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Deepwater Demersal Fisheries Targeting Snappers and Groupers In Indonesia

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1 Introduction

This report summarizes results from length-based assessments of multi-species deep demersal fisheries in Indonesia, targeting snappers, groupers, and emperors, as well as a number of other families, at depths ranging from about 50 to 500 meters. Deep demersal fisheries operate in all Fisheries Management Areas (Wilayah Pengelolaan Perikanan or WPP) in Indonesia (Figure 1.1), with some of the better known fishing grounds located in the Arafura Sea in the far East of the country, in the Indonesian part of the Timor Sea, near the edge of the Australian continental shelf, on the slopes dropping down from the Java Sea into the Makassar Strait and in the Natuna Sea and Karimata Strait to the West of Kalimantan (Figures 1.2 to 1.4).

Deep slopes and shelves throughout Indonesian waters are fished by boats from numerous ports and landing sites (Figures 1.5 to 1.12). Long range trips are very common for medium sized and larger vessels fishing continental shelves, slopes, and banks scattered throughout all Fisheries Management Areas in the Indonesia EEZ. Larger vessels ranging from 15 to 100 GT and more, commonly make trips to distant fishing grounds located up to 2,000 kilometres 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 even more. Large numbers of small boats are active throughout the country.

The most common gear types in these fisheries are drop lines and bottom-set long lines, deployed from boats of less than 5 GT to medium-scale and larger 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 as common but are also used in various locations in the deep demersal fisheries, often in combination with hook and line gear.

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). Length weight relationships for all these species have been established to enable conversion to weight (volume) from size based CODRS information and interviews with traders and processors produced "trading limits" which roughly indicate a minimum preferred size in high end markets (Tables 1.1 and 1.2). The current report presents sample sizes for the top 50 most abundant species in CODRS sample sizes from the Indonesian deep demersal fisheries (Tables 1.3 and 1.4), as well as for a number of categories of other species in the catch (Table 1.5).

Catch length frequencies of the 50 most important species in each WPP are analysed in separate stock assessment reports (Mous et al., 2019a-k). Please refer to these reports for details on the length based analysis and stock assessments. For a complete overview of the species composition please refer to the ID guide prepared for these fisheries[1]. 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 fisheries[2].

[1] http://72.14.187.103:8080/ifish/pub/TNC_FishID.pdf
[2] http://72.14.187.103:8080/ifish/pub/DeepSlopeSpeciesAssessmentTool.pdf

Data in this report represent complete catches by all size categories of vessels from the above described fleets. In most cases all fish captured by fishing boats were photographed on measuring boards by fishing crew participating in the CODRS. In some cases incomplete catches were raised to total catches using the factor between landed weight (from receipts) and calculated weight for the measured sample. 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.

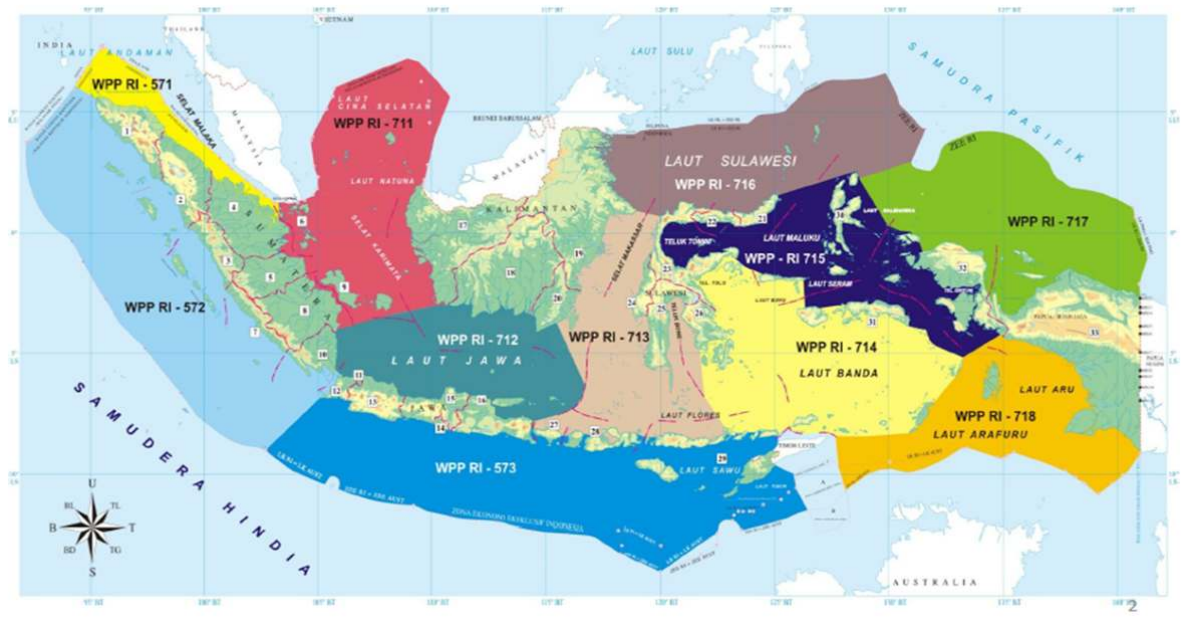

Figure 1.1: Fisheries Management Areas (*Wilayah Pengelolaan Perikanan* or WPP) in Indonesian marine waters.

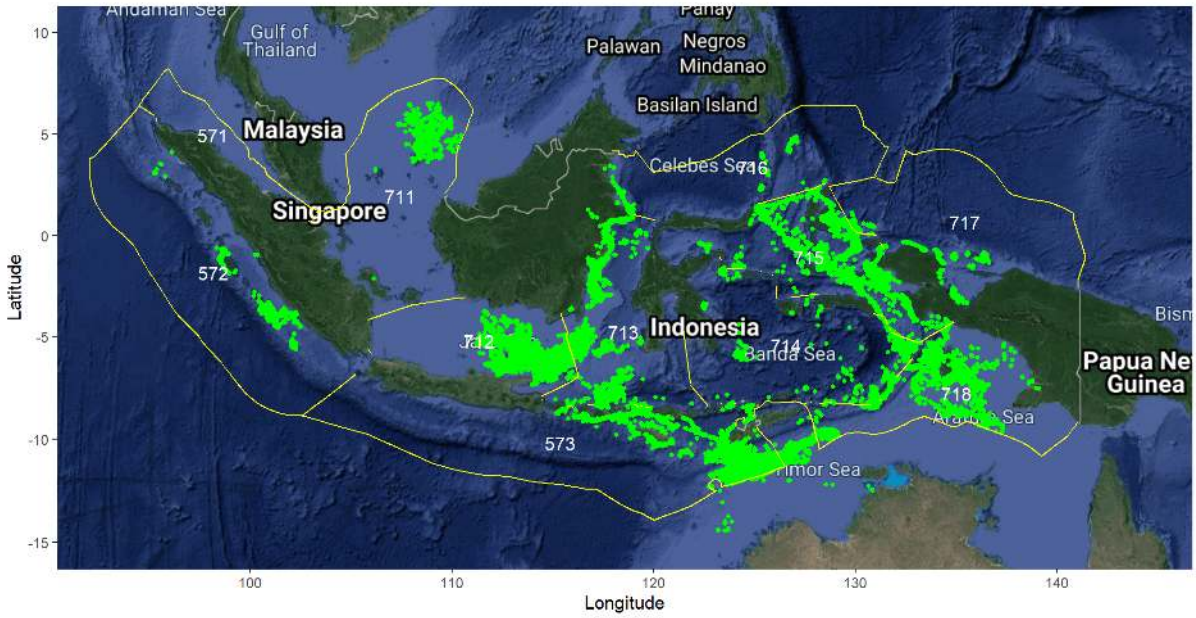

Figure 1.2: Fishing positions of dropliners participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

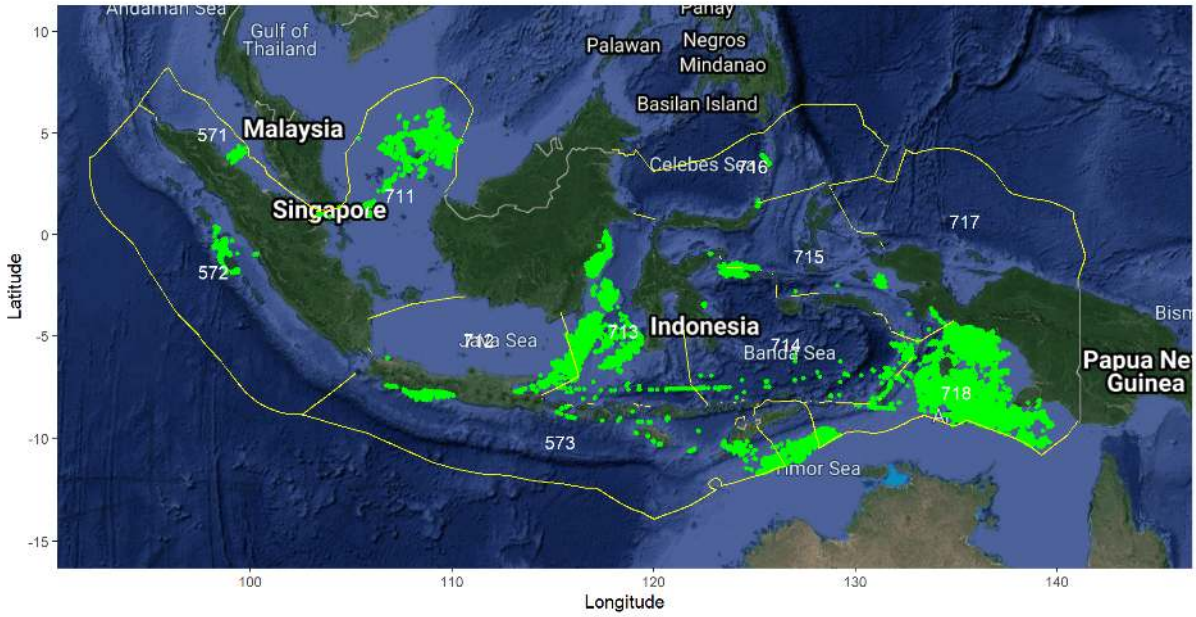

Figure 1.3: Fishing positions of longliners participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

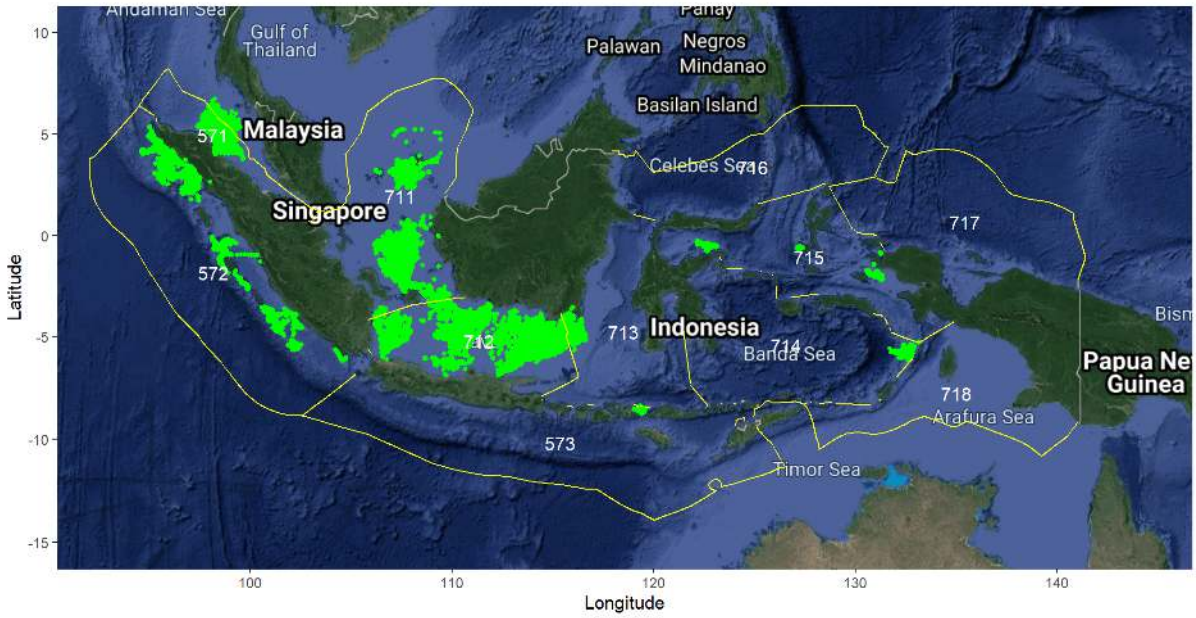

Figure 1.4: Fishing positions of vessels applying more than one gear, participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Gears used by the vessels in this group are a combination of droplines, longlines, traps, and gillnets. Reported positions during steaming, anchoring, or docking are excluded from this map.

Figure 1.5: A typical snapper fishing boat used for long line fishing from Tanjung Balai Karimun, Kepulauan Riau, operating in the Natuna Sea (WPP 711) and on nearby fishing grounds.

Figure 1.6: A typical snapper fishing boat used for trap fishing from Manggar, Belitung Timur, operating in the Natuna Sea and Karimata Strait (WPP 711) and on nearby fishing grounds.

Figure 1.7: A typical snapper fishing boat from Kandang Semangkon, Lamongan, Jawa Timur, operating in the Java Sea (WPP 712) and on nearby fishing grounds.

Figure 1.8: A typical snapper fishing boat from Galesong, Takalar, Sulawesi Selatan, operating in the Makassar Strait (WPP 713) and on nearby fishing grounds.

Figure 1.9: A typical snapper fishing boat from Saumlaki, Kepulauan Tanimbar, Maluku, operating in the Banda Sea (WPP 714) and on nearby fishing grounds.

Figure 1.10: A typical snapper fishing boat used for drop line fishing from Kema, Minahasa Utara, Sulawesi Utara, operating in the Maluku and Seram Sea (WPP 715) and on nearby fishing grounds.

Figure 1.11: A typical snapper fishing boat (front) used for long line fishing from Probolinggo, Jawa Timur, operating in the Arafura Seas (WPP 718) and on nearby fishing grounds.

Figure 1.12: 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.

Table 1.1: Length-Weight Relationships and Trading Limits for the 100 most Abundant Species in Deepwater Demersal Fisheries in Indonesia

#ID	Species	Reported Trade Limit Weight (g)	$W = a\ L^b$ a	b	Length Type for a & b TL-FL-SL	Converted Trade Limit L(cm)	Plotted Trade Limit TL(cm)
1	Aphareus rutilans	1000	0.015	2.961	FL	42.20	49.61
2	Aprion virescens	1000	0.023	2.886	FL	40.49	45.90
3	Etelis carbunculus	500	0.017	3.010	FL	30.44	33.15
4	Etelis sp.	500	0.022	2.950	FL	30.16	32.84
5	Etelis radiosus	1000	0.056	2.689	FL	38.05	43.15
6	Etelis coruscans	500	0.041	2.758	FL	30.28	37.85
7	Pristipomoides multidens	500	0.020	2.944	FL	31.18	34.92
8	Pristipomoides typus	500	0.014	2.916	TL	36.16	36.16
9	Pristipomoides filamentosus	500	0.038	2.796	FL	29.70	33.27
10	Pristipomoides sieboldii	300	0.022	2.942	FL	25.52	29.21
11	Pristipomoides argyrogrammicus	300	0.013	3.140	FL	24.70	28.46
12	Pristipomoides zonatus	300	0.041	2.833	FL	23.16	26.68
13	Pristipomoides flavipinnis	300	0.030	2.825	FL	26.09	29.92
14	Lutjanus bitaeniatus	500	0.014	2.980	FL	33.61	34.18
15	Lutjanus argentimaculatus	500	0.034	2.792	FL	31.22	31.78
16	Lutjanus bohar	500	0.016	3.059	FL	29.70	31.31
17	Lutjanus malabaricus	500	0.009	3.137	FL	33.11	33.11
18	Lutjanus sebae	500	0.009	3.208	FL	29.97	31.26
19	Lutjanus timorensis	500	0.009	3.137	FL	33.11	33.34
20	Lutjanus gibbus	500	0.015	3.091	FL	28.87	31.09
21	Lutjanus erythropterus	500	0.024	2.870	FL	31.79	31.79
22	Pinjalo lewisi	300	0.014	2.970	FL	28.42	29.64
23	Pinjalo pinjalo	300	0.014	2.970	FL	28.42	31.16
24	Lutjanus johnii	300	0.020	2.907	FL	27.28	28.49
25	Lutjanus russelli	300	0.020	2.907	FL	27.28	28.49
26	Lutjanus lemniscatus	300	0.020	2.907	FL	27.28	28.49
27	Lutjanus vitta	300	0.017	2.978	FL	26.72	27.64
28	Lutjanus boutton	300	0.034	3.000	FL	20.75	21.56
29	Lutjanus rivulatus	500	0.008	3.260	FL	29.12	29.97
30	Lipocheilus carnolabrum	500	0.149	2.488	FL	26.13	28.32
31	Symphorus nematophorus	1000	0.015	3.046	FL	38.63	40.18
32	Paracaesio gonzalesi	300	0.020	3.050	FL	23.24	24.96
33	Paracaesio xanthura	300	0.023	3.000	SL	23.64	27.39
34	Paracaesio kusakarii	500	0.011	3.135	FL	30.96	34.80
35	Paracaesio stonei	500	0.024	2.960	FL	28.78	32.35
36	Saloptia powelli	300	0.008	3.175	FL	27.28	27.28
37	Cephalopholis miniata	300	0.026	2.864	TL	26.35	26.35
38	Cephalopholis sexmaculata	300	0.027	3.000	SL	22.37	28.24
39	Cephalopholis sonnerati	300	0.015	3.058	TL	25.78	25.78
40	Cephalopholis igarashiensis	300	0.049	2.748	FL	23.86	23.86
41	Epinephelus latifasciatus	1500	0.010	3.088	TL	48.00	48.00
42	Epinephelus radiatus	300	0.061	2.624	FL	25.59	25.59
43	Epinephelus morrhua	300	0.061	2.624	FL	25.59	25.59
44	Epinephelus poecilonotus	500	0.061	2.624	FL	31.09	31.09
45	Epinephelus areolatus	300	0.011	3.048	FL	28.18	28.77
46	Epinephelus bleekeri	300	0.009	3.126	TL	28.09	28.09
47	Epinephelus miliaris	300	0.025	3.000	SL	22.74	29.23
48	Epinephelus bilobatus	300	0.014	2.990	TL	27.82	27.82
49	Epinephelus malabaricus	1500	0.013	3.034	TL	46.85	46.85
50	Epinephelus coioides	1500	0.011	3.084	TL	46.94	46.94

Table 1.2: (Cont. Table 1.1) Length-Weight Relationships and Trading Limits for the 100 most Abundant Species in Deepwater Demersal Fisheries in Indonesia

#ID	Species	Reported Trade Limit Weight (g)	$W = a L^b$ a	b	Length Type for a & b TL-FL-SL	Converted Trade Limit L(cm)	Plotted Trade Limit TL(cm)
51	Epinephelus chlorostigma	500	0.015	2.940	FL	34.62	34.62
52	Epinephelus retouti	300	0.027	3.000	SL	22.37	28.24
53	Epinephelus heniochus	300	0.061	2.624	FL	25.59	25.59
54	Epinephelus stictus	300	0.027	3.000	SL	22.37	28.24
55	Epinephelus epistictus	1500	0.009	3.126	TL	47.01	47.01
56	Epinephelus multinotatus	1500	0.017	2.964	TL	46.90	46.90
57	Epinephelus undulosus	1500	0.015	2.940	FL	50.31	50.31
58	Epinephelus amblycephalus	1500	0.012	3.057	TL	45.99	45.99
59	Hyporthodus octofasciatus	1500	0.106	2.560	TL	41.82	41.82
60	Plectropomus maculatus	500	0.016	3.000	FL	31.76	31.76
61	Plectropomus leopardus	500	0.012	3.060	FL	32.56	33.38
62	Variola albimarginata	300	0.012	3.079	FL	26.68	30.44
63	Lethrinus lentjan	300	0.020	2.986	FL	25.16	26.35
64	Lethrinus laticaudis	300	0.020	2.986	FL	25.16	26.35
65	Lethrinus nebulosus	500	0.019	2.996	FL	30.03	32.14
66	Lethrinus olivaceus	300	0.029	2.851	FL	25.49	27.50
67	Lethrinus amboinensis	300	0.029	2.851	FL	25.49	28.06
68	Lethrinus rubrioperculatus	300	0.013	3.108	FL	25.48	28.05
69	Wattsia mossambica	500	0.040	2.824	FL	28.21	29.34
70	Gymnocranius grandoculis	500	0.032	2.885	FL	28.43	30.53
71	Gymnocranius griseus	500	0.032	2.885	FL	28.43	30.56
72	Carangoides coeruleopinnatus	1000	0.032	2.902	FL	35.35	40.12
73	Carangoides fulvoguttatus	1000	0.033	2.808	FL	39.51	43.62
74	Carangoides malabaricus	1000	0.023	3.020	FL	34.20	39.74
75	Carangoides chrysophrys	1000	0.027	2.902	FL	37.68	42.12
76	Carangoides gymnostethus	1000	0.046	2.746	FL	37.88	41.55
77	Caranx bucculentus	2000	0.023	3.033	FL	42.51	49.83
78	Caranx ignobilis	2000	0.027	2.913	FL	46.78	54.36
79	Caranx lugubris	2000	0.020	3.001	FL	46.51	55.35
80	Caranx sexfasciatus	2000	0.032	2.930	FL	43.43	49.51
81	Caranx tille	2000	0.032	2.930	FL	43.43	49.51
82	Elagatis bipinnulata	1000	0.013	2.920	FL	46.53	55.37
83	Seriola dumerili	2000	0.022	2.847	TL	54.74	54.74
84	Seriola rivoliana	2000	0.006	3.170	FL	54.23	60.03
85	Erythrocles schlegelii	1500	0.011	3.040	FL	48.55	53.60
86	Argyrops spinifer	300	0.055	2.670	TL	25.11	27.87
87	Dentex carpenteri	300	0.023	2.930	FL	25.42	27.66
88	Glaucosoma buergeri	500	0.045	2.725	TL	30.40	30.40
89	Diagramma labiosum	500	0.014	2.988	FL	33.08	36.71
90	Diagramma pictum	500	0.014	2.988	FL	33.08	36.71
91	Pomadasys kaakan	300	0.017	2.985	TL	26.57	26.57
92	Cookeolus japonicus	300	0.014	3.000	TL	27.58	27.58
93	Sphyraena barracuda	1500	0.006	3.011	FL	61.48	69.47
94	Sphyraena forsteri	500	0.005	3.034	FL	43.51	49.16
95	Sphyraena putnamae	1500	0.008	2.931	FL	64.24	70.92
96	Parascolopsis eriomma	100	0.012	2.990	FL	20.47	21.90
97	Ostichthys japonicus	300	0.018	3.020	FL	25.10	26.23
98	Rachycentron canadum	1000	0.003	3.088	FL	60.67	67.28
99	Protonibea diacanthus	1000	0.013	2.940	TL	46.15	46.15
100	Atrobucca brevis	1000	0.013	2.940	TL	46.15	46.15

Table 1.3: Sample Sizes over the period 2016 to 2024 for the 50 most Abundant Species in CODRS Samples of Deepwater Demersal Fisheries in Indonesia

Rank	Species	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
1	Lutjanus malabaricus	28470	73093	153069	196339	92332	0	0	0	0	543303
2	Atrobucca brevis	239	1258	90639	274581	17430	0	0	0	0	384147
3	Pristipomoides multidens	56764	69343	74841	115286	39030	0	0	0	0	355264
4	Epinephelus areolatus	19761	24223	51646	97271	43180	0	0	0	0	236081
5	Pristipomoides typus	22357	35785	43099	52988	23012	0	0	0	0	177241
6	Lutjanus erythropterus	7119	11809	37482	44087	25761	0	0	0	0	126258
7	Lutjanus vitta	4254	6206	26478	43586	18684	0	0	0	0	99208
8	Pristipomoides filamentosus	16345	8330	11966	19082	20828	0	0	0	0	76551
9	Lethrinus laticaudis	3875	10260	27708	20467	13243	0	0	0	0	75553
10	Aphareus rutilans	12065	9480	13191	23741	14978	0	0	0	0	73455
11	Lutjanus sebae	4392	8286	14772	22562	6637	0	0	0	0	56649
12	Pristipomoides sieboldii	4320	5319	7046	11953	21770	0	0	0	0	50408
13	Etelis sp.	8193	7881	12532	11350	5886	0	0	0	0	45842
14	Epinephelus coioides	874	1274	6012	21663	13167	0	0	0	0	42990
15	Diagramma pictum	837	2960	11656	18290	8676	0	0	0	0	42419
16	Lutjanus timorensis	5719	4975	6526	13453	6662	0	0	0	0	37335
17	Paracaesio kusakarii	9187	9546	9037	6275	2181	0	0	0	0	36226
18	Etelis coruscans	5308	5692	9400	9520	4982	0	0	0	0	34902
19	Lethrinus lentjan	1002	2667	8210	14568	6494	0	0	0	0	32941
20	Gymnocranius grandoculis	4635	6332	6540	10147	3617	0	0	0	0	31271
21	Carangoides chrysophrys	1194	2432	6824	12966	5352	0	0	0	0	28768
22	Etelis radiosus	2320	2566	3990	10486	6654	0	0	0	0	26016
23	Pinjalo lewisi	3613	5873	6113	5622	3596	0	0	0	0	24817
24	Pinjalo pinjalo	115	403	6728	11868	3893	0	0	0	0	23007
25	Pomadasys kaakan	2560	2473	6943	6687	3160	0	0	0	0	21823
26	Lutjanus johnii	611	1583	3446	8124	4740	0	0	0	0	18504
27	Caranx sexfasciatus	810	1213	4178	7865	4192	0	0	0	0	18258
28	Plectropomus maculatus	82	237	4288	7848	4727	0	0	0	0	17182
29	Epinephelus bleekeri	488	1102	2596	7979	4549	0	0	0	0	16714
30	Lutjanus russelli	324	1407	3648	6867	3587	0	0	0	0	15833
31	Cephalopholis sonnerati	1640	1625	2753	6384	3107	0	0	0	0	15509
32	Lethrinus olivaceus	1080	1330	2242	6100	4207	0	0	0	0	14959
33	Lutjanus gibbus	907	491	1687	7455	4161	0	0	0	0	14701
34	Aprion virescens	1632	1291	1239	7787	2661	0	0	0	0	14610
35	Caranx bucculentus	391	3269	4035	5526	476	0	0	0	0	13697
36	Lutjanus argentimaculatus	1665	2010	2910	4976	1880	0	0	0	0	13441
37	Paracaesio stonei	2354	3491	3296	3184	1046	0	0	0	0	13371
38	Wattsia mossambica	3380	2148	3212	3281	910	0	0	0	0	12931
39	Lutjanus boutton	248	527	2088	6123	3788	0	0	0	0	12774
40	Erythrocles schlegelii	1388	1819	2398	2810	2348	0	0	0	0	10763
41	Seriola rivoliana	1349	1499	2347	4080	1287	0	0	0	0	10562
42	Plectropomus leopardus	445	419	2318	4414	2683	0	0	0	0	10279
43	Carangoides coeruleopinnatus	371	1295	3410	4086	822	0	0	0	0	9984
44	Diagramma labiosum	582	1186	3024	3871	822	0	0	0	0	9485
45	Caranx ignobilis	388	552	2525	3919	1701	0	0	0	0	9085
46	Paracaesio xanthura	706	761	1765	2376	3468	0	0	0	0	9076
47	Lutjanus bohar	999	951	1922	3520	1664	0	0	0	0	9056
48	Caranx tille	538	917	1134	4031	2416	0	0	0	0	9036
49	Parascolopsis eriomma	305	104	1450	1993	5117	0	0	0	0	8969
50	Variola albimarginata	387	354	1274	4013	2778	0	0	0	0	8806

Table 1.4: Ranking, Sample Sizes and Sample Weights over the period 2016 to 2024 for 50 Most Abundant Species in CODRS Samples of Deepwater Demersal Fisheries in Indonesia

Rank	#ID	Species	N	Cum N	%N	Cum %N	W (Kg)	Cum W	%W	Cum %W
1	17	Lutjanus malabaricus	543303	543303	16	16	1287323	1287323	25	25
2	100	Atrobucca brevis	384147	927450	11	27	285861	1573183	6	31
3	7	Pristipomoides multidens	355264	1282714	10	37	674146	2247330	13	44
4	45	Epinephelus areolatus	236081	1518795	7	44	97233	2344563	2	46
5	8	Pristipomoides typus	177241	1696036	5	49	225096	2569659	4	51
6	21	Lutjanus erythropterus	126258	1822294	4	52	145340	2714999	3	53
7	27	Lutjanus vitta	99208	1921502	3	55	28119	2743118	1	54
8	9	Pristipomoides filamentosus	76551	1998053	2	57	103904	2847022	2	56
9	64	Lethrinus laticaudis	75553	2073606	2	60	137398	2984420	3	59
10	1	Aphareus rutilans	73455	2147061	2	62	204907	3189326	4	63
11	18	Lutjanus sebae	56649	2203710	2	63	116302	3305628	2	65
12	10	Pristipomoides sieboldii	50408	2254118	1	65	31104	3336733	1	66
13	4	Etelis sp.	45842	2299960	1	66	181583	3518315	4	69
14	50	Epinephelus coioides	42990	2342950	1	67	179360	3697675	4	73
15	90	Diagramma pictum	42419	2385369	1	69	54472	3752147	1	74
16	19	Lutjanus timorensis	37335	2422704	1	70	30335	3782482	1	74
17	34	Paracaesio kusakarii	36226	2458930	1	71	68042	3850524	1	76
18	6	Etelis coruscans	34902	2493832	1	72	63166	3913690	1	77
19	63	Lethrinus lentjan	32941	2526773	1	73	25135	3938825	0	78
20	70	Gymnocranius grandoculis	31271	2558044	1	74	55267	3994092	1	79
21	75	Carangoides chrysophrys	28768	2586812	1	74	42283	4036375	1	79
22	5	Etelis radiosus	26016	2612828	1	75	70213	4106588	1	81
23	22	Pinjalo lewisi	24817	2637645	1	76	16472	4123060	0	81
24	23	Pinjalo pinjalo	23007	2660652	1	76	17045	4140106	0	82
25	91	Pomadasys kaakan	21823	2682475	1	77	34491	4174597	1	82
26	24	Lutjanus johnii	18504	2700979	1	78	34171	4208767	1	83
27	80	Caranx sexfasciatus	18258	2719237	1	78	53262	4262029	1	84
28	60	Plectropomus maculatus	17182	2736419	0	79	48979	4311008	1	85
29	46	Epinephelus bleekeri	16714	2753133	0	79	33289	4344296	1	86
30	25	Lutjanus russelli	15833	2768966	0	80	9529	4353825	0	86
31	39	Cephalopholis sonnerati	15509	2784475	0	80	14460	4368285	0	86
32	66	Lethrinus olivaceus	14959	2799434	0	80	54063	4422348	1	87
33	20	Lutjanus gibbus	14701	2814135	0	81	9134	4431483	0	87
34	2	Aprion virescens	14610	2828745	0	81	37539	4469022	1	88
35	77	Caranx bucculentus	13697	2842442	0	82	25550	4494572	1	88
36	15	Lutjanus argentimaculatus	13441	2855883	0	82	47878	4542450	1	89
37	35	Paracaesio stonei	13371	2869254	0	82	17508	4559957	0	90
38	69	Wattsia mossambica	12931	2882185	0	83	13615	4573572	0	90
39	28	Lutjanus boutton	12774	2894959	0	83	5243	4578815	0	90
40	85	Erythrocles schlegelii	10763	2905722	0	84	24256	4603072	0	91
41	84	Seriola rivoliana	10562	2916284	0	84	38467	4641539	1	91
42	61	Plectropomus leopardus	10279	2926563	0	84	15407	4656946	0	92
43	72	Carangoides coeruleopinnatus	9984	2936547	0	84	11297	4668243	0	92
44	89	Diagramma labiosum	9485	2946032	0	85	20742	4688985	0	92
45	78	Caranx ignobilis	9085	2955117	0	85	36067	4725051	1	93
46	33	Paracaesio xanthura	9076	2964193	0	85	6100	4731151	0	93
47	16	Lutjanus bohar	9056	2973249	0	85	24313	4755464	0	94
48	81	Caranx tille	9036	2982285	0	86	26447	4781911	1	94
49	96	Parascolopsis eriomma	8969	2991254	0	86	1419	4783331	0	94
50	62	Variola albimarginata	8806	3000060	0	86	3801	4787132	0	94

Table 1.5: Sample Sizes over the period 2016 to 2024 for Other Species in Assessment of Deepwater Demersal Fisheries in Indonesia

Family Name	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	%Catch
Acanthuridae	0	2	532	1124	762	0	0	0	0	2420	0.070
Ariidae	22	503	1990	8274	2239	0	0	0	0	13028	0.375
Ariommatidae	0	0	0	232	96	0	0	0	0	328	0.009
Balistidae	0	9	1609	4978	2560	0	0	0	0	9156	0.263
Belonidae	0	0	0	1	9	0	0	0	0	10	0.000
Bramidae	34	0	0	378	3	0	0	0	0	415	0.012
Caesionidae	0	3	833	4489	4114	0	0	0	0	9439	0.271
Carangidae	372	2082	19798	62762	19845	0	0	0	0	104859	3.015
Carcharhinidae	0	0	5	0	0	0	0	0	0	5	0.000
Centropomidae	0	0	0	1	0	0	0	0	0	1	0.000
Chaetodontidae	0	1	91	56	56	0	0	0	0	204	0.006
Chirocentridae	0	0	0	3	0	0	0	0	0	3	0.000
Clupeidae	0	0	0	4	39	0	0	0	0	43	0.001
Coryphaenidae	2	0	123	410	174	0	0	0	0	709	0.020
Dasyatidae	0	0	0	3	0	0	0	0	0	3	0.000
Eceneidae	0	0	0	1	0	0	0	0	0	1	0.000
Elopidae	0	0	0	10	0	0	0	0	0	10	0.000
Ephippidae	10	3	603	1721	702	0	0	0	0	3039	0.087
Epinephelidae	169	311	1697	6415	4443	0	0	0	0	13035	0.375
Fistulariidae	0	0	0	2	0	0	0	0	0	2	0.000
Gempylidae	36	0	66	389	156	0	0	0	0	647	0.019
Glaucosomatidae	0	0	2	5	0	0	0	0	0	7	0.000
Haemulidae	12	10	313	1098	520	0	0	0	0	1953	0.056
Harpodontidae	0	0	0	3	0	0	0	0	0	3	0.000
Hemiramphidae	0	0	0	7	0	0	0	0	0	7	0.000
Holocentridae	17	105	222	3089	1285	0	0	0	0	4718	0.136
Istiophoridae	0	0	0	7	4	0	0	0	0	11	0.000
Kyphosidae	0	0	0	1	0	0	0	0	0	1	0.000
Labridae	0	4	257	755	333	0	0	0	0	1349	0.039
Latidae	0	0	0	1	3	0	0	0	0	4	0.000
Lethrinidae	122	337	2300	9642	6052	0	0	0	0	18453	0.530
Lobotidae	0	0	1	37	47	0	0	0	0	85	0.002
Loliginidae	0	0	0	1	1	0	0	0	0	2	0.000
Lutjanidae	96	321	2068	8511	6573	0	0	0	0	17569	0.505
Malacanthidae	24	35	24	50	196	0	0	0	0	329	0.009
Monacanthidae	0	0	193	323	26	0	0	0	0	542	0.016
Mugilidae	0	0	0	9	1	0	0	0	0	10	0.000
Mullidae	0	3	68	636	876	0	0	0	0	1583	0.046
Muraenesocidae	0	0	122	1788	229	0	0	0	0	2139	0.061
Nemipteridae	24	250	1895	5123	2981	0	0	0	0	10273	0.295
Other	525	2612	4531	3677	1382	0	0	0	0	12727	0.366
Polynemidae	0	0	0	40	0	0	0	0	0	40	0.001
Pomacanthidae	0	0	11	93	41	0	0	0	0	145	0.004
Priacanthidae	8	100	334	2264	1921	0	0	0	0	4627	0.133
Psettodidae	0	0	0	1613	0	0	0	0	0	1613	0.046
Rachycentridae	0	0	4	10	6	0	0	0	0	20	0.001
Rays	18	104	379	1077	404	0	0	0	0	1982	0.057
Scaridae	0	0	113	501	634	0	0	0	0	1248	0.036
Sciaenidae	0	0	5	282	353	0	0	0	0	640	0.018
Scombridae	289	667	4740	8052	3575	0	0	0	0	17323	0.498
Scorpaenidae	0	0	2	21	65	0	0	0	0	88	0.003
Serranidae	63	19	43	141	261	0	0	0	0	527	0.015
Sharks	83	803	2368	1978	600	0	0	0	0	5832	0.168
Siganidae	0	0	289	1606	681	0	0	0	0	2576	0.074
Sillaginidae	0	0	0	2	0	0	0	0	0	2	0.000
Sparidae	0	0	2	30	6	0	0	0	0	38	0.001
Sphyraenidae	57	118	209	428	117	0	0	0	0	929	0.027
Sphyrnidae	0	0	5	0	0	0	0	0	0	5	0.000
Terapontidae	0	0	0	2	0	0	0	0	0	2	0.000
Tetraodontidae	0	0	131	158	6	0	0	0	0	295	0.008
Trichiuridae	0	10	606	4972	232	0	0	0	0	5820	0.167
Xiphiidae	0	0	0	1	2	0	0	0	0	3	0.000
Zanclidae	0	0	0	0	1	0	0	0	0	1	0.000
Total	1983	8412	48584	149287	64612	0	0	0	0	272878	7.845

2 Materials and methods for data collection, analysis and reporting

2.1 Approach to estimation of catch composition

The overall approach of the data collection program is to measure total catch, detailed by species and size, for each fleet segment in the fleet. We defined a fleet segment as a part of the fleet comprising boats that have the same characteristics in terms of boat size category (nano, small, medium, large), and gear (dropline, longline, etc.). We usually assessed fleet segments within Fishery Management Area (FMA, also known by its Indonesian acronym, WPP).

The program comprises two parts: A frame survey to describe the total fleet participating in the deepwater demersal fishery, and a catch survey to describe the catch characteristics of each fleet segment within each WPP. The catch survey aims to cover 4-5% of the total fleet, where the total fleet size and composition is estimated through the frame survey. The method we applied for the catch survey is the Crew-Operated Data Recording System (CODRS, see below), which shares characteristics with a system based on catch logbooks. The program's field technicians approach crews of fishing vessels to ask if they are willing to join the CODRS program. Selection of fishing vessels is based on representativeness for each fleet segment, whether that fleet segment already has CODRS representation, and whether the captain and crew is willing to participate. The program aims to have CODRS in each major fleet segment, roughly aiming for proportional representation. Crews of fishing boats who participate in CODRS receive training, and they are compensated for their effort through a standard contract. Crews selected for the CODRS program participate for one year if performance is satisfactory. After one year, their contracts are usually renewed, unless it is necessary to adjust allocation of CODRS contracts between the various fleet segments.

2.2 Frame survey

We implemented a country-wide frame survey to obtain complete and detailed information on the deep demersal fishing fleet in Indonesia. This was done using a combination of analysis of satellite images from Google Maps, ground-truthing visits to all locations where either satellite imagery or other information indicated the presence of a demersal fishing fleet, and analysis of data from the local fisheries monitoring agency (PSDKP), who usually shares an office with the harbor authority. The PSDKP offices have data on departure and arrival of fishing boats by name, as well as rough data on the catch. Whereas the departure/arrival data are usually incomplete, the data suffice to estimate the number of active vessels, and the rough catch data suffice to check whether the boat has been operating on demersal fish. We collected data on boat size, gear type, port of registration, designated FMAs (as specified on the license), captain contacts, and other details, for all fishing boats in the fleet. We distinguished 4 boat size categories: "nano"($<$5 GT), "small" (5-$<$ 10 GT), "medium" (10-30 GT), and "large" ($>$30 GT). These categories align with current administrative practices, as "medium" boats are licensed by the provinces, and "large" boats by national government, whereas "nano" and "small" boats do not require a fishing license. We distinguished four gear types: Vertical drop lines, bottom-set long lines, deep water gillnets, and traps. We added a fifth category "mixed gear" for trips where the boat used two or more gear types in one trip, which made it impossible to separate the catch by gear type.

Fleet information is summarized by registration port and home district (Table 2.1) and by 2020 most of the fleet was on record, while almost all of the Indonesian coastline had been surveyed by then. The total fleet in each WPP is a dynamic number, as boats are leaving and being added all the time. Frame survey data are therefore continuously updated to keep complete records of the currently active fishing fleet in the deep demersal fisheries.

2.3 Vessel Tracking and CODRS

To determine location of fishing grounds and number of fishing days per vessel, we deployed a low-cost tracking unit (Spot Trace, www.findmespot.com) on each fishing boat participating in the program. 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. Fishers can switch off Spot Trace, at which time the unit generates a "power-off" message with the position at the time that the unit was switched off. Anecdotal information suggests that some captains do so when they plan to fish in Australian waters (an illegal practice). A relatively high number of "power-off" messages near the Australian border corroborates this supposition. Captains do not always switch off the unit—for example, there is no indication that captains fishing in the Malaysian part of the Malacca Strait do so.

Data on species and size distribution of catches, as needed for accurate length-based stock assessments, are collected via Crew Operated Data Recording Systems or CODRS. Fishers take pictures of each that they catch, where the fish is put on a measuring board (Fig. 2.1 and 2.2). The measuring board on the background of the picture helps program technicians to measure the length of the fish later on. The process of taking pictures differs between boats, depending on the fish handling process. Boats that have chillers on deck usually take picture a couples of hours after capture, while moving the fish from the chillers into the hold. Crew of smaller boats may take the pictures right after capture, before they put the fish in their iceboxes, and very small vessels ("nano", around 1 GT) may take pictures once they offload the catch, at the end of their fishing day. Hence, the time stamp of the picture roughly corresponds to the time when the fish was caught, except for most of the "nano" fishers. In our analyses, we used the timestamp of the pictures to indicate a "fishing day", implicitly assuming that each fishing day resulted in catch of at least one fish. For "nano" fishers, the timestamps of the pictures were 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 captain makes a picture of the receipt of his fish sales, and the captain hands over the storage chip of the camera to a program technicians. Sometimes, the captain does not receive a receipt, and in such cases the the technician will ask the captain to make a simple hand-written note that states the landing date and the total catch volume. These receipts and notes were assumed to represent a fairy reliable estimate of the total weight of a catch (from a single trip, and including all species) that is independent from CODRS data. To facilitate the hand-over of the images, the technicians have access to live Spot Trace data so that they can check on what date and time the boat will land. Processing of images consists of species identification, measurement of the length of the fish, and uploading the data and the images to a server (Figure 2.2). Before the data is added to the database, a data quality control technician double-checks the data, after which the data are cleared for addition to the IFish database.

2.4 Data Quality Control

If most of the images from a fishing trip were of low quality, the images from that trip were not further processed and not included in the dataset. Such low-quality sets are usually from the first couple of trips of captains who were just recruited to the CODRS program. Low-quality sets usually have (a combination of) the following issues: Out-of-focus, images are taken at an angle instead of perpendicular to the measuring board, snouts of the fish not aligned to the strip at zero cm on the measuring board, or the set only includes a small number of images of one or two species (i.e., the crew were under the impression that only a couple of images would suffice). In such cases, the technician provides feed-back to the crew how to improve data collection. The technician may terminate the contract with the fisher if, after a couple of trips, data quality remains low. The technician will process the images if the set of images appears of reasonable quality at first sight.

The next level of data quality control is based on the estimated volume of all fish on the images, compared to volume on the receipt or the hand-written note. After the data are added to the database, a script estimates body weight of each fish from the measured length and a length-weight relationship for that species, and the volume (weight) of the catch follows from adding the weights of the individual fish. The length-weight relationship was obtained from published sources. A senior technician then compares the weight according to the CODRS data and the catch weight stated on the receipt. The senior technician labels a set of images as "complete" when estimated weights from CODRS data where above 90% of the catch weight stated on the receipts. If the CODRS data amounted less than 90% but more than 30% of the catch weight stated on the receipt, the senior technician labels the set as "incomplete". The senior technician labels the set as "biased" if the CODRS data comprise less than 30% of the catch weight as stated on the receipt.

There are various reasons for CODRS data ending up as "incomplete" or "biased". A common reason is that the weather conditions made it difficult for the crew to take pictures, which means that some of the fishing days were not covered. Another reason is material failure: Camera battery down, or camera broken. It may also be that the crew member designated to take the pictures got ill, that the crew were simply too tired to take pictures.

Data from "biased" landings were not used in any analysis. "Incomplete" data from boats larger than 10 GT were used, but "incomplete" data from smaller boats (less than 10 GT) were not used. The reason is that larger boats tend to make longer trips (one-four weeks), and therefore even "incomplete" catches still have valuable information. As we evaluated Catch-per-Unit-Effort (CpUE) on a per-day basis, and not on a per-trip basis, our CpUE estimates are not affected by missing pictures from part of the trip. The underlying assumption is that "incompleteness" is caused by the crew deciding on some days not to take any pictures (in contrast to the crew deciding to take pictures on only, say, half of the catch on each fishing day). Interviews with the crew suggest that there is some justification for this assumption. The length-based indicators should be even more robust to glitches in the data collection process than the CpUE estimates, assuming that the species and size composition of the catch does not affect the crew's picture-taking practices.

2.5 Catch per Unit of Effort and Total Catch

By the end of 2019, more than 400 boats participated in the CODRS program with close to 40 boats enrolled in each WPP (Figure 2.3), selected from a fleet of about 10,000 vessels across all fishing grounds in Indonesia (Table 2.1). Recruitment of captains from the overall fleet into the CODRS program (Table 2.2) was not exactly proportional to composition of the fleet in terms of fleet segments (Table 2.4). This means that average observations over CODRS samples give a biased representation for the fleet. Therefore, in CpUE and catch calculations we used information from the frame survey on fleet composition to weigh the contribution of each fleet segment. We used daily catch weights, obtained from catch size frequencies on individual fishing days, to estimate catch per unit of effort (CpUE) by fleet segment (boat size * gear type), by WPP, by species. We defined CpUE as the catch (kg) per GT per active fishing day for each fleet segment in each WPP. There are clear differences in CpUE between fleet segments (Figure 2.4).

Activity data from Spot Trace on more than 400 CODRS boats were used to estimate the number of active fishing days per year for each fleet segment (Table 2.3), and we assumed that the number of fishing days was the same within fleet segments, irrespective of the WPP.

To calculate total catch by fleet segment (Table 2.6), we multiplied the CpUE for that gear segment with the number of fishing days per year and the total (hull) gross tonnage(GT) in each fleet segment (Table 2.5). See Table 2.7 for the catch by species in each WPP (all gears combined). Table 2.14 presents the average CpUE for each species in each WPP. Note that differences in CpUE between WPPs are caused by differences in fish abundance between WPPs, as well as by differences in fleet composition between WPPs. Hence, the average CpUE presented in Table 2.14 is not necessarily the same as the average CpUE estimated by the regression line in Figure 2.4, summarizes daily observations on catch for each CODRS vessel in the program since 2015

We calculated catch length-frequency distributions for each fleet segment in the same way as we calculated total catch volume for each fleet segment, namely by combining observation from CODRS with data from our frame survey. Tables 2.8 - 2.12 present the catch per species, over all WPPs, for each gear type, together with a basic length-based stock indicator (percentage immature fish by number and by weight)

As the CODRS program is still in development, some fleet segments 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 toget 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.

Table 2.1: 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 2.1: 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	Pengambengan	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 2.1: 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 Sedepap	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 2.1: 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 2.1: 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 2.1: 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 2.1: 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	Sofifi	Sofifi	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 2.1: 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 Parururang	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 2.1: 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

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.

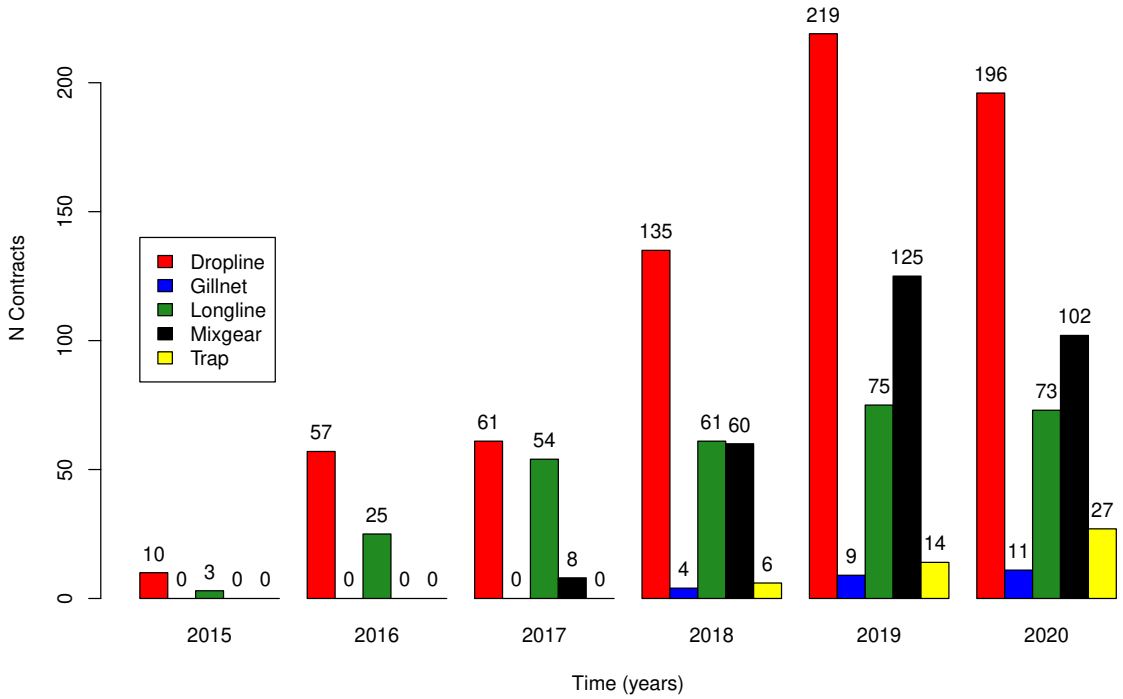

Figure 2.3: Number of CODRS Contractors by Gear Type Actively Fishing in Indonesian Waters.

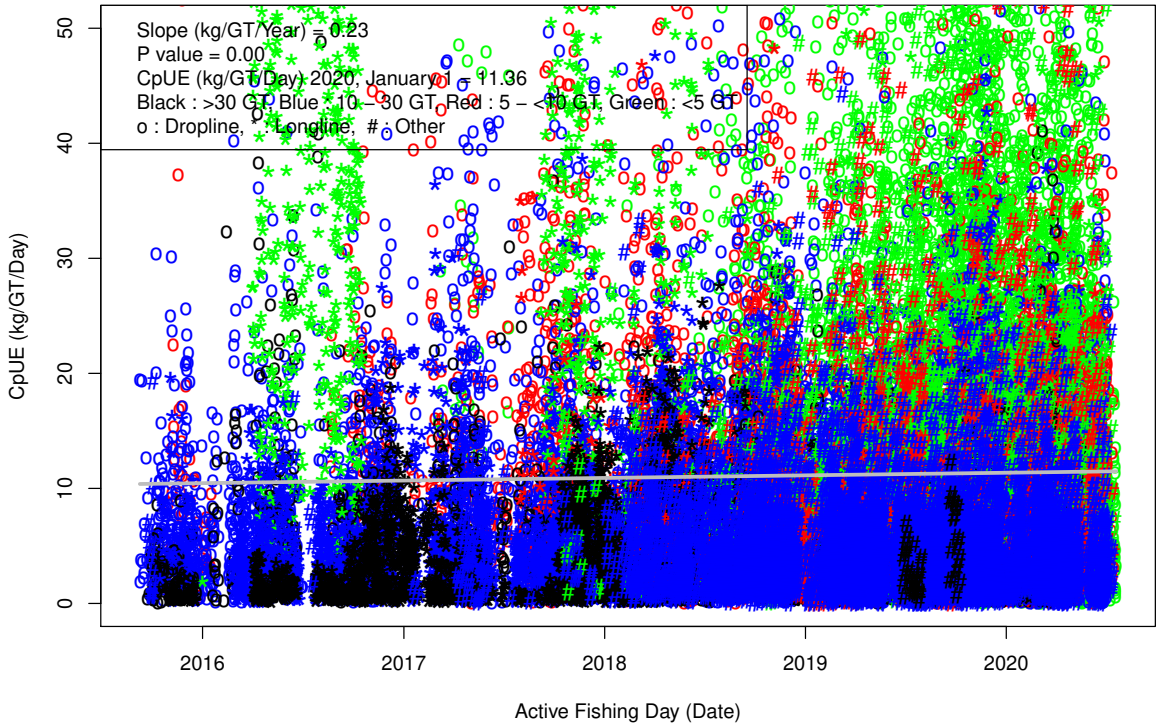

Figure 2.4: Catch-per-unit-effort (CpUE, in kg/GT/day) in deepwater demersal fisheries in Indonesia, all species combined. Each point represents the total catch of any fishing day recorded by a CODRS vessel, divided by the gross tonnage (hull) of that vessel. The regression line is based on these points, and therefore the regression line does not take into account any inconsistencies between the composition of total fleet versus the composition of CODRS. Hence the regression line should not be compared directly with the results presented in Table 2.14, which include a correction for such inconsistencies.

Table 2.2: Number of CODRS Deployed by Gear Type and Boat Size Category in Indonesian Waters

N	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano	115	15	0	6	24	160
Small	41	12	0	7	39	99
Medium	36	29	7	14	39	125
Large	4	17	4	0	NA	25
Total	196	73	11	27	102	409

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

Table 2.3: Average Active-Fishing Days per Year by Fishing Gear and Boat Size Category in Indonesian Waters

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 2.4: Current Number of Boats in the Fleet by Fishing Gear and Boat Size Category in Indonesia Waters

Number of Boat	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	3235	530	0	61	330	4156
Nano Seasonal	2169	316	3	20	678	3186
Small Dedicated	504	106	19	355	296	1280
Small Seasonal	402	25	6	0	5	438
Medium Dedicated	188	237	48	270	102	845
Medium Seasonal	92	8	6	1	0	107
Large Dedicated	22	200	93	2	0	317
Large Seasonal	0	0	0	0	0	0
Total	6612	1422	175	709	1411	10329

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

Table 2.5: Current Total Gross Tonnage of All Boats in the Fleet by Fishing Gear and Boat Size Category in Indonesian Waters

Gross Tonnage	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	3931	794	0	201	957	5884
Nano Seasonal	2959	356	13	27	915	4271
Small Dedicated	3402	805	117	2214	1823	8360
Small Seasonal	3340	184	36	0	32	3592
Medium Dedicated	3247	4822	1128	5100	1528	15826
Medium Seasonal	1616	134	97	24	0	1871
Large Dedicated	1325	12866	7021	65	0	21277
Large Seasonal	0	0	0	0	0	0
Total	19821	19962	8412	7631	5255	61081

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

Table 2.6: Total Catch in Metric Tons per Year by Fishing Gear and Boat Size Category in Indonesian Deep Water Demersal Fisheries for the most recent 365 days

Total Catch	Dropline	Longline	Gillnet	Trap	Mix Gear	Total
Nano Dedicated	20892	3053	0	444	3305	27694
Nano Seasonal	7149	469	22	22	1912	9575
Small Dedicated	10460	2282	261	9634	6678	29314
Small Seasonal	4730	292	66	0	70	5157
Medium Dedicated	6506	9885	2245	3847	1439	23923
Medium Seasonal	1668	160	145	87	0	2060
Large Dedicated	2515	16677	6550	145	0	25887
Large Seasonal	0	0	0	0	0	0
Total	53920	32818	9290	14178	13403	123609

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

Table 2.7: Total Catch in Metric Tons per Year for Top 20 Species by Volume in Indonesian Deep Water Demersal Fisheries with Species Distribution by WPP for the most recent 365 days

Species	571	572	573	711	712	713	714	715	716	717	718	Indonesia
Lutjanus malabaricus	27	13	588	6863	7855	1216	69	235	25	80	9579	26551
Pristipomoides multidens	374	170	1702	2034	6114	831	254	641	116	599	2560	15394
Aphareus rutilans	1	572	414	0	31	3549	346	5760	149	1400	19	12241
Epinephelus coioides	727	20	126	2714	1614	125	70	8	40	68	367	5877
Etelis radiosus	0	244	380	0	0	187	56	554	1447	1725	0	4594
Epinephelus areolatus	139	148	90	1446	856	223	27	37	4	128	230	3328
Etelis sp.	0	208	50	8	0	578	384	1024	68	784	9	3112
Pristipomoides typus	9	250	664	536	695	367	43	46	0	261	161	3033
Pristipomoides filamentosus	0	1312	161	1	65	106	47	1034	87	26	63	2903
Atrobucca brevis	0	0	0	0	0	0	0	0	0	0	2812	2812
Aprion virescens	0	1914	20	58	127	91	137	277	86	9	26	2747
Caranx sexfasciatus	74	135	96	35	191	459	158	505	194	170	71	2088
Lutjanus erythropterus	0	16	102	258	999	137	2	414	4	0	135	2068
Diagramma pictum	3	5	45	1207	318	310	40	10	14	0	1	1953
Etelis coruscans	0	158	91	0	0	61	161	707	249	463	0	1891
Lutjanus sebae	1	4	86	405	257	211	77	19	0	4	766	1829
Plectropomus maculatus	0	1	0	1316	298	30	16	25	4	1	53	1746
Lethrinus laticaudis	0	0	0	0	0	0	0	16	0	0	1468	1485
Gymnocranius grandoculis	0	40	32	209	312	230	41	106	145	59	265	1439
Elagatis bipinnulata	0	229	25	79	12	86	43	103	47	742	0	1366
Total Top 20 Species	1355	5441	4671	17168	19744	8797	1973	11520	2681	6520	18586	98456
Total Top 100 Species	1960	7845	6526	20307	22088	11473	3441	14139	4083	8164	23583	123609

Table 2.8: Top 20 Species by Volume in Indonesian Deepwater Demersal Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	26551	21	21	61	27	High
Pristipomoides multidens	15394	12	34	50	23	High
Aphareus rutilans	12241	10	44	51	21	High
Epinephelus coioides	5877	5	49	18	5	Med
Etelis radiosus	4594	4	52	68	27	High
Epinephelus areolatus	3328	3	55	3	1	Low
Etelis sp.	3112	3	58	56	27	High
Pristipomoides typus	3033	2	60	48	26	High
Pristipomoides filamentosus	2903	2	62	89	68	High
Atrobucca brevis	2812	2	65	17	8	Med
Aprion virescens	2747	2	67	89	67	High
Caranx sexfasciatus	2088	2	69	16	4	Med
Lutjanus erythropterus	2068	2	70	46	22	High
Diagramma pictum	1953	2	72	46	16	High
Etelis coruscans	1891	2	73	76	47	High
Lutjanus sebae	1829	1	75	75	35	High
Plectropomus maculatus	1746	1	76	11	2	Med
Lethrinus laticaudis	1485	1	77	0	0	Low
Gymnocranius grandoculis	1439	1	79	34	12	High
Elagatis bipinnulata	1366	1	80	21	6	Med
Total Top 20 Species	98456	80	80	45	24	High
Total Top 100 Species	123609	100	100	42	22	High

Table 2.9: Top 20 Species by Volume in Indonesian Dropline Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Aphareus rutilans	9366	17	17	51	21	High
Pristipomoides multidens	7313	14	31	55	25	High
Lutjanus malabaricus	6373	12	43	56	26	High
Etelis radiosus	4033	7	50	69	28	High
Etelis sp.	2567	5	55	56	27	High
Pristipomoides filamentosus	1780	3	58	87	63	High
Pristipomoides typus	1748	3	62	50	27	High
Etelis coruscans	1615	3	65	76	47	High
Epinephelus areolatus	1321	2	67	2	0	Low
Caranx sexfasciatus	1231	2	69	17	4	Med
Elagatis bipinnulata	1148	2	71	21	6	Med
Lutjanus erythropterus	1130	2	73	32	13	High
Pristipomoides sieboldii	731	1	75	61	43	High
Lethrinus laticaudis	717	1	76	0	0	Low
Paracaesio kusakarii	648	1	77	43	19	High
Seriola rivoliana	626	1	79	36	12	High
Aprion virescens	582	1	80	55	25	High
Lutjanus argentimaculatus	572	1	81	16	6	Med
Lethrinus olivaceus	545	1	82	7	2	Low
Lutjanus timorensis	543	1	83	49	27	High
Total Top 20 Species	44590	83	83	46	24	High
Total Top 100 Species	53920	100	100	41	23	High

Table 2.10: Top 20 Species by Volume in Indonesian Longline Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	7684	23	23	28	12	Med
Pristipomoides multidens	6047	18	42	32	14	High
Atrobucca brevis	2644	8	50	17	8	Med
Aphareus rutilans	1420	4	54	67	25	High
Epinephelus coioides	1296	4	58	15	4	Med
Lutjanus sebae	1014	3	61	46	19	High
Epinephelus areolatus	856	3	64	1	0	Low
Pristipomoides typus	755	2	66	34	14	High
Gymnocranius grandoculis	722	2	68	20	5	Med
Lethrinus laticaudis	689	2	70	0	0	Low
Lutjanus erythropterus	566	2	72	26	10	Med
Caranx ignobilis	566	2	74	4	2	Low
Diagramma pictum	560	2	76	6	1	Low
Caranx sexfasciatus	457	1	77	3	1	Low
Aprion virescens	402	1	78	25	8	Med
Lethrinus olivaceus	383	1	79	3	1	Low
Lutjanus argentimaculatus	380	1	81	9	4	Low
Plectropomus maculatus	344	1	82	4	0	Low
Carangoides chrysophrys	328	1	83	1	0	Low
Pristipomoides filamentosus	315	1	84	60	28	High
Total Top 20 Species	27427	84	84	21	10	Medium
Total Top 100 Species	32818	100	100	19	9	Medium

Table 2.11: Top 20 Species by Volume in Indonesian Gillnet Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	5459	59	59	13	6	Med
Caranx bucculentus	1070	12	70	0	0	Low
Diagramma labiosum	389	4	74	0	0	Low
Pristipomoides multidens	251	3	77	5	1	Low
Epinephelus coioides	191	2	79	NA	NA	
Aphareus rutilans	189	2	81	5	1	Low
Aprion virescens	172	2	83	22	9	Med
Atrobucca brevis	149	2	85	NA	NA	
Pristipomoides filamentosus	121	1	86	NA	NA	
Lethrinus laticaudis	78	1	87	NA	NA	
Lutjanus johnii	74	1	88	NA	NA	
Etelis radiosus	73	1	88	4	1	Low
Lethrinus olivaceus	67	1	89	0	0	Low
Pristipomoides typus	64	1	90	NA	NA	
Diagramma pictum	57	1	90	0	0	Low
Rachycentron canadum	54	1	91	2	0	Low
Lutjanus sebae	52	1	92	69	42	High
Caranx sexfasciatus	48	1	92	1	0	Low
Pristipomoides sieboldii	47	1	93	NA	NA	
Caranx ignobilis	46	0	93	11	4	Med
Total Top 20 Species	8651	93	93	10	5	Medium
Total Top 100 Species	9290	100	100	10	5	Medium

Table 2.12: Top 20 Species by Volume in Indonesian Trap Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	4803	34	34	82	47	High
Epinephelus coioides	2193	15	49	15	4	Med
Plectropomus maculatus	891	6	56	12	2	Med
Aphareus rutilans	767	5	61	NA	NA	
Diagramma pictum	742	5	66	49	20	High
Pristipomoides multidens	631	4	71	72	48	High
Epinephelus areolatus	572	4	75	8	2	Low
Lutjanus johnii	508	4	78	79	46	High
Lutjanus vitta	274	2	80	63	41	High
Pristipomoides typus	251	2	82	57	33	High
Lutjanus erythropterus	210	1	84	79	64	High
Lutjanus sebae	196	1	85	96	77	High
Pristipomoides filamentosus	193	1	86	NA	NA	
Aprion virescens	184	1	88	NA	NA	
Etelis sp.	141	1	89	NA	NA	
Carangoides gymnostethus	128	1	89	21	6	Med
Lethrinus lentjan	107	1	90	1	0	Low
Caranx sexfasciatus	107	1	91	NA	NA	
Epinephelus bleekeri	86	1	92	10	2	Low
Etelis radiosus	77	1	92	NA	NA	
Total Top 20 Species	13058	92	92	60	30	High
Total Top 100 Species	14178	100	100	59	30	High

Table 2.13: Top 20 Species by Volume in Indonesian Mixgears Fisheries with % Immature Fish in the Catch for the most recent 365 days.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	2233	17	17	82	46	High
Epinephelus coioides	1774	13	30	21	7	Med
Aprion virescens	1407	10	40	96	90	High
Pristipomoides multidens	1152	9	49	46	21	High
Epinephelus areolatus	540	4	53	2	0	Low
Aphareus rutilans	500	4	57	95	76	High
Pristipomoides filamentosus	493	4	60	97	93	High
Diagramma pictum	334	2	63	58	22	High
Epinephelus bleekeri	293	2	65	10	3	Med
Plectropomus maculatus	276	2	67	4	1	Low
Lutjanus johnii	260	2	69	82	50	High
Etelis radiosus	249	2	71	83	56	High
Caranx sexfasciatus	246	2	73	11	3	Med
Pristipomoides typus	215	2	74	50	28	High
Lutjanus argentimaculatus	196	1	76	NA	NA	
Lethrinus olivaceus	188	1	77	0	0	Low
Gymnocranius grandoculis	187	1	79	81	70	High
Seriola rivoliana	150	1	80	99	97	High
Caranx ignobilis	149	1	81	82	72	High
Lutjanus erythropterus	148	1	82	72	57	High
Total Top 20 Species	10990	82	82	61	40	High
Total Top 100 Species	13403	100	100	59	39	High

Table 2.14: CpUE in kg/GT/day for Top 20 Species by Volume in Indonesian Deep Water Demersal Fisheries with Species Distribution by WPP for the most recent 365 days

Species	571	572	573	711	712	713	714	715	716	717	718	Indonesia
Lutjanus malabaricus	0.18	0.03	1.33	2.68	3.67	1.28	0.36	0.55	0.17	0.21	2.28	2.20
Pristipomoides multidens	2.51	0.36	3.86	0.79	2.86	0.87	1.33	1.50	0.76	1.58	0.61	1.27
Aphareus rutilans	0.01	1.21	0.94	0.00	0.01	3.73	1.81	13.47	0.98	3.70	0.00	1.01
Epinephelus coioides	4.88	0.04	0.28	1.06	0.75	0.13	0.37	0.02	0.26	0.18	0.09	0.49
Etelis radiosus	0.00	0.52	0.86	0.00	0.00	0.20	0.30	1.29	9.51	4.55	0.00	0.38
Epinephelus areolatus	0.93	0.31	0.20	0.56	0.40	0.23	0.14	0.09	0.03	0.34	0.05	0.28
Etelis sp.	0.00	0.44	0.11	0.00	0.00	0.61	2.01	2.39	0.45	2.07	0.00	0.26
Pristipomoides typus	0.06	0.53	1.50	0.21	0.32	0.39	0.22	0.11	0.00	0.69	0.04	0.25
Pristipomoides filamentosus	0.00	2.77	0.37	0.00	0.03	0.11	0.25	2.42	0.57	0.07	0.02	0.24
Atrobucca brevis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.23
Aprion virescens	0.00	4.04	0.04	0.02	0.06	0.10	0.72	0.65	0.56	0.02	0.01	0.23
Caranx sexfasciatus	0.50	0.28	0.22	0.01	0.09	0.48	0.83	1.18	1.27	0.45	0.02	0.17
Lutjanus erythropterus	0.00	0.03	0.23	0.10	0.47	0.14	0.01	0.97	0.02	0.00	0.03	0.17
Diagramma pictum	0.02	0.01	0.10	0.47	0.15	0.33	0.21	0.02	0.09	0.00	0.00	0.16
Etelis coruscans	0.00	0.33	0.21	0.00	0.00	0.06	0.84	1.65	1.64	1.22	0.00	0.16
Lutjanus sebae	0.00	0.01	0.20	0.16	0.12	0.22	0.40	0.04	0.00	0.01	0.18	0.15
Plectropomus maculatus	0.00	0.00	0.00	0.51	0.14	0.03	0.09	0.06	0.03	0.00	0.01	0.14
Lethrinus laticaudis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.35	0.12
Gymnocranius grandoculis	0.00	0.08	0.07	0.08	0.15	0.24	0.21	0.25	0.95	0.16	0.06	0.12
Elagatis bipinnulata	0.00	0.48	0.06	0.03	0.01	0.09	0.22	0.24	0.31	1.96	0.00	0.11
Total Top 20 Species	9.09	11.47	10.59	6.69	9.23	9.25	10.33	26.94	17.62	17.21	4.42	8.15
Total Top 100 Species	13.15	16.54	14.79	7.92	10.32	12.06	18.02	33.06	26.84	34.41	5.60	10.23

Table 2.15: Spawning Potential Ratio (SPR) by WPP for the Top 20 Species in the Catch (by Volume for the most recent 365 days) in the Indonesian Deep Water Demersal Fisheries.

Species	571	572	573	711	712	713	714	715	716	717	718
Lutjanus malabaricus	1	NA	2	1	4	4	13	4	0	NA	2
Pristipomoides multidens	32	3	11	6	14	14	19	18	NA	7	18
Aphareus rutilans	NA	0	7	NA	NA	9	6	2	2	6	NA
Epinephelus coioides	18	NA	NA	33	36	40	87	NA	8	NA	34
Etelis radiosus	NA	0	12	NA	NA	8	4	3	15	2	NA
Epinephelus areolatus	42	35	30	20	26	13	16	6	NA	9	34
Etelis sp.	NA	2	1	NA	NA	13	3	2	NA	3	NA
Pristipomoides typus	NA	3	11	5	9	8	8	4	NA	5	16
Pristipomoides filamentosus	NA	0	2	NA	NA	0	0	3	0	NA	27
Atrobucca brevis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4
Aprion virescens	NA	0	NA	NA	NA	16	11	12	NA	NA	NA
Caranx sexfasciatus	73	100	NA	NA	49	65	50	63	NA	NA	72
Lutjanus erythropterus	NA	5	34	0	7	2	NA	13	3	NA	53
Diagramma pictum	NA	NA	58	22	14	83	NA	34	8	NA	NA
Etelis coruscans	NA	1	1	NA	NA	0	3	1	4	1	NA
Lutjanus sebae	NA	NA	2	0	0	0	NA	NA	NA	NA	3
Plectropomus maculatus	NA	NA	NA	100	100	42	55	NA	43	NA	100
Lethrinus laticaudis	NA	NA	NA	NA	NA	NA	NA	100	NA	NA	100
Gymnocranius grandoculis	NA	17	40	0	8	36	29	26	NA	NA	46
Elagatis bipinnulata	NA	7	NA	NA	NA	10	23	70	NA	20	NA

3 Global End Value of Indonesian Deep Demersal Fisheries Trade

3.1 Approach to estimating the Global End Value of the Trade

A global end value of the trade in 100 target species assessed in the Indonesian deep demersal fisheries has been estimated on the basis of catch volumes by species, percentages local retail and export by species and local as well as International retail (consumer) prices (Tables 3.1 and 3.2). Catch volumes by species are based on CODRS data and calculated and presented in Chapter 2 of this report. Estimated percentages of catch volumes destined for local retail and for export are based on interviews with buyers, sellers and traders at various points in local and International supply lines. Almost all species from the Indonesian deep demersal fisheries are sold to consumers locally, in Indonesia, as well as overseas in other Asian countries, in the USA, in Australia, in Europe, in Africa as well as in other regions around the World.

Target species sold in Indonesia on the domestic market are mostly sold as fresh products. Local retail price by species in Indonesia, was determined by averaging consumer prices at various locations including Balikpapan, Jakarta, Bali, Kupang, Makassar, Semarang, and Manado. Prices were collected from supermarkets (e.g. Papaya, Hypermart, Carefour, etc.), from online marketplaces (Instagram, Tokopedia, etc.), from seafood shops (both physical and online), and from local market that sell directly to end-customers (e.g. Damena, fish market Kupang, Kedonganan, Paotere, etc.). International retail values were collected from several major export destination countries, including mainly Asian countries (Malaysia, Singapore, China, and Hong Kong), Middle Eastern countries, the USA (multiple states and cities), and Australia. The retail values by species used in our assessment of the Global End Value are the averages of the consumer prices found in these countries.

All units of weight were converted to kilograms, processed products (fillets, etc.) were converted to whole fish using yield information by species, and all currencies were converted to US dollars. The global end value by species is calculated from the total catch volume, the percentages domestic sales and export, and the domestic as well as International retail prices.

3.2 Trade Characteristics of Important Species Groups

Red Snappers and White Snappers (*family Lutjanidae, subfamilies Lutjaninae, Paradichthyinae and Apsilinae*)

The Red Snapper species *Lutjanus malabaricus*, *L. sebae*, *L. timorensis*, *L. erythropterus* and *L. lemniscatus* are often grouped in the trade under Malabar or Red Snapper, with *L. sebae* also going as Red Emperor and *L. erythropterus* as Crimson Snapper. These species are often traded as frozen skin-on fillets with the USA as one of the main destinations. *Pinjalo lewisi* is often mixed in as well with the above species, while *P. pinjalo* is more often sold locally. High quality fresh Red Snappers are also sold fresh to various Asian markets. Additional Lutjanus species like *Lutjanus bitaeniatus*, *L. argentimaculatus*, *L. bohar*, *L. johnii*, *L. ruselli*, *L. lemniscatus*, *L. rivulatus*, *Lipocheilus carnolabrum* and *Symphorus nematophorus* are also often grouped and traded as Red Snapper or Lutjanus sp., at somewhat lower prices, and mainly sold as frozen skinless fillets to EU countries and Mauritius. *Lutjanus vitta* and *L. boutton* are sold mainly as "Surimi" or fish paste

products, with export destinations Japan and other Asian countries. The Paracaesio species including *Paracaesio gonzalesi*, *Paracaesio xanthura*, *Paracaesio kusakarii* and *Paracaesio stonei* are mostly sold as frozen White Snapper skinless fillets.

Eteline Snappers (*family Lutjanidae, subfamily Etelinae*)

The ruby colored and closely resembling species *Etelis sp.*, *E. radiosus* and *E. carbunculus*, are usually combined in a single group and traded as Ruby Sapper or Ehu. The valuable *E. coruscans* is sold separately as Flame snapper or Onaga. *Pristipomoides multidens* and *P. typus* are usually traded together as Gold Band Snapper but *P. multidens* is also sold separately in the Asian market. *P. filamentosus* is sold separately as Crimson Jobfish or Opakapaka, but also sometimes sold together with *P. typus* as Opakapaka. *P. sieboldii* (Kalekale), *P. argyrogrammicus*, and *P. flavipinnis* are mostly sold in the local market, with *P. sieboldii* also being exported in small quantities. *P. zonatus* is sold in the local market as "Kakap Bendera", but also exported in very small quantities to Hawaii as "Gindai". *Aprion virescens* or "Uku" is a high quality species but not much is exported. *Aphareus rutilans* has a darker (browner) meat, and therefore its value is not that high and it is not usually exported.

Groupers (*family Epinephelidae*)

Almost all grouper species from the deep demersal fisheries in Indonesia are destined for export to China and Taiwan as frozen whole fish, to Singapore, Hong Kong, other Asian & Middle Eastern countries as fresh whole fish and to the USA as frozen fillets. Red or golden or otherwise bright colored species are often the most valuable on the Asian markets and species like *Saloptia powelli*, *Cephalopholis miniata*, *Cephalopholis sexmaculata*, *Cephalopholis sonnerati*, *Cephalopholis igarashiensis*, *Epinephelus retouti*, *Epinephelus stictus*, *Plectropomus maculatus*, *Plectropomus leopardus*, and *Variola albimarginata* are sold mainly in fresh whole form in these countries. Other grouper species with brownish or dark skin color are mainly exported as frozen skinless fillets.

Emperors & Seabreams (*Lethrinidea*)

All Lethrinus species (Emperors) are mainly processed and traded as frozen skinless fillets, and destined for export to the USA and Australia. Some of the higher quality fish from this group are exported also as fresh whole fish to Australia, Asia and several Middle Eastern countries. Seabream species including *Wattsia mossambica*, *Gymnocranius grandoculis* and *Gymnocranius griseus* are mainly exported to Australia as frozen skinless fillets.

Sweetlips & Grunters (*Haemulidae*), ***Corvinas*** (*Sciaenidae*)
and ***Trevallies*** (*Carangidae*)

Sweetlips including *Diagramma labiosum* and *Diagramma pictum* are also mainly exported as frozen skinless fillets, to Australia and the USA. *Pomadasys kaakan* is mainly exported to Malaysia as Grunter, fresh whole fish, gutted and gilled, while their swimming bladders are exported to China. Species from the Corvina group include *Protonibea diacanthus* and *Atrobucca brevis*, which are commonly processed as frozen corvina skinless fillets, while swimming bladders from these species are also exported to China. Trevallies are mostly destined for local markets only, supposedly (according to some traders) because their meat breaks down and also changes color (into brown) rather quickly.

Table 3.1: Catch Volumes, Export Percentages, Retail Prices and Global End Value of the Trade in 100 Target Species from the Indonesian Deep Demersal Fisheries

Rank	Species Name	Weight (1000kg)	Local %	Export %	Retail Local (US$/kg)	Retail Intl. (US$/kg)	End Value (1000US$)	Value %	Cumm. %
1	Lutjanus malabaricus	26551	30	70	7.43	18.77	408043	30.6	30.6
2	Pristipomoides multidens	15394	30	70	4.20	15.74	189011	14.2	44.8
3	Epinephelus coioides	5877	30	70	8.62	13.02	68765	5.2	50.0
4	Etelis radiosus	4594	50	50	3.32	23.13	60754	4.6	54.6
5	Plectropomus maculatus	1746	30	70	6.47	38.93	50957	3.8	58.4
6	Epinephelus areolatus	3328	30	70	4.37	18.29	46966	3.5	61.9
7	Pristipomoides filamentosus	2903	50	50	2.47	29.49	46384	3.5	65.4
8	Etelis sp.	3112	50	50	3.32	23.13	41158	3.1	68.5
9	Etelis coruscans	1891	50	50	6.63	35.17	39515	3.0	71.5
10	Aphareus rutilans	12241	80	20	2.21	6.47	37482	2.8	74.3
11	Lutjanus erythropterus	2068	30	70	5.78	20.19	32820	2.5	76.8
12	Lutjanus sebae	1829	30	70	6.48	20.05	29232	2.2	78.9
13	Pristipomoides typus	3033	30	70	2.24	11.77	27023	2.0	81.0
14	Aprion virescens	2747	60	40	3.47	11.10	17917	1.3	82.3
15	Diagramma pictum	1953	40	60	7.30	9.54	16879	1.3	83.6
16	Lutjanus johnii	1244	30	70	7.74	10.96	12432	0.9	84.5
17	Lutjanus argentimaculatus	1231	30	70	6.14	10.88	11646	0.9	85.4
18	Lutjanus timorensis	752	30	70	3.32	20.19	11377	0.9	86.3
19	Atrobucca brevis	2812	30	70	3.32	3.69	10063	0.8	87.0
20	Plectropomus leopardus	368	30	70	5.08	34.45	9440	0.7	87.7
21	Epinephelus bleekeri	975	30	70	4.31	11.86	9352	0.7	88.4
22	Caranx sexfasciatus	2088	100	0	4.09	5.12	8541	0.6	89.1
23	Lethrinus olivaceus	1243	40	60	5.31	7.68	8365	0.6	89.7
24	Gymnocranius grandoculis	1439	40	60	3.98	6.45	7859	0.6	90.3
25	Lethrinus laticaudis	1485	60	40	3.98	6.45	7376	0.6	90.8
26	Lutjanus vitta	878	30	70	4.98	9.45	7121	0.5	91.4
27	Elagatis bipinnulata	1366	100	0	4.64	6.45	6336	0.5	91.8
28	Paracaesio kusakarii	770	40	60	2.65	11.21	5993	0.5	92.3
29	Cephalopholis sonnerati	483	30	70	4.23	11.86	4625	0.3	92.6
30	Diagramma labiosum	620	40	60	5.97	7.66	4332	0.3	93.0
31	Caranx bucculentus	1185	100	0	3.65	5.12	4327	0.3	93.3
32	Caranx ignobilis	1175	100	0	3.65	5.12	4288	0.3	93.6
33	Lethrinus lentjan	656	40	60	5.31	6.53	3962	0.3	93.9
34	Seriola rivoliana	1026	100	0	3.65	6.45	3743	0.3	94.2
35	Epinephelus latifasciatus	387	30	70	4.31	11.86	3712	0.3	94.5
36	Lutjanus gibbus	569	70	30	4.35	11.21	3645	0.3	94.7
37	Lutjanus bohar	502	30	70	2.65	8.87	3517	0.3	95.0
38	Pristipomoides sieboldii	876	80	20	2.32	8.87	3179	0.2	95.2
39	Lutjanus boutton	356	30	70	2.65	11.21	3077	0.2	95.5
40	Carangoides gymnostethus	416	100	0	7.30	5.12	3037	0.2	95.7
41	Variola albimarginata	202	30	70	5.64	17.30	2784	0.2	95.9
42	Carangoides chrysophrys	754	100	0	3.65	5.94	2753	0.2	96.1
43	Epinephelus amblycephalus	259	30	70	4.31	11.86	2484	0.2	96.3
44	Protonibea diacanthus	437	30	70	3.32	6.45	2406	0.2	96.5
45	Caranx tille	714	100	0	3.32	5.12	2372	0.2	96.7
46	Symphorus nematophorus	242	30	70	6.45	11.21	2365	0.2	96.8
47	Lutjanus russelli	256	50	50	6.37	11.01	2225	0.2	97.0
48	Paracaesio xanthura	279	40	60	2.65	11.21	2169	0.2	97.2
49	Erythrocles schlegelii	607	100	0	3.32	6.45	2016	0.2	97.3
50	Lethrinus nebulosus	342	40	60	3.98	6.75	1928	0.1	97.5
	SUB-TOTAL	118258					1297753		

Table 3.2: (Cont. Table 3.1) Catch Volumes, Export Percentages, Retail Prices and Global End Value of the Trade in 100 Target Species from the Indonesian Deep Demersal Fisheries

Rank	Species Name	Weight (1000kg)	Local %	Export %	Retail Local (US$/kg)	Retail Intl. (US$/kg)	End Value (1000US$)	Value %	Cumm. %
51	Epinephelus epistictus	201	30	70	4.31	11.86	1927	0.1	97.6
52	Rachycentron canadum	314	40	60	1.99	8.32	1819	0.1	97.8
53	Paracaesio stonei	222	40	60	2.65	11.21	1729	0.1	97.9
54	Pinjalo lewisi	242	60	40	4.31	11.21	1710	0.1	98.0
55	Pinjalo pinjalo	231	60	40	4.31	11.21	1633	0.1	98.1
56	Sphyraena barracuda	384	50	50	1.99	6.45	1622	0.1	98.3
57	Lutjanus rivulatus	205	40	60	2.65	11.21	1592	0.1	98.4
58	Hyporthodus octofasciatus	162	30	70	4.31	11.86	1559	0.1	98.5
59	Epinephelus malabaricus	161	30	70	3.65	11.86	1512	0.1	98.6
60	Paracaesio gonzalesi	172	40	60	2.65	11.21	1337	0.1	98.7
61	Pomadasys kaakan	230	50	50	3.32	8.00	1302	0.1	98.8
62	Carangoides fulvoguttatus	279	100	0	3.65	5.12	1019	0.1	98.9
63	Epinephelus morrhua	105	30	70	4.31	11.86	1003	0.1	99.0
64	Lethrinus amboinensis	197	60	40	3.98	6.45	978	0.1	99.0
65	Glaucosoma buergeri	170	40	60	3.32	6.45	884	0.1	99.1
66	Lethrinus rubrioperculatus	138	40	60	3.98	7.68	858	0.1	99.2
67	Cephalopholis miniata	85	30	70	3.98	11.86	807	0.1	99.2
68	Sphyraena putnamae	184	50	50	1.99	6.45	776	0.1	99.3
69	Lipocheilus carnolabrum	89	40	60	2.65	11.21	695	0.1	99.3
70	Gymnocranius griseus	124	40	60	3.98	6.45	678	0.1	99.4
71	Epinephelus multinotatus	68	30	70	4.31	11.86	655	0.0	99.4
72	Cephalopholis sexmaculata	64	30	70	4.31	11.86	614	0.0	99.5
73	Sphyraena forsteri	127	50	50	1.16	6.45	484	0.0	99.5
74	Wattsia mossambica	110	90	10	3.98	6.45	465	0.0	99.6
75	Caranx lugubris	118	100	0	3.65	5.12	429	0.0	99.6
76	Carangoides coeruleopinnatus	129	100	0	3.32	5.12	428	0.0	99.6
77	Epinephelus radiatus	44	30	70	4.31	11.86	425	0.0	99.6
78	Epinephelus heniochus	43	30	70	4.31	11.86	415	0.0	99.7
79	Epinephelus stictus	43	30	70	4.31	11.86	415	0.0	99.7
80	Lutjanus lemniscatus	48	50	50	4.31	11.21	369	0.0	99.7
81	Epinephelus retouti	38	30	70	4.31	11.86	367	0.0	99.8
82	Argyrops spinifer	85	90	10	3.32	10.15	340	0.0	99.8
83	Seriola dumerili	91	100	0	3.65	7.42	332	0.0	99.8
84	Pristipomoides flavipinnis	108	90	10	2.32	8.87	320	0.0	99.8
85	Etelis carbunculus	21	50	50	3.32	23.13	281	0.0	99.9
86	Epinephelus chlorostigma	29	30	70	4.31	11.86	279	0.0	99.9
87	Epinephelus bilobatus	29	30	70	4.31	11.86	276	0.0	99.9
88	Epinephelus poecilonotus	27	30	70	4.31	11.86	258	0.0	99.9
89	Epinephelus undulosus	23	30	70	4.31	11.86	224	0.0	99.9
90	Epinephelus miliaris	16	30	70	4.31	11.86	157	0.0	99.9
91	Pristipomoides zonatus	31	90	10	2.32	22.29	132	0.0	100.0
92	Cookeolus japonicus	32	90	10	2.65	6.45	98	0.0	100.0
93	Parascolopsis eriomma	48	100	0	1.99	6.45	96	0.0	100.0
94	Pristipomoides argyrogrammicus	25	80	20	2.32	8.87	90	0.0	100.0
95	Lutjanus bitaeniatus	15	90	10	3.32	8.87	59	0.0	100.0
96	Cephalopholis igarashiensis	5	30	70	4.31	11.86	49	0.0	100.0
97	Saloptia powelli	4	30	70	4.31	11.86	42	0.0	100.0
98	Dentex carpenteri	11	90	10	3.32	6.45	41	0.0	100.0
99	Ostichthys japonicus	15	90	10	1.99	6.45	37	0.0	100.0
100	Carangoides malabaricus	6	100	0	3.65	5.67	23	0.0	100.0
	SUB-TOTAL	5351					33643		
	TOTAL	123609					1331396		

4 Discussion and Conclusions

The deep demersal fisheries for snappers, groupers and emperors are fairly clean fisheries when it comes to the species spectrum in the catch, even though these fisheries are much more species-rich then sometimes assumed, also within the snapper category, which forms the main target group. Some questions still remain on by-catch of sharks and what happens with those, as shark fishing is legal in most but not all places in Indonesia, and finning of shark by catch would be problematic in relation to MSC certification if carcasses would not be landed or used otherwise as bait for example. Further information on this issue is still being collected and analysed (Table 1.5).

The major gear types in the deep demersal fisheries for snappers, groupers and emperors are drop lines and bottom long lines. Drop line and ling line fisheries are characterized by a low impact on habitat at the fishing grounds. There will be some tangling with various life forms or structure on the bottom at the fishing grounds, but captains avoid areas with high or complicated structure as they do not want to lose their gear through tangling. Habitat impact by hook and line fishing is nowhere near the impact from destructive dragging gears, for example, and also much less than could be expected from other demersal fisheries with nets or traps. However, due to a very high fishing effort on the best known fishing grounds, there is a high potential for overfishing of target species in these fisheries.

Risks of overfishing are high for the larger snapper species which are common on deep slopes and continental shelve areas throughout Indonesia, and which are readily caught with various types of gear. Fishing mortality in many 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 landed well below the size where these fish reach maturity and almost all of the larger species are harvested well below the optimum size. Only a few of the somewhat smaller snapper species seem to be excluded from this general pattern. Larger specimen of the largest snapper species have become extremely rare in our region.

The top 10 snapper species in the deep demersal fisheries are all considered at high risk overfishing, based on length based indicators. This pattern is consistent over a range of indicators used in our assessment, with only a few indicators for a few species indicating medium risk. Fishing effort and fishing mortality have been too high in recent years. Time trends show continued deterioration in the stocks of most species, especially the Lutjanids, as assessed with combined data from across all Indonesian fishing grounds. There are some exceptions only for a small number of non-snapper species such as for example *Pomadasys kaakan* and *Caranx bucculentus*.

For more details on any species we need to look at the data by WPP when drawing conclusions and separate assessment reports are available for each WPP. Trends in length based indicators can be compared with trends in CpUE by gear types and boat size category, but we need to take into account that not all boat sizes and gear types are used in all WPP so specific gear type and boat size combinations are usually characteristic only for specific WPP. This also means that in presentations that combine all data from Indonesia, we can expect different trends for specific fleet segments, representing the trends that belong to the WPP where those fleet segments are most common. In addition, fishing behaviour is changing all the time for various reasons, potentially obscuring trends in CpUE.

Overall we are currently looking at a high risk of overfishing for all major snapper species in Indonesia, combined with a worrisome trend of deterioration in these snapper stocks, based on the size based stock assessments from deep demersal fisheries. Interestingly though, the groupers seem to be less vulnerable to these fisheries than the snappers are. Impact on grouper populations may be limited because most groupers are staying closer to high rugosity bottom habitat, while fishers will be avoiding such areas to prevent tangling. Fishing mortality (from deep demersal fisheries) 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 demersal fisheries.

For those grouper species which spend all or most of their life cycle in high rugosity habitats on shelf and deep slope fishing grounds, the relatively low vulnerability to the deep demersal 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 in-shore 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 species (such as emperors, trevallies and grunts) 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 colour 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.

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 may already be 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. At present these fisheries show clear signs of over-exploitation in Indonesia. There may be some differences between various major fishing areas in the country, but all of them show the same general pattern and fleets move from one area to another for a variety of reasons, including expectations on better catches in areas which they expect to be under less fishing pressure at present.

Highly important fishing grounds in the Arafura Sea, Makassar Strait, Java Sea and South China Sea are heavily fished by large numbers of Indonesian fishing boats targeting the snapper resources there. Possibly the main reason that the fishery is still so profitable in areas like the Arafura Sea is that there is such a huge amount of shelf habitat just across the Australian border. The Australian fishing grounds are much better managed and experiences much lower fishing pressure. The Indonesian boats are fishing the line in the most literal sense here, profiting from a spill-over effect from that Australian shelf area where stocks of target species are in decent shape. The differences in stock densities on either side of the border are stark and very well known by fishing boat captains. In the past this has led to IUU incidents and arrests of Indonesian boats on the Australian side of the border, although these incidents have become much less frequent in recent years.

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 size-based indicators will show in which direction these fisheries are heading and what the effects are of any fisheries management measures in future years.

Government policies and regulations 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.

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