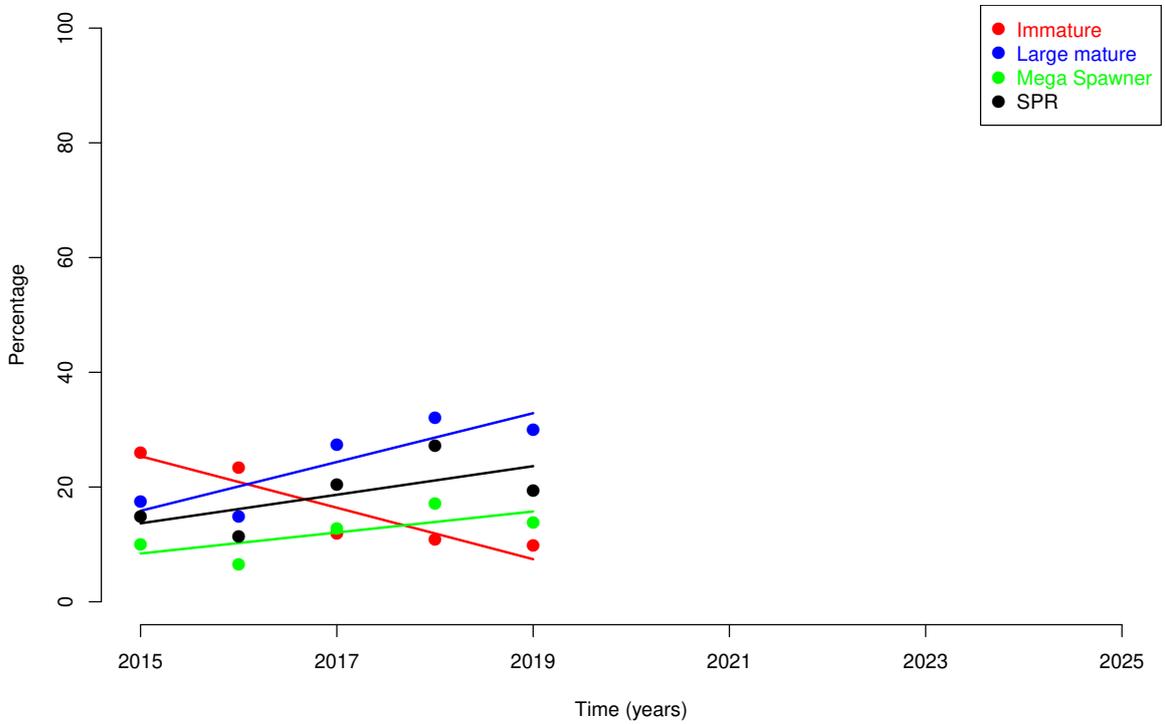
% Large Mature falling over recent years, situation deteriorating. P: 0.411

% Mega Spawner falling over recent years, situation deteriorating. P: 0.407

% SPR falling over recent years, situation deteriorating. P: 0.336



Trends in relative abundance by size group for *Epinephelus morrhua* (ID #43, Epinephelidae)



The percentages of *Epinephelus morrhua* (ID #43, Epinephelidae) in most recent 365 days.

N (Catch) = 6,193, n (Sample) = 336

Immature (< 31cm): 6%

Small mature (\geq 31cm, < 41cm): 59%

Large mature (\geq 41cm): 35%

Mega spawner (\geq 45.1cm): 18% (subset of large mature fish)

Spawning Potential Ratio: 21 %

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 *Epinephelus morrhua* (ID #43, 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: 0.023

% Large Mature rising over recent years, situation improving. P: 0.057

% Mega Spawner rising over recent years, situation improving. P: 0.168

% SPR rising over recent years, situation improving. P: 0.229

Table 4.1: Values of indicators over the most recent 365 days in length-based assessments for the top 50 most abundant species by total CODRS samples in WPP 573.

Rank	#ID	Species	Trade Limit Prop. Lmat	Immature %	Exploitation %	Mega Spawn %	SPR %
1	7	<i>Pristipomoides multidentis</i>	0.73	45	89	3	11
2	8	<i>Pristipomoides typus</i>	0.80	41	91	3	11
3	17	<i>Lutjanus malabaricus</i>	0.66	36	92	3	2
4	45	<i>Epinephelus areolatus</i>	1.31	1	22	64	30
5	10	<i>Pristipomoides sieboldii</i>	0.83	33	99	0	1
6	9	<i>Pristipomoides filamentosus</i>	0.69	77	95	2	2
7	21	<i>Lutjanus erythropterus</i>	0.86	0	12	48	34
8	19	<i>Lutjanus timorensis</i>	0.98	24	92	3	5
9	34	<i>Paracaesio kusakarii</i>	0.77	22	59	21	29
10	6	<i>Etelis coruscans</i>	0.59	80	95	2	1
11	22	<i>Pinjalo lewisi</i>	0.96	7	72	11	15
12	4	<i>Etelis sp.</i>	0.50	74	98	1	1
13	96	<i>Parascolopsis eriomma</i>	1.37	0	3	85	57
14	18	<i>Lutjanus sebae</i>	0.61	55	97	1	2
15	27	<i>Lutjanus vitta</i>	1.20	1	81	3	2
16	1	<i>Aphareus rutilans</i>	0.78	36	58	18	7
17	70	<i>Gymnocranius grandoculis</i>	0.85	11	60	27	40
18	5	<i>Etelis radiosus</i>	0.71	50	88	5	12
19	28	<i>Lutjanus bouton</i>	1.20	0	62	14	19
20	43	<i>Epinephelus morrhua</i>	0.83	6	65	18	21
21	39	<i>Cephalopholis sonnerati</i>	1.03	2	32	48	32
22	88	<i>Glaucosoma buergeri</i>		unknown	unknown	unknown	unknown
23	69	<i>Wattsia mossambica</i>	1.09	24	73	17	27
24	32	<i>Paracaesio gonzalesi</i>	0.86	1	52	23	15
25	33	<i>Paracaesio xanthura</i>	0.98	0	34	36	30
26	84	<i>Seriola rivoliana</i>	1.00	9	33	43	7
27	71	<i>Gymnocranius griseus</i>	1.53	2	49	31	18
28	46	<i>Epinephelus bleekeri</i>	0.85	0	32	35	39
29	41	<i>Epinephelus latifasciatus</i>		unknown	unknown	unknown	unknown
30	35	<i>Paracaesio stonei</i>		unknown	unknown	unknown	unknown
31	20	<i>Lutjanus gibbus</i>	1.07	11	75	16	19
32	63	<i>Lethrinus lentjan</i>	1.05	3	42	39	74
33	52	<i>Epinephelus retouti</i>	1.41	0	10	80	97
35	15	<i>Lutjanus argentimaculatus</i>	0.62	8	50	33	39
36	37	<i>Cephalopholis miniata</i>	1.55	1	21	66	83
37	75	<i>Carangoides chrysophrys</i>	1.17	3	27	61	near 100
38	16	<i>Lutjanus bohar</i>	0.67	30	59	25	78
39	92	<i>Cookeolus japonicus</i>		unknown	unknown	unknown	unknown
40	86	<i>Argyrops spinifer</i>		unknown	unknown	unknown	unknown
41	67	<i>Lethrinus amboinensis</i>	1.00	5	45	40	55
43	14	<i>Lutjanus bitaeniatus</i>		unknown	unknown	unknown	unknown
44	85	<i>Erythrocles schlegelii</i>	1.31	22	62	30	near 100
46	81	<i>Caranx tille</i>	1.30	13	81	19	11
47	62	<i>Variola albimarginata</i>	1.45	2	21	66	77
49	58	<i>Epinephelus amblycephalus</i>		unknown	unknown	unknown	unknown
50	89	<i>Diagramma labiosum</i>		unknown	unknown	unknown	unknown

Table 4.2: Risk levels in the fisheries over the most recent 365 days
 for the top 50 most abundant species by total CODRS samples in WPP 573.

Rank	#ID	Species	Trade Limit	Immature	Exploitation	Mega Spawn	SPR
1	7	Pristipomoides multidens	high	high	high	high	high
2	8	Pristipomoides typus	high	high	high	high	high
3	17	Lutjanus malabaricus	high	high	high	high	high
4	45	Epinephelus areolatus	low	low	low	low	medium
5	10	Pristipomoides sieboldii	high	high	high	high	high
6	9	Pristipomoides filamentosus	high	high	high	high	high
7	21	Lutjanus erythropterus	high	low	low	low	medium
8	19	Lutjanus timorensis	medium	medium	high	high	high
9	34	Paracaesio kusakarii	high	medium	medium	medium	medium
10	6	Etelis coruscans	high	high	high	high	high
11	22	Pinjalo lewisi	medium	low	high	high	high
12	4	Etelis sp.	high	high	high	high	high
13	96	Parascloopsis eriomma	low	low	low	low	low
14	18	Lutjanus sebae	high	high	high	high	high
15	27	Lutjanus vitta	low	low	high	high	high
16	1	Aphareus rutilans	high	high	medium	high	high
17	70	Gymnocranius grandoculis	high	medium	medium	medium	medium
18	5	Etelis radius	high	high	high	high	high
19	28	Lutjanus bouton	low	low	medium	high	high
20	43	Epinephelus morrhua	high	low	medium	high	high
21	39	Cephalopholis sonnerati	medium	low	low	low	medium
22	88	Glucosoma buergeri	unknown	unknown	unknown	unknown	unknown
23	69	Wattsia mossambica	medium	medium	high	high	medium
24	32	Paracaesio gonzalesi	high	low	medium	medium	high
25	33	Paracaesio xanthura	medium	low	low	low	medium
26	84	Seriola rivoliana	medium	low	low	low	high
27	71	Gymnocranius griseus	low	low	low	low	high
28	46	Epinephelus bleekeri	high	low	low	low	medium
29	41	Epinephelus latifasciatus	unknown	unknown	unknown	unknown	unknown
30	35	Paracaesio stonoi	unknown	unknown	unknown	unknown	unknown
31	20	Lutjanus gibbus	medium	medium	high	high	high
32	63	Lethrinus lentjan	medium	low	low	low	low
33	52	Epinephelus retouti	low	low	low	low	low
35	15	Lutjanus argentimaculatus	high	low	medium	low	medium
36	37	Cephalopholis miniata	low	low	low	low	low
37	75	Carangoides chrysophrys	low	low	low	low	low
38	16	Lutjanus bohar	high	medium	medium	medium	low
39	92	Cookeolus japonicus	unknown	unknown	unknown	unknown	unknown
40	86	Argyrops spinifer	unknown	unknown	unknown	unknown	unknown
41	67	Lethrinus amboinensis	medium	low	low	low	low
43	14	Lutjanus bitaeniatus	unknown	unknown	unknown	unknown	unknown
44	85	Erythrocles schlegelii	low	medium	medium	low	low
46	81	Caranx tille	low	medium	high	high	high
47	62	Variola albimarginata	low	low	low	low	low
49	58	Epinephelus amblycephalus	unknown	unknown	unknown	unknown	unknown
50	89	Diagramma labiosum	unknown	unknown	unknown	unknown	unknown

Table 4.3: Trends during recent years for SPR and relative abundance by size group for the top 50 most abundant species by total CODRS samples in WPP 573.

Rank	#ID	Species	% Immature	% Large Mature	% Mega Spawner	% SPR
1	7	Pristipomoides multidens	improving	improving	improving	improving
2	8	Pristipomoides typus	deteriorating	deteriorating	stable	improving
3	17	Lutjanus malabaricus	deteriorating	improving	improving	improving
4	45	Epinephelus areolatus	deteriorating	deteriorating	deteriorating	deteriorating
5	10	Pristipomoides sieboldii	deteriorating	improving	stable	improving
6	9	Pristipomoides filamentosus	deteriorating	improving	improving	stable
7	21	Lutjanus erythropterus	stable	improving	improving	improving
8	19	Lutjanus timorensis	deteriorating	deteriorating	deteriorating	improving
9	34	Paracaesio kusakarii	improving	improving	improving	improving
10	6	Etelis coruscans	improving	improving	improving	improving
11	22	Pinjalo lewisi	improving	improving	improving	improving
12	4	Etelis sp.	improving	improving	improving	improving
13	96	Parascloopsis eriomma	stable	improving	improving	improving
14	18	Lutjanus sebae	improving	improving	improving	improving
15	27	Lutjanus vitta	deteriorating	deteriorating	stable	improving
16	1	Aphareus rutilans	deteriorating	improving	improving	improving
17	70	Gymnocranius grandoculus	improving	improving	improving	improving
18	5	Etelis radiusus	deteriorating	deteriorating	deteriorating	deteriorating
19	28	Lutjanus boutton	deteriorating	deteriorating	deteriorating	deteriorating
20	43	Epinephelus morrhua	improving	improving	improving	improving
21	39	Cephalopholis sonnerati	improving	improving	improving	improving
22	88	Glaucosoma buergeri	improving	improving	improving	improving
23	69	Wattsia mossambica	deteriorating	deteriorating	deteriorating	deteriorating
24	32	Paracaesio gonzalesi	deteriorating	improving	improving	improving
25	33	Paracaesio xanthura	stable	improving	improving	improving
26	84	Seriola rivoliana	deteriorating	improving	improving	deteriorating
27	71	Gymnocranius griseus	deteriorating	deteriorating	deteriorating	deteriorating
28	46	Epinephelus bleekeri	improving	deteriorating	deteriorating	deteriorating
29	41	Epinephelus latifasciatus	improving	deteriorating	deteriorating	deteriorating
30	35	Paracaesio stonei	improving	improving	improving	deteriorating
31	20	Lutjanus gibbus	unknown	unknown	unknown	unknown
32	63	Lethrinus lentjan	deteriorating	deteriorating	deteriorating	improving
33	52	Epinephelus retouti	improving	improving	improving	improving
35	15	Lutjanus argentimaculatus	improving	improving	improving	improving
36	37	Cephalopholis miniata	unknown	unknown	unknown	unknown
37	75	Carangoides chrysophrys	deteriorating	deteriorating	deteriorating	stable
38	16	Lutjanus bohar	unknown	unknown	unknown	unknown
39	92	Cookeolus japonicus	unknown	unknown	unknown	unknown
40	86	Argyrops spinifer	unknown	unknown	unknown	unknown
41	67	Lethrinus amboinensis	unknown	unknown	unknown	unknown
43	14	Lutjanus bitaeniatus	unknown	unknown	unknown	unknown
44	85	Erythrocles schlegelii	unknown	unknown	unknown	unknown
46	81	Caranx tille	unknown	unknown	unknown	unknown
47	62	Variola albimarginata	unknown	unknown	unknown	unknown
49	58	Epinephelus amblycephalus	unknown	unknown	unknown	unknown
50	89	Diagramma labiosum	unknown	unknown	unknown	unknown

5 Discussion and conclusions

The deep water drop line fishery for snappers, groupers and emperors in WPP 573 is a fairly “clean” fishery when it comes to the species spectrum in the catch (Table 5.7 and 5.8), 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. Other deep demersal gear types like traps and gillnets are not very common in WPP 573 but may also include various by-catch 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. Nowhere 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 hook and line fisheries.

Risk of overfishing is high for all the larger snappers which are common on deep slopes in Eastern Indonesia (Table 4.1 and Table 4.2), and SPR is dangerously low (Table 5.1) 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, bottom long line and other 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 among all major target snapper species seems to be unacceptably high while the catches of these species include large percentages of relatively small and even immature specimen. For several species of snappers, sizes are consistently targeted and landed well below the size where these fish reach maturity and many species are harvested well below the optimum size. Bigger specimen of the largest snapper species are already becoming extremely rare in our region.

Most of the top 10 snapper species (except *Lutjanus erythropterus*) in the deep demersal fisheries in WPP 573 are considered at high risk of overfishing, based on length based indicators. This pattern is consistent over a range of indicators used in our assessment. Fishing effort and fishing mortality in this fisheries management areas have been too high in recent years and probably for decades already. Time trends for size based indicators (Table 4.3), however, show improvement for many of the target species in WPP 573, notably so also across all indicators for the highly important *Pristipomoides multidens* and *Pristipomoides typus* catches in this WPP.

Stocks of *Pristipomoides multidens*, *Pristipomoides typus* and many other species are showing improvement across all length based parameters when combining data from all gear types in WPP 573. Trends in length based indicators can also be compared with trends in CpUE by gear types and boat size category (Tables 5.2 to 5.6), and especially for *P. multidens* the trends in CpUE seem to confirm the trends observed in size based indicators. While various factors may have contributed to the gradual improvement in status of many of the stocks in WPP 573, it should be noted that the fisheries here

concentrates in the Timor Sea, closely along the boundary which separates Indonesian from Australian fishing grounds. Fishing effort in Australian waters has been drastically limited in recent years, and stock recovery on Northern Australian fishing grounds may well be “spilling over” to the Indonesian side.

Overall we are currently looking mainly at a high risk of overfishing for all major snapper species, combined with a trend of improvement in these snapper stocks in WPP 573. 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 up 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 grouper species 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 straight forward 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 straightforward 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 (such as some of the *Paracaesio* species) 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 of various species 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 demersal fisheries, judging from a number of indicators as presented in this report.

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 currently heading and what the effects are of any fisheries management measures in future years.

Government policies and regulations are needed and 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 and by fishing ground.

Recommendations for specific regulations may include:

- Make mandatory correct display of scientific name (correct labeling) of all traded fish (besides market name).
- 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: SPR values over the period 2016 to 2024 for the top 20 most abundant species in CODRS samples in WPP 573, based on total catch LFD analysis, for all gear types combined and adjusted for relative effort by gear type.

Rank	Species	2016	2017	2018	2019	2020	2021	2022	2023	2024
1	<i>Pristipomoides multidentis</i>	9	15	22	14	12	NA	NA	NA	NA
2	<i>Pristipomoides typus</i>	6	9	9	11	8	NA	NA	NA	NA
3	<i>Lutjanus malabaricus</i>	2	1	3	3	2	NA	NA	NA	NA
4	<i>Epinephelus areolatus</i>	31	39	33	30	29	NA	NA	NA	NA
5	<i>Pristipomoides sieboldii</i>	0	1	1	1	1	NA	NA	NA	NA
6	<i>Pristipomoides filamentosus</i>	3	4	2	4	1	NA	NA	NA	NA
7	<i>Lutjanus erythropterus</i>	34	39	36	34	34	NA	NA	NA	NA
8	<i>Lutjanus timorensis</i>	9	8	8	5	7	NA	NA	NA	NA
9	<i>Paracaesio kusakarii</i>	3	13	5	33	19	NA	NA	NA	NA
10	<i>Etelis coruscans</i>	0	0	1	3	0	NA	NA	NA	NA
11	<i>Pinjalo lewisi</i>	1	8	63	10	3	NA	NA	NA	NA
12	<i>Etelis sp.</i>	0	1	2	1	2	NA	NA	NA	NA
13	<i>Parascolopsis eriomma</i>	NA	NA	51	50	58	NA	NA	NA	NA
14	<i>Lutjanus sebae</i>	1	4	3	2	2	NA	NA	NA	NA
15	<i>Lutjanus vitta</i>	3	4	5	3	1	NA	NA	NA	NA
16	<i>Aphareus rutilans</i>	6	8	15	8	20	NA	NA	NA	NA
17	<i>Gymnocranius grandoculis</i>	17	31	38	47	41	NA	NA	NA	NA
18	<i>Etelis radiosus</i>	NA	NA	14	15	3	NA	NA	NA	NA
19	<i>Lutjanus boutton</i>	NA	NA	41	19	20	NA	NA	NA	NA
20	<i>Epinephelus morrhua</i>	11	20	27	19	NA	NA	NA	NA	NA

Table 5.2: CpUE (kg/GT/day) trends by fleet segment for *Pristipomoides multidens* in WPP 573

CpUE	2016	2017	2018	2019	2020	2021	2022	2023	2024
Nano Dropline	4.4	NA	1.1	0.4	0.1	NA	NA	NA	NA
Nano Longline	4.4	3.9	5.2	0.5	0.1	NA	NA	NA	NA
Small Dropline	7.6	11.3	14.9	12.5	9.1	NA	NA	NA	NA
Small Longline	NA								
Medium Dropline	3.1	4.0	4.4	5.9	7.7	NA	NA	NA	NA
Medium Longline	5.0	6.3	8.9	6.1	7.6	NA	NA	NA	NA
Large Dropline	NA								
Large Longline	NA								

Table 5.3: CpUE (kg/GT/day) trends by fleet segment for *Pristipomoides typus* in WPP 573

CpUE	2016	2017	2018	2019	2020	2021	2022	2023	2024
Nano Dropline	1.6	NA	0.5	0.0	0.0	NA	NA	NA	NA
Nano Longline	1.6	1.5	1.8	0.1	NA	NA	NA	NA	NA
Small Dropline	2.8	3.8	3.7	2.9	4.9	NA	NA	NA	NA
Small Longline	NA								
Medium Dropline	1.2	2.0	2.3	2.7	2.3	NA	NA	NA	NA
Medium Longline	1.2	0.6	1.6	1.3	0.9	NA	NA	NA	NA
Large Dropline	NA								
Large Longline	NA								

Table 5.4: CpUE (kg/GT/day) trends by fleet segment for *Lutjanus malabaricus* in WPP 573

CpUE	2016	2017	2018	2019	2020	2021	2022	2023	2024
Nano Dropline	0.7	NA	0.5	0.1	0.2	NA	NA	NA	NA
Nano Longline	0.7	1.2	1.5	0.1	0.0	NA	NA	NA	NA
Small Dropline	1.2	3.9	3.6	3.5	3.0	NA	NA	NA	NA
Small Longline	NA								
Medium Dropline	0.6	1.3	1.2	2.1	2.6	NA	NA	NA	NA
Medium Longline	0.7	1.0	3.6	3.0	3.6	NA	NA	NA	NA
Large Dropline	NA								
Large Longline	NA								

Table 5.5: CpUE (kg/GT/day) trends by fleet segment for *Aphareus rutilans* in WPP 573

CpUE	2016	2017	2018	2019	2020	2021	2022	2023	2024
Nano Dropline	0.2	NA	2.2	3.8	2.2	NA	NA	NA	NA
Nano Longline	0.2	0.1	0.8	0.2	0.2	NA	NA	NA	NA
Small Dropline	0.1	0.2	0.1	0.0	0.4	NA	NA	NA	NA
Small Longline	NA								
Medium Dropline	0.3	0.1	0.1	0.0	0.0	NA	NA	NA	NA
Medium Longline	NA								
Large Dropline	NA								
Large Longline	NA								

Table 5.6: CpUE (kg/GT/day) trends by fleet segment for all species in WPP 573

CpUE	2016	2017	2018	2019	2020	2021	2022	2023	2024
Nano Dropline	10.9	21.6	17.6	20.8	14.8	NA	NA	NA	NA
Nano Longline	10.9	16.3	16.4	7.9	8.2	NA	NA	NA	NA
Small Dropline	16.5	26.3	28.0	24.0	21.7	NA	NA	NA	NA
Small Longline	NA								
Medium Dropline	9.3	10.0	11.5	12.5	15.5	NA	NA	NA	NA
Medium Longline	9.3	8.7	15.8	11.2	12.6	NA	NA	NA	NA
Large Dropline	NA								
Large Longline	NA								

Table 5.7: Sample sizes over the period 2016 to 2024 for the others species in WPP 573 Dropline

Family Name	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	%Catch
Acanthuridae	0	0	5	66	82	0	0	0	0	153	0.026
Ariidae	0	6	10	2	14	0	0	0	0	32	0.005
Ariommatidae	0	0	0	18	7	0	0	0	0	25	0.004
Balistidae	0	0	61	166	391	0	0	0	0	618	0.103
Bramidae	4	0	0	0	0	0	0	0	0	4	0.001
Caesionidae	0	0	0	2	11	0	0	0	0	13	0.002
Carangidae	38	88	100	648	405	0	0	0	0	1279	0.214
Chaetodontidae	0	0	0	1	0	0	0	0	0	1	0.000
Coryphaenidae	0	0	2	13	15	0	0	0	0	30	0.005
Dasyatidae	0	0	0	1	0	0	0	0	0	1	0.000
Ephippidae	0	0	0	0	4	0	0	0	0	4	0.001
Epinephelidae	4	25	315	453	856	0	0	0	0	1653	0.276
Gempylidae	0	0	36	67	15	0	0	0	0	118	0.020
Glaucosomatidae	0	0	0	1	0	0	0	0	0	1	0.000
Haemulidae	1	0	2	403	204	0	0	0	0	610	0.102
Holocentridae	4	5	50	54	145	0	0	0	0	258	0.043
Istiophoridae	0	0	0	1	1	0	0	0	0	2	0.000
Labridae	0	0	3	37	77	0	0	0	0	117	0.020
Lethrinidae	37	4	42	214	512	0	0	0	0	809	0.135
Loliginidae	0	0	0	1	1	0	0	0	0	2	0.000
Lutjanidae	37	18	80	1604	2056	0	0	0	0	3795	0.634
Malacanthidae	1	2	7	1	0	0	0	0	0	11	0.002
Mugilidae	0	0	0	6	0	0	0	0	0	6	0.001
Mullidae	0	0	11	15	162	0	0	0	0	188	0.031
Muraenesocidae	0	0	0	4	1	0	0	0	0	5	0.001
Nemipteridae	2	7	29	957	1418	0	0	0	0	2413	0.403
Other	162	251	341	316	169	0	0	0	0	1239	0.207
Priacanthidae	0	17	103	349	306	0	0	0	0	775	0.129
Psettodidae	0	0	0	0	0	0	0	0	0	0	0.000
Rachycentridae	0	0	3	5	0	0	0	0	0	8	0.001
Rays	0	0	0	3	11	0	0	0	0	14	0.002
Scaridae	0	0	4	1	3	0	0	0	0	8	0.001
Sciaenidae	0	0	4	236	327	0	0	0	0	567	0.095
Scombridae	24	6	90	143	108	0	0	0	0	371	0.062
Scorpaenidae	0	0	0	9	57	0	0	0	0	66	0.011
Serranidae	55	10	18	9	43	0	0	0	0	135	0.023
Sharks	0	4	88	49	25	0	0	0	0	166	0.028
Siganidae	0	0	0	1	0	0	0	0	0	1	0.000
Sparidae	0	0	0	0	0	0	0	0	0	0	0.000
Sphyrinaeidae	0	0	1	3	2	0	0	0	0	6	0.001
Tetraodontidae	0	0	0	0	2	0	0	0	0	2	0.000
Total	369	443	1405	5859	7430	0	0	0	0	15506	2.591

Table 5.8: Sample sizes over the period 2016 to 2024 for the others species in WPP 573 Longline

Family Name	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	%Catch
Acanthuridae	0	0	0	0	4	0	0	0	0	4	0.001
Ariidae	0	0	0	10	0	0	0	0	0	10	0.002
Ariommatidae	0	0	0	4	0	0	0	0	0	4	0.001
Balistidae	0	0	0	0	8	0	0	0	0	8	0.001
Bramidae	0	0	0	0	0	0	0	0	0	0	0.000
Caesionidae	0	0	0	0	0	0	0	0	0	0	0.000
Carangidae	2	1	11	39	46	0	0	0	0	99	0.017
Chaetodontidae	0	0	0	0	0	0	0	0	0	0	0.000
Coryphaenidae	0	0	0	0	1	0	0	0	0	1	0.000
Dasyatidae	0	0	0	0	0	0	0	0	0	0	0.000
Ephippidae	0	0	0	0	0	0	0	0	0	0	0.000
Epinephelidae	1	0	0	15	17	0	0	0	0	33	0.006
Gempylidae	0	0	0	5	0	0	0	0	0	5	0.001
Glaucosomatidae	0	0	0	0	0	0	0	0	0	0	0.000
Haemulidae	0	0	1	8	4	0	0	0	0	13	0.002
Holocentridae	3	0	0	7	3	0	0	0	0	13	0.002
Istiophoridae	0	0	0	0	0	0	0	0	0	0	0.000
Labridae	0	0	0	2	3	0	0	0	0	5	0.001
Lethrinidae	0	0	0	17	7	0	0	0	0	24	0.004
Loliginidae	0	0	0	0	0	0	0	0	0	0	0.000
Lutjanidae	0	0	6	70	44	0	0	0	0	120	0.020
Malacanthidae	0	0	0	0	0	0	0	0	0	0	0.000
Mugilidae	0	0	0	0	0	0	0	0	0	0	0.000
Mullidae	0	0	0	0	2	0	0	0	0	2	0.000
Muraenesocidae	0	0	0	2	3	0	0	0	0	5	0.001
Nemipteridae	1	0	1	84	18	0	0	0	0	104	0.017
Other	26	1	2	14	13	0	0	0	0	56	0.009
Priacanthidae	1	0	0	8	2	0	0	0	0	11	0.002
Psettodidae	0	0	0	0	0	0	0	0	0	0	0.000
Rachycentridae	0	0	0	0	0	0	0	0	0	0	0.000
Rays	0	0	0	1	1	0	0	0	0	2	0.000
Scaridae	0	0	1	0	0	0	0	0	0	1	0.000
Sciaenidae	0	0	0	35	7	0	0	0	0	42	0.007
Scombridae	1	0	1	2	3	0	0	0	0	7	0.001
Scorpaenidae	0	0	0	0	1	0	0	0	0	1	0.000
Serranidae	0	0	0	0	0	0	0	0	0	0	0.000
Sharks	0	0	0	26	58	0	0	0	0	84	0.014
Siganidae	0	0	0	0	0	0	0	0	0	0	0.000
Sparidae	0	0	0	21	0	0	0	0	0	21	0.004
Sphyraenidae	0	0	0	0	0	0	0	0	0	0	0.000
Tetraodontidae	0	0	0	0	0	0	0	0	0	0	0.000
Total	35	2	23	370	245	0	0	0	0	675	0.113

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