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Catch, Effort and Retail Value of Fisheries Targeting Snappers, Groupers and Emperors In Indonesia

YKAN Technical Paper

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Abstract

This report describes catch, effort, catch-per-unit-of-effort, and retail value of the Indonesia deepwater demersal fishery targeting snappers, disaggregated by species, gear, and by Indonesia Fishery Management Area (WPP). The report features a table with details on the snapper fishing vessels operating in Indonesia's Exclusive Economic Zone, including the main WPP where the boat operates. Findings are based on a country-wide frame survey and on YKAN's Crew-Operated Data Recording System, an initiative that involves fishers in data collection using digital imagery.

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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 catch 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 samples 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/FishID.pdf
[2] http://72.14.187.103:8080/ifish/pub/IFishAssessmentGuide.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.

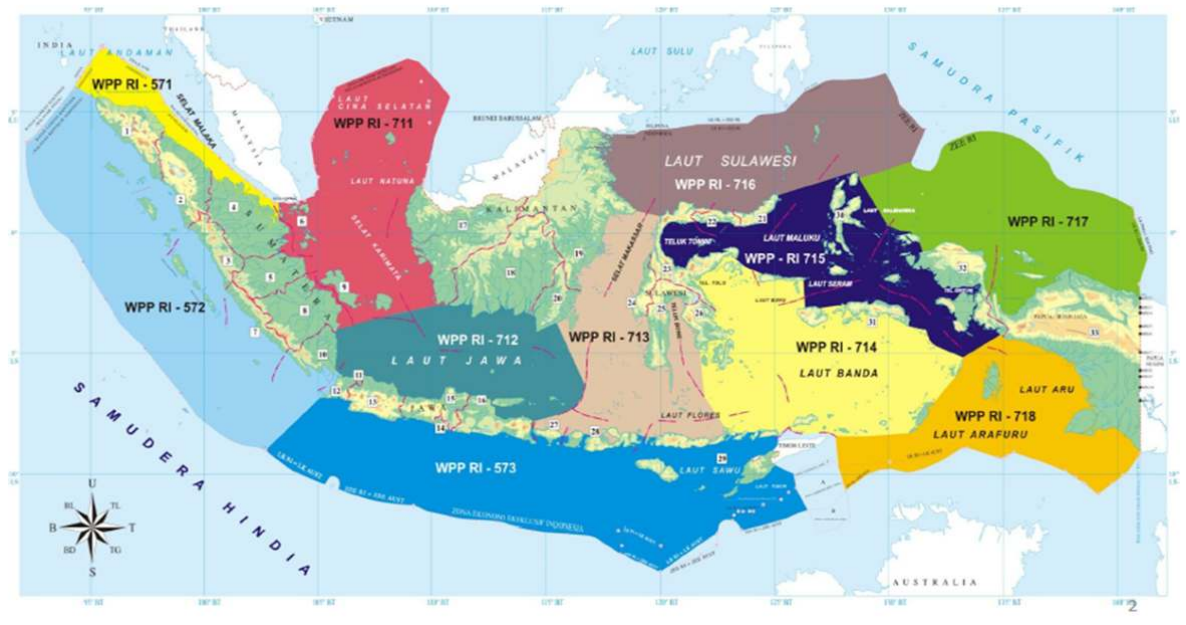

Figure 1.1: Fisheries Management Areas (*Wilayah Pengelolaan Perikanan* or WPP) in Indonesian marine waters.

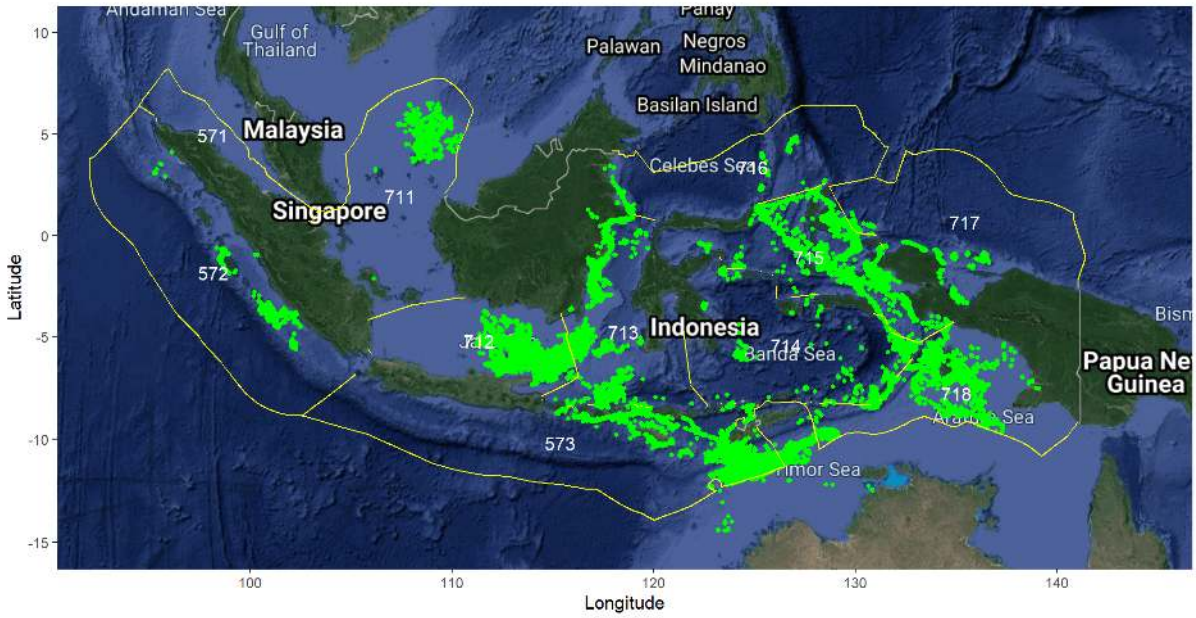

Figure 1.2: Fishing positions of dropliners participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

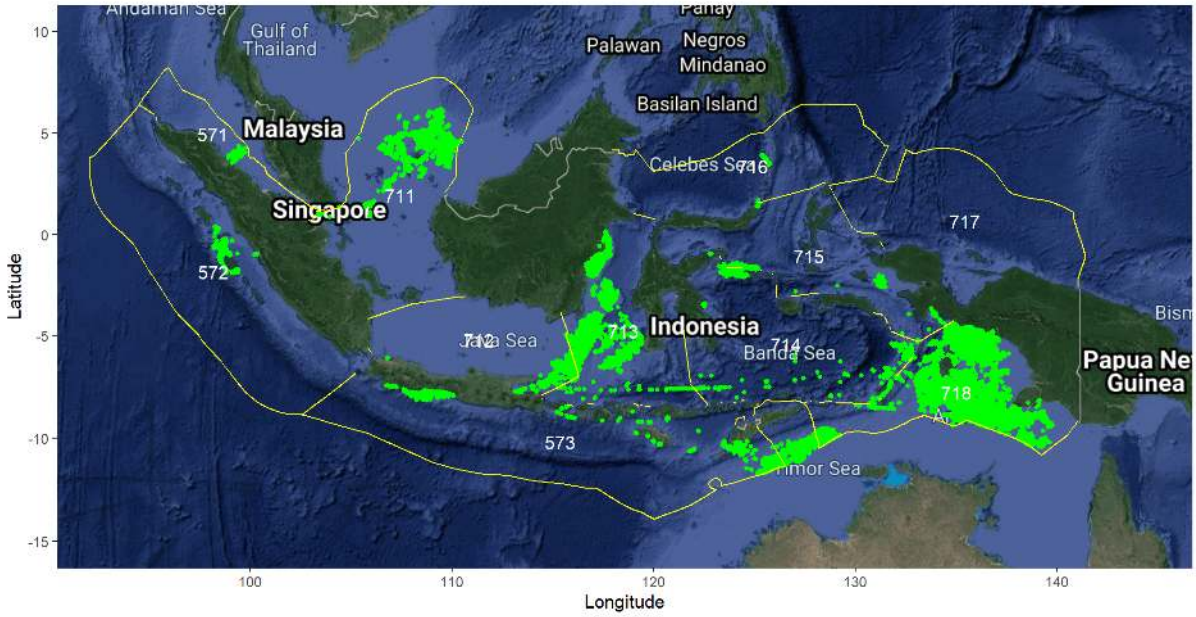

Figure 1.3: Fishing positions of longliners participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Reported positions during steaming, anchoring, or docking are excluded from this map.

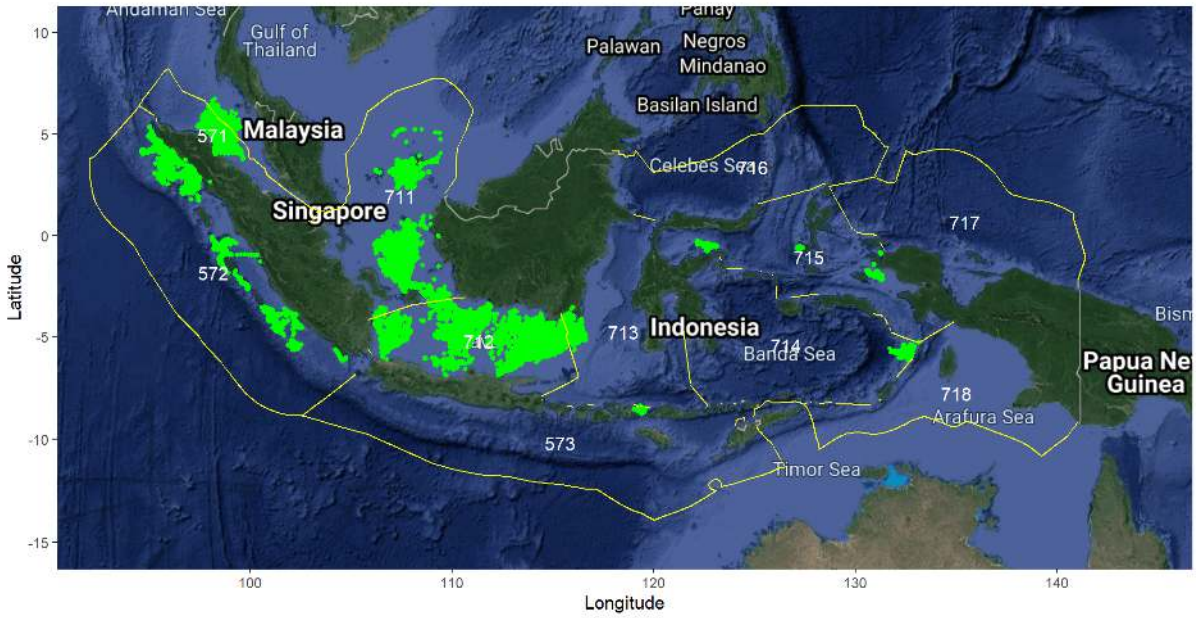

Figure 1.4: Fishing positions of vessels applying more than one gear, participating in the CODRS program over the years 2014 - 2019, as reported by Spot Trace. Gears used by the vessels in this group are a combination of droplines, longlines, traps, and gillnets. Reported positions during steaming, anchoring, 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 boweni	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	25794	79336	165341	211682	228020	0	0	0	0	710173
2	Atrobucca brevis	239	1256	98638	272201	242111	0	0	0	0	614445
3	Pristipomoides multidens	37308	76865	89386	129508	171672	0	0	0	0	504739
4	Epinephelus areolatus	12220	26089	57150	101766	122587	0	0	0	0	319812
5	Pristipomoides typus	10872	40981	51857	60421	72392	0	0	0	0	236523
6	Lutjanus erythropterus	2814	12686	40396	45597	55565	0	0	0	0	157058
7	Lutjanus vitta	2089	6700	29172	47668	52813	0	0	0	0	138442
8	Pristipomoides sieboldii	1085	5352	7841	13526	79956	0	0	0	0	107760
9	Pristipomoides filamentosus	5716	8523	12704	22748	58052	0	0	0	0	107743
10	Aphareus rutilans	4371	9668	13827	28097	41629	0	0	0	0	97592
11	Lethrinus laticaudis	3785	11178	30434	21646	26805	0	0	0	0	93848
12	Lutjanus sebae	2948	8903	16038	24316	22762	0	0	0	0	74967
13	Epinephelus coioides	615	1460	6901	24567	36256	0	0	0	0	69799
14	Diagramma pictum	481	3135	12394	20233	29700	0	0	0	0	65943
15	Etelis boweni	2878	8032	12882	12554	18374	0	0	0	0	54720
16	Lutjanus timorensis	1812	5282	7346	15180	18395	0	0	0	0	48015
17	Lethrinus lentjan	789	2848	8813	15324	17379	0	0	0	0	45153
18	Etelis coruscans	1450	5807	10029	10169	15978	0	0	0	0	43433
19	Paracaesio kusakarii	4087	9916	9299	6919	11762	0	0	0	0	41983
20	Pinjalo lewisi	1329	6416	7492	6769	19828	0	0	0	0	41834
21	Gymnocranius grandoculis	2330	6678	7242	11024	11867	0	0	0	0	39141
22	Etelis radiosus	842	2585	4145	11616	19690	0	0	0	0	38878
23	Pomadasys kaakan	2559	2610	7387	6116	16819	0	0	0	0	35491
24	Carangoides chrysophrys	651	2591	7501	13127	10501	0	0	0	0	34371
25	Pinjalo pinjalo	22	408	8612	12669	8802	0	0	0	0	30513
26	Plectropomus maculatus	14	213	4792	9247	14165	0	0	0	0	28431
27	Lutjanus johnii	612	1719	4308	9746	11629	0	0	0	0	28014
28	Caranx sexfasciatus	267	1252	4710	8631	12138	0	0	0	0	26998
29	Epinephelus bleekeri	318	1186	3039	8602	13527	0	0	0	0	26672
30	Lutjanus gibbus	167	469	2035	9189	13664	0	0	0	0	25524
31	Lutjanus russelli	286	1539	4006	7032	8974	0	0	0	0	21837
32	Lethrinus olivaceus	352	1443	2507	7168	9732	0	0	0	0	21202
33	Cephalopholis sonnerati	791	1820	3314	7225	7753	0	0	0	0	20903
34	Lutjanus boutton	85	531	2277	7144	10368	0	0	0	0	20405
35	Aprion virescens	421	1445	1494	10242	6451	0	0	0	0	20053
36	Lutjanus argentimaculatus	743	2166	3240	5618	5885	0	0	0	0	17652
37	Paracaesio xanthura	316	783	1919	2896	11131	0	0	0	0	17045
38	Caranx bucculentus	339	3712	4316	5281	3357	0	0	0	0	17005
39	Paracaesio stonei	789	3491	3355	3521	4717	0	0	0	0	15873
40	Plectropomus leopardus	228	477	2722	4898	7337	0	0	0	0	15662
41	Parascolopsis eriomma	99	106	1708	2246	9835	0	0	0	0	13994
42	Erythrocles schlegelii	280	1856	2517	3049	6088	0	0	0	0	13790
43	Caranx ignobilis	160	759	3141	4417	5271	0	0	0	0	13748
44	Seriola rivoliana	463	1519	2441	4868	4361	0	0	0	0	13652
45	Wattsia mossambica	1068	2186	3362	3519	3362	0	0	0	0	13497
46	Variola albimarginata	101	378	1594	5329	6022	0	0	0	0	13424
47	Diagramma labiosum	464	1431	3179	4019	3169	0	0	0	0	12262
48	Lutjanus bohar	297	1029	2095	4177	4593	0	0	0	0	12191
49	Carangoides coeruleopinnatus	239	1358	3602	4920	2060	0	0	0	0	12179
50	Elagatis bipinnulata	188	616	1652	4632	5089	0	0	0	0	12177

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	710173	710173	16	16	1653898	1653898	25	25
2	100	Atrobucca brevis	614445	1324618	14	30	435664	2089562	6	31
3	7	Pristipomoides multidens	504739	1829357	11	41	925138	3014700	14	45
4	45	Epinephelus areolatus	319812	2149169	7	49	128295	3142994	2	47
5	8	Pristipomoides typus	236523	2385692	5	54	295041	3438035	4	51
6	21	Lutjanus erythropterus	157058	2542750	4	57	174591	3612627	3	54
7	27	Lutjanus vitta	138442	2681192	3	61	37668	3650295	1	54
8	10	Pristipomoides sieboldii	107760	2788952	2	63	61303	3711598	1	55
9	9	Pristipomoides filamentosus	107743	2896695	2	65	129502	3841101	2	57
10	1	Aphareus rutilans	97592	2994287	2	68	249844	4090945	4	61
11	64	Lethrinus laticaudis	93848	3088135	2	70	170802	4261747	3	63
12	18	Lutjanus sebae	74967	3163102	2	71	148361	4410108	2	66
13	50	Epinephelus coioides	69799	3232901	2	73	273532	4683641	4	70
14	90	Diagramma pictum	65943	3298844	1	75	78968	4762608	1	71
15	4	Etelis boweni	54720	3353564	1	76	216094	4978702	3	74
16	19	Lutjanus timorensis	48015	3401579	1	77	37768	5016470	1	75
17	63	Lethrinus lentjan	45153	3446732	1	78	34434	5050904	1	75
18	6	Etelis coruscans	43433	3490165	1	79	74119	5125023	1	76
19	34	Paracaesio kusakarii	41983	3532148	1	80	74724	5199747	1	77
20	22	Pinjalo lewisi	41834	3573982	1	81	24728	5224474	0	78
21	70	Gymnocranius grandoculis	39141	3613123	1	82	65592	5290067	1	79
22	5	Etelis radiosus	38878	3652001	1	83	98032	5388099	1	80
23	91	Pomadasys kaakan	35491	3687492	1	83	53420	5441519	1	81
24	75	Carangoides chrysophrys	34371	3721863	1	84	51727	5493246	1	82
25	23	Pinjalo pinjalo	30513	3752376	1	85	23435	5516681	0	82
26	60	Plectropomus maculatus	28431	3780807	1	85	73144	5589826	1	83
27	24	Lutjanus johnii	28014	3808821	1	86	50293	5640119	1	84
28	80	Caranx sexfasciatus	26998	3835819	1	87	80061	5720180	1	85
29	46	Epinephelus bleekeri	26672	3862491	1	87	49049	5769229	1	86
30	20	Lutjanus gibbus	25524	3888015	1	88	14701	5783930	0	86
31	25	Lutjanus russelli	21837	3909852	0	88	12900	5796830	0	86
32	66	Lethrinus olivaceus	21202	3931054	0	89	74222	5871052	1	87
33	39	Cephalopholis sonnerati	20903	3951957	0	89	19481	5890533	0	88
34	28	Lutjanus boutton	20405	3972362	0	90	8024	5898557	0	88
35	2	Aprion virescens	20053	3992415	0	90	49093	5947650	1	89
36	15	Lutjanus argentimaculatus	17652	4010067	0	91	60820	6008470	1	90
37	33	Paracaesio xanthura	17045	4027112	0	91	10074	6018544	0	90
38	77	Caranx bucculentus	17005	4044117	0	91	31937	6050481	0	90
39	35	Paracaesio stonei	15873	4059990	0	92	20143	6070624	0	90
40	61	Plectropomus leopardus	15662	4075652	0	92	23656	6094280	0	91
41	96	Parascolopsis eriomma	13994	4089646	0	92	2200	6096480	0	91
42	85	Erythrocles schlegelii	13790	4103436	0	93	29037	6125517	0	91
43	78	Caranx ignobilis	13748	4117184	0	93	53834	6179351	1	92
44	84	Seriola rivoliana	13652	4130836	0	93	47478	6226829	1	93
45	69	Wattsia mossambica	13497	4144333	0	94	13763	6240592	0	93
46	62	Variola albimarginata	13424	4157757	0	94	5692	6246284	0	93
47	89	Diagramma labiosum	12262	4170019	0	94	26237	6272521	0	93
48	16	Lutjanus bohar	12191	4182210	0	95	31263	6303785	0	94
49	72	Carangoides coeruleopinnatus	12179	4194389	0	95	13079	6316864	0	94
50	82	Elagatis bipinnulata	12177	4206566	0	95	19118	6335982	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	%Sample
Acanthuridae	0	0	540	1284	2888	0	0	0	0	4712	0.107
Alepisauridae	0	0	0	0	44	0	0	0	0	44	0.001
Ariidae	13	637	2565	8864	12552	0	0	0	0	24631	0.557
Ariommatidae	0	0	0	249	472	0	0	0	0	721	0.016
Balistidae	0	11	1862	5761	9617	0	0	0	0	17251	0.390
Belonidae	0	0	0	1	11	0	0	0	0	12	0.000
Bramidae	9	0	0	378	47	0	0	0	0	434	0.010
Caesionidae	0	0	1122	5094	15821	0	0	0	0	22037	0.498
Carangidae	184	2286	22452	67470	38147	0	0	0	0	130539	2.951
Chaetodontidae	0	0	94	75	227	0	0	0	0	396	0.009
Clupeidae	0	0	0	9	66	0	0	0	0	75	0.002
Coryphaenidae	0	0	152	560	1071	0	0	0	0	1783	0.040
Ephippidae	0	0	643	1757	1806	0	0	0	0	4206	0.095
Epinephelidae	62	338	1990	8047	9944	0	0	0	0	20381	0.461
Gempylidae	6	0	77	435	842	0	0	0	0	1360	0.031
Haemulidae	7	10	318	1172	1322	0	0	0	0	2829	0.064
Holocentridae	4	94	266	3395	3700	0	0	0	0	7459	0.169
Istiophoridae	0	0	0	11	7	0	0	0	0	18	0.000
Labridae	0	0	270	774	667	0	0	0	0	1711	0.039
Lethrinidae	102	413	2822	12689	15209	0	0	0	0	31235	0.706
Lobotidae	0	0	9	54	153	0	0	0	0	216	0.005
Lutjanidae	30	339	2637	10039	16455	0	0	0	0	29500	0.667
Malacanthidae	27	35	27	72	939	0	0	0	0	1100	0.025
Monacanthidae	0	0	202	326	245	0	0	0	0	773	0.017
Mugilidae	0	0	0	9	2	0	0	0	0	11	0.000
Mullidae	0	0	85	770	3352	0	0	0	0	4207	0.095
Muraenesocidae	0	0	123	1839	2749	0	0	0	0	4711	0.106
Nemipteridae	16	299	2080	5849	10738	0	0	0	0	18982	0.429
Ophichthidae	0	0	0	0	13	0	0	0	0	13	0.000
Other	261	3595	5709	4417	4531	0	0	0	0	18513	0.418
Polynemidae	0	0	0	30	13	0	0	0	0	43	0.001
Pomacanthidae	0	0	12	101	75	0	0	0	0	188	0.004
Priacanthidae	2	104	370	2802	4155	0	0	0	0	7433	0.168
Psettodidae	0	0	0	1613	266	0	0	0	0	1879	0.042
Rachycentridae	0	0	4	12	14	0	0	0	0	30	0.001
Rays	1	118	437	1218	1941	0	0	0	0	3715	0.084
Scaridae	0	0	125	593	1970	0	0	0	0	2688	0.061
Sciaenidae	0	0	5	319	1245	0	0	0	0	1569	0.035
Scombridae	93	1011	5635	9537	9254	0	0	0	0	25530	0.577
Scorpaenidae	0	0	4	26	128	0	0	0	0	158	0.004
Serranidae	3	17	56	150	496	0	0	0	0	722	0.016
Sharks	7	893	2662	2221	3272	0	0	0	0	9055	0.205
Siganidae	0	0	337	1798	2731	0	0	0	0	4866	0.110
Sparidae	0	0	2	53	10	0	0	0	0	65	0.001
Sphyraenidae	22	210	523	759	581	0	0	0	0	2095	0.047
Synodontidae	0	0	0	0	14	0	0	0	0	14	0.000
Terapontidae	0	0	0	3	191	0	0	0	0	194	0.004
Tetraodontidae	0	0	133	155	242	0	0	0	0	530	0.012
Trichiuridae	0	0	614	5206	8946	0	0	0	0	14766	0.334
Total	849	10410	56964	167996	189181	0	0	0	0	425400	9.615

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 a 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 targeting 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.

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 the Crew Operated Data Recording Systems or CODRS. Fishers take pictures of all fish in the 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 he hands over the storage chip of the camera to a program technician. Sometimes, the captain does not receive a receipt, and in such cases 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 be landing. 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 2.13 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 2.13 is not necessarily the same as the average CpUE estimated by the regression line in Figure 2.4, which 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 to get the estimated total annual catch for that fleet segment. This means that, within each WPP, fleet segments that do not have CODRS representation all have the same CPUE-estimate-per-WPP, but their total catch estimates vary because effort between those fleet segments vary. We applied this approach for total catch as well as total catch by species.

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	Trap	2	6
2	571	Desa Sungai Kuruk III	Aceh Tamiang	Small	Trap	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	Desa Belawan Lama	Kota Medan	Small	Trap	10	50
6	571	Desa Beurawang	Kota Sabang	Nano	Dropline	1	4
7	571	PP. Pasiran	Kota Sabang	Nano	Dropline	2	3
8	571	PP. Pasiran	Kota Sabang	Small	Dropline	1	8
9	571	Desa Sei Bilah	Langkat	Medium	Trap	2	22
10	571	Desa Sei Bilah	Langkat	Nano	Dropline	1	4
11	571	Desa Sei Bilah	Langkat	Small	Dropline	2	18
12	571	Desa Sei Bilah	Langkat	Small	Trap	2	16
13	571	Desa Ujung Kampung	Langkat	Medium	Trap	1	12
14	571	Desa Ujung Kampung	Langkat	Nano	Trap	6	27
15	571	Desa Ujung Kampung	Langkat	Small	Trap	3	20
16	571	Pangkalan Susu	Langkat	Nano	Trap	38	114
17	571	Pelabuhan Ujung Kampung	Langkat	Medium	Trap	1	13
18	571	PPI. Pangkalan Brandan	Langkat	Nano	Trap	32	131
19	571	PPI. Pangkalan Brandan	Langkat	Small	Trap	2	14
20	571	PP. Ujung Blang	Lhokseumawe	Nano	Longline	7	11
21	571	Desa Sialang Buah	Serdang Bedagai	Medium	Longline	1	13
22	571	Desa Sialang Buah	Serdang Bedagai	Nano	Longline	2	7
23	571	Desa Sialang Buah	Serdang Bedagai	Small	Longline	3	22
24	571	Sialang Buah	Serdang Bedagai	Nano	Longline	11	44
25	571	Sialang Buah	Serdang Bedagai	Small	Longline	4	30
26	571	Teluk Mengkudu	Serdang Bedagai	Small	Longline	5	48
27	572	Kuala Bubon	Aceh Barat	Medium	Trap	2	21
28	572	Kuala Bubon	Aceh Barat	Small	Trap	2	14
29	572	PP. Ujoeng Baroh	Aceh Barat	Nano	Longline	1	4
30	572	PP. Ujoeng Baroh	Aceh Barat	Small	Dropline	1	6
31	572	PP. Ujoeng Baroh	Aceh Barat	Small	Longline	1	5
32	572	PP. Ujong Baroeh	Aceh Barat	Nano	Dropline	8	28
33	572	PP. Ujong Baroeh	Aceh Barat	Nano	Longline	3	12
34	572	PP. Ujong Baroeh	Aceh Barat	Small	Dropline	14	84
35	572	PP. Ujong Baroeh	Aceh Barat	Small	Longline	3	21
36	572	PP. Ujong Baroeh	Aceh Barat	Small	Trap	2	10
37	572	Susoh	Aceh Barat Daya	Medium	Dropline	1	11
38	572	Susoh	Aceh Barat Daya	Small	Dropline	2	12
39	572	Desa Lampuyang	Aceh Besar	Nano	Dropline	15	22
40	572	PP. Lhok Bengkuang	Aceh Selatan	Nano	Dropline	5	6
41	572	PP. Lhok Bengkuang	Aceh Selatan	Nano	Longline	8	26
42	572	PP. Lhok Bengkuang	Aceh Selatan	Small	Dropline	2	12
43	572	PP. Lhok Bengkuang	Aceh Selatan	Small	Longline	27	165
44	572	PP. Meukek	Aceh Selatan	Nano	Longline	1	3
45	572	Desa Pulau Balai	Aceh Singkil	Medium	Gillnet	1	10
46	572	Desa Pulau Balai	Aceh Singkil	Nano	Trap	6	29
47	572	PP. Lampulo	Banda Aceh	Nano	Dropline	1	4
48	572	PP. Lampulo	Banda Aceh	Nano	Longline	2	6
49	572	PP. Lampulo	Banda Aceh	Small	Dropline	8	49
50	572	PP. Lampulo	Banda Aceh	Small	Longline	1	6
51	572	PPS Lampulo	Banda Aceh	Small	Dropline	9	63
52	572	PP. Sikakap	Kepulauan Mentawai	Nano	Dropline	1	3
53	572	PP. Tuapejat	Kepulauan Mentawai	Medium	Dropline	2	24
54	572	PP. Tuapejat	Kepulauan Mentawai	Small	Dropline	2	18
55	572	PP. Pulau Baai	Kota Bengkulu	Large	Trap	1	31
56	572	PP. Pulau Baai	Kota Bengkulu	Medium	Dropline	8	107
57	572	PP. Pulau Baai	Kota Bengkulu	Medium	Gillnet	7	153
58	572	PP. Pulau Baai	Kota Bengkulu	Nano	Dropline	4	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
59	572	PP. Pulau Baai	Kota Bengkulu	Small	Dropline	12	70
60	572	PP. Pulau Baai	Kota Bengkulu	Small	Gillnet	1	6
61	572	Desa Taluak	Kota Pariaman	Nano	Longline	10	16
62	572	Desa Keuneukai	Kota Sabang	Nano	Dropline	2	3
63	572	PP. Sibolga	Kota Sibolga	Medium	Trap	6	87
64	572	PP. Sibolga	Kota Sibolga	Nano	Dropline	4	14
65	572	PP. Sibolga	Kota Sibolga	Nano	Trap	12	47
66	572	PP. Sibolga	Kota Sibolga	Small	Dropline	3	18
67	572	PP. Sibolga	Kota Sibolga	Small	Trap	9	55
68	572	PP. Muara Piluk Bakauheni	Lampung	Nano	Longline	16	43
69	572	PP. Muara Piluk Bakauheni	Lampung	Small	Longline	1	5
70	572	PP. Pasar Bantal	Mukomuko	Small	Dropline	20	100
71	572	Kec. Teluk Dalam	Nias Selatan	Nano	Dropline	5	18
72	572	Desa Botolakha	Nias Utara	Small	Dropline	25	197
73	572	Desa Helera	Nias Utara	Nano	Longline	13	21
74	572	Desa Helera	Nias Utara	Small	Longline	2	11
75	572	Muara Padang	Padang	Medium	Longline	1	11
76	572	Muara Padang	Padang	Small	Dropline	4	21
77	572	PP. Bungus	Padang	Small	Longline	1	8
78	572	PP. Muaro	Padang	Medium	Dropline	4	52
79	572	PP. Muaro	Padang	Medium	Longline	5	61
80	572	PP. Muaro	Padang	Small	Dropline	1	5
81	572	PP. Muaro	Padang	Small	Longline	5	41
82	572	Pantai Ulakan	Padang Pariaman	Nano	Longline	10	17
83	572	PP. Labuan	Pandeglang	Small	Dropline	29	152
84	572	PP. Carocok Tarusan	Pesisir Selatan	Medium	Longline	4	40
85	572	PP. Kambang	Pesisir Selatan	Medium	Longline	3	30
86	572	Desa Pulau Tunda	Serang	Nano	Dropline	5	23
87	572	Desa Pulau Tunda	Serang	Small	Dropline	16	103
88	573	Desa Alor Kecil	Alor	Nano	Dropline	25	17
89	573	PP. Kedonganan	Badung	Nano	Dropline	30	56
90	573	PP. Grajagan	Banyuwangi	Nano	Dropline	452	1446
91	573	PP. Grajagan	Banyuwangi	Small	Dropline	150	780
92	573	PP. Pancer	Banyuwangi	Medium	Dropline	1	15
93	573	PP. Pancer	Banyuwangi	Nano	Dropline	174	348
94	573	PP. Pancer	Banyuwangi	Small	Dropline	125	625
95	573	Atapupu	Belu	Nano	Dropline	2	3
96	573	PP. Atapupu	Belu	Nano	Dropline	3	4
97	573	PP. Rompo	Bima	Nano	Dropline	15	15
98	573	PP. Rompo	Bima	Nano	Longline	57	44
99	573	PP. Sape	Bima	Nano	Dropline	162	553
100	573	PP. Sape	Bima	Small	Dropline	1	6
101	573	PP.Tambakrejo	Blitar	Nano	Longline	15	30
102	573	PP.Tambakrejo	Blitar	Small	Longline	1	6
103	573	Jetis	Cilacap	Nano	Longline	30	26
104	573	Pelabuhan Benoa	Denpasar	Medium	Dropline	11	241
105	573	Pelabuhan Benoa	Denpasar	Medium	Longline	1	27
106	573	PP. Tenau Kupang	Denpasar	Medium	Dropline	1	22
107	573	PP. Hu'u	Dompu	Small	Dropline	38	236
108	573	PP. Puger	Jember	Nano	Longline	50	160
109	573	Desa Yeh Kuning	Jembrana	Nano	Longline	150	126
110	573	PP. Pengambengan	Jembrana	Nano	Longline	20	40
111	573	Desa Tablolong	Kupang	Nano	Dropline	36	97
112	573	Pelabuhan Benoa	Kupang	Medium	Dropline	1	27
113	573	Pelabuhan Sulamu	Kupang	Nano	Dropline	50	87
114	573	PP. Mayangan	Kupang	Medium	Longline	1	29
115	573	PP. Oeba Kupang	Kupang	Nano	Dropline	5	5
116	573	PP. Tenau Kupang	Kupang	Medium	Dropline	21	347

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	573	PP. Tenau Kupang	Kupang	Medium	Longline	3	72
118	573	PP. Tenau Kupang	Kupang	Nano	Dropline	6	22
119	573	PP. Tenau Kupang	Kupang	Small	Dropline	21	166
120	573	Desa Tapolango	Lembata	Nano	Dropline	20	14
121	573	Desa waijarang	Lembata	Nano	Dropline	20	14
122	573	PP. Hadakewa	Lembata	Nano	Dropline	30	26
123	573	PP. Tanjung Luar	Lombok Timur	Medium	Longline	14	141
124	573	PP. Tanjung Luar	Lombok Timur	Nano	Dropline	15	36
125	573	PP. Tanjung Luar	Lombok Timur	Nano	Longline	39	101
126	573	Pulau Maringkik	Lombok Timur	Medium	Longline	1	10
127	573	Pulau Maringkik	Lombok Timur	Small	Longline	3	22
128	573	TPI Kampung Ujung	Manggarai Barat	Nano	Dropline	60	74
129	573	PP. Poumako	Mimika	Medium	Gillnet	1	29
130	573	PP. Watukarung	Pacitan	Nano	Longline	100	222
131	573	PP Cikidang	Pangandaran	Small	Gillnet	8	50
132	573	PP. Cikidang	Pangandaran	Nano	Gillnet	2	9
133	573	Desa Batutua	Rote Ndao	Nano	Dropline	9	11
134	573	Desa Oeseli	Rote Ndao	Nano	Dropline	2	2
135	573	Dusun Papela	Rote Ndao	Nano	Dropline	20	21
136	573	Sukabumi	Sukabumi	Nano	Longline	50	50
137	573	KSOP Kelas III Kupang	Sumba Barat	Nano	Dropline	35	80
138	573	Pelabuhan Waingapu	Sumba Barat	Nano	Dropline	8	14
139	573	Pelabuhan Waingapu	Sumba Barat	Nano	Longline	7	16
140	573	Desa Pulau Bungin	Sumbawa	Nano	Dropline	29	23
141	573	Desa Pulau Bungin	Sumbawa	Nano	Longline	15	12
142	573	Labuhan Mapin	Sumbawa	Nano	Dropline	61	43
143	573	Labuhan Mapin	Sumbawa	Nano	Longline	35	17
144	573	PP Labuhan Lalar	Sumbawa	Nano	Dropline	25	22
145	573	PP. Wini	Timor Tengah Utara	Nano	Dropline	7	12
146	711	PP. Sungailiat	Bangka	Medium	Trap	1	10
147	711	PP. Sungailiat	Bangka	Small	Dropline	1	6
148	711	PP. Sungailiat	Bangka	Small	Trap	17	133
149	711	PP. Kurau	Bangka Tengah	Small	Trap	30	159
150	711	Batam	Batam	Medium	Trap	2	56
151	711	Batam	Batam	Small	Dropline	2	12
152	711	Batam	Batam	Small	Trap	2	13
153	711	PP. Manggar	Belitung	Small	Trap	1	9
154	711	PP. Tanjung Pandan	Belitung	Medium	Trap	9	164
155	711	PP. Tanjung Pandan	Belitung	Nano	Dropline	108	250
156	711	PP. Tanjung Pandan	Belitung	Nano	Trap	63	202
157	711	PP. Tanjung Pandan	Belitung	Small	Dropline	5	27
158	711	PP. Tanjung Pandan	Belitung	Small	Trap	72	450
159	711	Tanjung Binga	Belitung	Small	Trap	20	192
160	711	PP. Manggar Belitung Timur	Belitung Timur	Medium	Trap	3	42
161	711	PP. Manggar Belitung Timur	Belitung Timur	Nano	Dropline	5	21
162	711	PP. Manggar Belitung Timur	Belitung Timur	Nano	Trap	1	4
163	711	PP. Manggar Belitung Timur	Belitung Timur	Small	Dropline	2	10
164	711	PP. Manggar Belitung Timur	Belitung Timur	Small	Trap	87	481
165	711	PP. Kijang	Bintan	Medium	Dropline	2	33
166	711	PP. Kijang	Bintan	Medium	Trap	241	4587
167	711	PP. Kijang	Bintan	Nano	Trap	2	8
168	711	PP. Kijang	Bintan	Small	Dropline	10	66
169	711	PP. Kijang	Bintan	Small	Trap	204	1385
170	711	Moro	Karimun	Small	Trap	1	7
171	711	Tanjung Balai Karimun	Karimun	Medium	Longline	5	111
172	711	PP. Tarempa	Kepulauan Anambas	Nano	Dropline	202	298
173	711	PP. Tarempa	Kepulauan Anambas	Nano	Trap	19	24
174	711	PP. Tarempa	Kepulauan Anambas	Small	Dropline	11	63

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	PPI Ladan	Kepulauan Anambas	Nano	Dropline	73	182
176	711	PPI Ladan	Kepulauan Anambas	Small	Dropline	1	5
177	711	Pangkal Balam	Kota Pangkalpinang	Nano	Dropline	2	7
178	711	Pangkal Balam	Kota Pangkalpinang	Nano	Trap	1	4
179	711	Pangkal Balam	Kota Pangkalpinang	Small	Trap	12	67
180	711	PP. Muara Sungai Baturusa	Kota Pangkalpinang	Nano	Trap	3	12
181	711	PP. Muara Sungai Baturusa	Kota Pangkalpinang	Small	Trap	9	51
182	711	Dermaga Kayu Sededap	Natuna	Nano	Dropline	1	5
183	711	Desa Air Nusa	Natuna	Nano	Dropline	23	43
184	711	Desa Air Ringau	Natuna	Nano	Dropline	12	18
185	711	Desa Batu Ampar	Natuna	Nano	Dropline	5	4
186	711	Desa Batu Brilian	Natuna	Nano	Dropline	21	44
187	711	Desa Batu Brilian	Natuna	Nano	Trap	1	4
188	711	Desa Pakkalung	Natuna	Nano	Dropline	1	2
189	711	Desa Sabang Mawang Barat	Natuna	Small	Dropline	12	72
190	711	Desa Sedanau	Natuna	Nano	Dropline	22	79
191	711	Desa Sepempang	Natuna	Small	Dropline	22	132
192	711	Desa Serantas_ Teluk Lagong	Natuna	Nano	Dropline	23	69
193	711	Desa Subi besar	Natuna	Nano	Dropline	23	69
194	711	Desa Tanjung Belau	Natuna	Nano	Dropline	31	56
195	711	Desa Tanjung Kumbik Utara	Natuna	Small	Dropline	15	90
196	711	Desa Tanjung Setelung	Natuna	Nano	Dropline	9	16
197	711	Desa Tanjung Setelung	Natuna	Nano	Trap	18	39
198	711	Desa Tanjung Setelung	Natuna	Small	Trap	3	18
199	711	Desa Teluk Buton	Natuna	Nano	Dropline	26	78
200	711	Natuna	Natuna	Large	Longline	3	94
201	711	Pelabuhan Harapan Air Putih	Natuna	Nano	Dropline	59	159
202	711	Pelabuhan Harapan Air Putih	Natuna	Small	Dropline	1	6
203	711	Pelabuhan Midai	Natuna	Medium	Dropline	1	12
204	711	Pelabuhan Midai	Natuna	Medium	Trap	2	22
205	711	Pelabuhan Midai	Natuna	Small	Dropline	2	11
206	711	Pelabuhan Pasir Putih	Natuna	Nano	Dropline	1	2
207	711	Pelabuhan Pering	Natuna	Medium	Dropline	2	30
208	711	Pelabuhan Pering	Natuna	Nano	Dropline	21	78
209	711	Pelabuhan Pering	Natuna	Small	Dropline	1	8
210	711	Pelabuhan Sabang Barat-Midai	Natuna	Medium	Trap	1	11
211	711	Pelabuhan Sabang Barat-Midai	Natuna	Small	Dropline	2	11
212	711	Pelabuhan Tanjung	Natuna	Nano	Dropline	30	59
213	711	Pering	Natuna	Nano	Dropline	1	4
214	711	PP. Pering	Natuna	Small	Dropline	1	5
215	711	PP. Tarempa	Natuna	Medium	Longline	1	18
216	711	Pulau Tiga Natuna	Natuna	Small	Dropline	1	8
217	711	Tanjung Balai Karimun	Natuna	Large	Longline	11	350
218	711	Tanjung Balai Karimun	Natuna	Medium	Longline	43	1223
219	711	PP. Bajomulyo	Pati	Large	Longline	1	85
220	711	PP. Kuala Mempawah	Pontianak	Medium	Trap	2	20
221	711	PP. Kuala Mempawah	Pontianak	Small	Trap	3	19
222	712	PP. Tanjung Pandan	Belitung	Nano	Trap	2	7
223	712	PP. Tanjung Pandan	Belitung	Small	Trap	12	63
224	712	Desa Parang	Jepara	Medium	Trap	26	404
225	712	Desa Parang	Jepara	Small	Trap	65	468
226	712	Pelabuhan Kartini, Jepara	Jepara	Nano	Longline	15	21
227	712	PP. Karimun Jawa	Jepara	Medium	Trap	8	104
228	712	PP. Karimun Jawa	Jepara	Small	Trap	4	37
229	712	TPI. Ujungbatu	Jepara	Nano	Longline	3	4
230	712	Kelurahan Pulau Kelapa Dua	Kepulauan Seribu	Small	Dropline	9	62
231	712	Kelurahan Pulau Pari	Kepulauan Seribu	Nano	Trap	2	9
232	712	Kelurahan Pulau Pari	Kepulauan Seribu	Small	Trap	3	17

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	712	Kelurahan Pulau Untung Jawa	Kepulauan Seribu	Nano	Trap	20	36
234	712	Kelurahan Pulau Untung Jawa	Kepulauan Seribu	Small	Trap	8	51
235	712	PP. Brondong	Lamongan	Medium	Dropline	167	2158
236	712	PP. Brondong	Lamongan	Medium	Longline	14	176
237	712	PP. Brondong	Lamongan	Small	Dropline	115	880
238	712	PP. Brondong	Lamongan	Small	Longline	1	9
239	712	PP. Bajomulyo	Pati	Large	Longline	30	1432
240	712	PP. Bajomulyo	Pati	Medium	Longline	13	355
241	712	PP. Asem Doyong	Pemalang	Small	Dropline	10	57
242	712	PP. Mayangan	Probolinggo	Medium	Longline	1	29
243	712	PP. Pondok Mimbo	Situbondo	Nano	Longline	100	156
244	712	Desa Bancamara	Sumenep	Medium	Dropline	2	28
245	712	Desa Bancamara	Sumenep	Nano	Dropline	1	4
246	712	Desa Bancamara	Sumenep	Small	Dropline	102	702
247	712	Desa Masalima	Sumenep	Small	Dropline	12	84
248	712	Pagerungan Besar	Sumenep	Medium	Longline	4	41
249	712	Pagerungan Besar	Sumenep	Nano	Longline	21	28
250	712	Pagerungan Besar	Sumenep	Small	Longline	45	312
251	712	Pagerungan Kecil	Sumenep	Nano	Longline	30	36
252	712	PP. Dungkek	Sumenep	Medium	Dropline	3	32
253	712	PP. Dungkek	Sumenep	Nano	Dropline	2	9
254	712	PP. Dungkek	Sumenep	Small	Dropline	7	43
255	712	Sumenep	Sumenep	Small	Dropline	300	2196
256	712	Pagatan	Tanah Bumbu	Small	Dropline	2	10
257	712	PP. Cituis	Tanggerang	Small	Trap	7	64
258	713	PP. Filial Klandasan	Balikpapan	Nano	Dropline	2	8
259	713	PP. Filial Klandasan	Balikpapan	Small	Dropline	22	126
260	713	PP. Klandasan	Balikpapan	Small	Dropline	3	21
261	713	PP. Manggar Baru	Balikpapan	Medium	Dropline	16	274
262	713	PP. Manggar Baru	Balikpapan	Nano	Longline	1	3
263	713	PP. Manggar Baru	Balikpapan	Small	Dropline	1	6
264	713	PP. Manggar Baru	Balikpapan	Small	Longline	7	39
265	713	PP. Tanjung Pandan	Belitung	Nano	Trap	1	3
266	713	PP. Tanjung Pandan	Belitung	Small	Dropline	1	5
267	713	PP. Tanjung Pandan	Belitung	Small	Trap	4	21
268	713	PP. Kore	Bima	Nano	Dropline	10	33
269	713	Lok Tuan	Bontang	Nano	Dropline	4	13
270	713	PP. Tanjung Limau	Bontang	Nano	Dropline	5	11
271	713	PP. Tanjung Limau	Bontang	Small	Dropline	4	24
272	713	Tanjung Laut	Bontang	Nano	Dropline	1	1
273	713	Desa Sangsit	Buleleng	Nano	Dropline	50	15
274	713	PP. Dannuang	Bulukumba	Nano	Dropline	20	20
275	713	PP. Kalumeme	Bulukumba	Nano	Dropline	20	20
276	713	PP. Kota Bulukumba	Bulukumba	Nano	Dropline	300	300
277	713	PP. Keramat	Dompu	Nano	Longline	10	4
278	713	PP. Malaju	Dompu	Nano	Dropline	1	1
279	713	PP. Malaju	Dompu	Nano	Longline	1	0
280	713	PP. Malaju	Dompu	Small	Dropline	10	52
281	713	PP. Soro Kempo	Dompu	Nano	Longline	32	13
282	713	PP. Soro Kempo	Dompu	Small	Dropline	17	88
283	713	PP. Labean	Donggala	Nano	Dropline	27	24
284	713	Anawoi	Kolaka	Medium	Trap	5	64
285	713	PP. Beba	Kota Makassar	Medium	Dropline	25	349
286	713	PP. Beba	Kota Makassar	Medium	Longline	61	735
287	713	PP. Beba	Kota Makassar	Nano	Longline	1	3
288	713	PP. Beba	Kota Makassar	Small	Dropline	1	8
289	713	PP. Beba	Kota Makassar	Small	Longline	3	24
290	713	Gang Kakap, Muara Jawa	Kutai Kartanegara	Nano	Longline	20	60

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	713	Kampung Terusan	Kutai Kartanegara	Small	Longline	10	85
292	713	Kuala Samboja	Kutai Kartanegara	Small	Longline	3	15
293	713	Pantai Biru Kersik	Kutai Kartanegara	Nano	Dropline	16	48
294	713	Semangkok	Kutai Kartanegara	Nano	Dropline	10	31
295	713	Maloy	Kutai Timur	Small	Dropline	1	5
296	713	Muara Selangkau	Kutai Timur	Nano	Dropline	40	120
297	713	PP. Kenyamukan	Kutai Timur	Medium	Dropline	3	32
298	713	PP. Kenyamukan	Kutai Timur	Nano	Dropline	40	40
299	713	PP. Kenyamukan	Kutai Timur	Small	Dropline	11	75
300	713	PP. Sangatta	Kutai Timur	Medium	Dropline	1	10
301	713	PP. Sangatta	Kutai Timur	Small	Dropline	5	31
302	713	PP. Brondong	Lamongan	Medium	Trap	1	19
303	713	Desa Wangatoa	Lembata	Nano	Dropline	20	23
304	713	Majene	Majene	Nano	Longline	38	114
305	713	Majene	Majene	Small	Dropline	1	7
306	713	Majene	Majene	Small	Longline	12	84
307	713	Pelabuhan Majene	Majene	Nano	Longline	34	96
308	713	PP. Rangas Majene	Majene	Nano	Longline	2	6
309	713	PP. Kasiwa	Mamuju	Nano	Dropline	31	93
310	713	PP. Kasiwa	Mamuju	Small	Dropline	4	20
311	713	PP. Labuhan Bajo	Manggarai Barat	Nano	Dropline	40	15
312	713	PP. Konge	Nagekeo	Nano	Dropline	30	8
313	713	Sumbawa	Pangkep	Nano	Longline	50	50
314	713	Muara Pasir	Paser	Nano	Longline	10	20
315	713	PP. Bajomulyo	Pati	Large	Longline	3	130
316	713	Kampung Pejala	Penajam Paser Utara	Nano	Dropline	2	7
317	713	Kampung Pejala	Penajam Paser Utara	Small	Dropline	17	85
318	713	Nenang	Penajam Paser Utara	Small	Trap	50	253
319	713	PP. Mayangan	Probolinggo	Medium	Longline	1	27
320	713	Desa Labuhan Sangoro	Sumbawa	Nano	Longline	20	37
321	713	Labuhan Sumbawa	Sumbawa	Medium	Dropline	1	17
322	713	Labuhan Sumbawa	Sumbawa	Nano	Dropline	3	12
323	713	Labuhan Sumbawa	Sumbawa	Small	Dropline	4	27
324	713	PP. Labuhan Terata	Sumbawa	Nano	Dropline	4	7
325	713	PP. Beba	Takalar	Medium	Dropline	2	25
326	713	PP. Beba	Takalar	Medium	Gillnet	12	185
327	713	PP. Beba	Takalar	Medium	Longline	19	244
328	713	PP. Beba	Takalar	Small	Dropline	2	17
329	713	PP. Beba	Takalar	Small	Gillnet	1	9
330	714	Kabola	Alor	Nano	Dropline	15	10
331	714	Kokar	Alor	Nano	Dropline	100	88
332	714	Banggai Kepulauan	Banggai Kepulauan	Nano	Dropline	10	10
333	714	Banggai Laut	Banggai Laut	Nano	Dropline	50	50
334	714	Bontosi	Banggai Laut	Nano	Dropline	1	3
335	714	Desa Bontosi	Banggai Laut	Nano	Dropline	1	2
336	714	Desa Matanga	Banggai Laut	Nano	Longline	5	4
337	714	Desa Tinakin Laut	Banggai Laut	Nano	Dropline	1	1
338	714	Kasuari	Banggai Laut	Nano	Longline	14	16
339	714	PP. Tanjung Pandan	Belitung	Small	Dropline	1	6
340	714	Desa Balimu	Buton	Nano	Dropline	5	6
341	714	Kelurahan Watolo	Buton Tengah	Nano	Gillnet	4	4
342	714	Kelurahan Watolo	Buton Tengah	Nano	Longline	13	13
343	714	Desa Tanjung Batu	Kepulauan Tanimbar	Nano	Dropline	1	2
344	714	Kampung Babar	Kepulauan Tanimbar	Nano	Dropline	1	4
345	714	Kampung Barbar	Kepulauan Tanimbar	Nano	Dropline	6	12
346	714	Pasar Baru Omele Saumlaki	Kepulauan Tanimbar	Nano	Dropline	6	13
347	714	Pasar Baru Omele Saumlaki	Kepulauan Tanimbar	Nano	Longline	1	3
348	714	Pasar Lama Saumlaki	Kepulauan Tanimbar	Nano	Dropline	1	2

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	714	Saumlaki	Kepulauan Tanimbar	Nano	Dropline	3	8
350	714	PPI Soropia	Konawe	Medium	Trap	1	12
351	714	PPI Soropia	Konawe	Nano	Trap	1	1
352	714	Desa Labengki	Konawe Utara	Nano	Dropline	5	5
353	714	Labengki	Konawe Utara	Nano	Dropline	4	5
354	714	Labengki	Konawe Utara	Nano	Longline	1	1
355	714	Asilulu	Maluku Tengah	Nano	Dropline	30	56
356	714	Batu Lubang	Maluku Tengah	Nano	Dropline	30	53
357	714	PP. Tulehu	Maluku Tengah	Large	Dropline	1	34
358	714	Desa Langgur	Maluku Tenggara	Small	Dropline	1	10
359	714	Desa Selayar	Maluku Tenggara	Nano	Dropline	5	7
360	714	Desa Watdek	Maluku Tenggara	Small	Dropline	5	32
361	714	PP. Kema	Minahasa Utara	Large	Dropline	1	30
362	714	Desa Bahonsuai	Morowali	Nano	Dropline	3	3
363	714	Desa Moahino	Morowali	Nano	Longline	2	4
364	714	Desa Umbele	Morowali	Nano	Dropline	2	2
365	714	Desa Umbele	Morowali	Nano	Longline	2	4
366	714	Desa Limbo	Pulau Taliabu	Nano	Longline	30	18
367	714	Dusun Anauni	Seram Bagian Barat	Nano	Dropline	15	15
368	714	Dusun Anauni	Seram Bagian Barat	Nano	Longline	35	44
369	714	Dusun Huaroa	Seram Bagian Barat	Nano	Dropline	50	74
370	714	Dusun Huhua	Seram Bagian Barat	Nano	Dropline	20	27
371	714	Dusun Naeselan	Seram Bagian Barat	Nano	Dropline	20	33
372	714	Dusun Patinea	Seram Bagian Barat	Nano	Dropline	15	21
373	714	Dusun Pohon Batu	Seram Bagian Barat	Nano	Dropline	10	11
374	714	Dusun Waisela	Seram Bagian Barat	Nano	Dropline	4	4
375	714	Desa Mangon	Tual	Small	Dropline	1	7
376	714	PP. Tual	Tual	Medium	Dropline	1	28
377	714	PP. Tual	Tual	Nano	Dropline	1	2
378	714	PP. Tual	Tual	Small	Dropline	4	25
379	714	Binongko	Wakatobi	Medium	Dropline	1	13
380	714	Binongko	Wakatobi	Nano	Dropline	28	16
381	714	Dermaga Desa Wali	Wakatobi	Small	Dropline	1	5
382	714	Desa Lagongga	Wakatobi	Nano	Dropline	7	26
383	714	Desa Lagongga	Wakatobi	Small	Dropline	1	6
384	714	Desa Wali	Wakatobi	Nano	Dropline	2	8
385	714	Pelabuhan Lagelewa	Wakatobi	Nano	Dropline	1	3
386	715	Desa Jayabakti	Banggai	Nano	Dropline	51	40
387	715	Desa Jayabakti	Banggai	Nano	Longline	5	4
388	715	Pagimana	Banggai	Nano	Dropline	2	4
389	715	Pangkalaseang	Banggai	Nano	Dropline	10	10
390	715	Kampung Sekar	Fakfak	Nano	Dropline	7	7
391	715	Kampung Sosar, Kokas	Fakfak	Nano	Dropline	7	7
392	715	Kampung Ugar	Fakfak	Nano	Dropline	17	11
393	715	Pasar Sorpeha	Fakfak	Nano	Dropline	9	22
394	715	PP. PP. Dulan Pok-Pok	Fakfak	Nano	Dropline	215	206
395	715	Bacan	Halmahera Selatan	Nano	Dropline	9	5
396	715	Bacan	Halmahera Selatan	Nano	Longline	1	0
397	715	Bacan Barat	Halmahera Selatan	Nano	Dropline	6	2
398	715	Bacan Tengah	Halmahera Selatan	Nano	Dropline	24	8
399	715	Bacan Timur	Halmahera Selatan	Nano	Dropline	4	1
400	715	Bacan Utara	Halmahera Selatan	Nano	Dropline	5	2
401	715	Desa Akegula	Halmahera Selatan	Nano	Dropline	15	16
402	715	Desa Amasing Kota Barat	Halmahera Selatan	Nano	Longline	1	2
403	715	Desa Babang	Halmahera Selatan	Nano	Dropline	7	4
404	715	Desa Jikotamo	Halmahera Selatan	Nano	Dropline	15	20
405	715	Desa Laiwui	Halmahera Selatan	Nano	Dropline	12	13
406	715	Desa Lalei	Halmahera Selatan	Nano	Dropline	29	17

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	715	Desa Sali Kecil	Halmahera Selatan	Nano	Dropline	20	8
408	715	Desa Tabapoma	Halmahera Selatan	Nano	Dropline	11	4
409	715	Gane Barat	Halmahera Selatan	Nano	Dropline	15	5
410	715	Gane Timur Selatan	Halmahera Selatan	Nano	Dropline	40	13
411	715	Kep. Batang Lomang	Halmahera Selatan	Nano	Dropline	12	4
412	715	Kep. Joronga	Halmahera Selatan	Nano	Dropline	7	2
413	715	Mandioli Selatan	Halmahera Selatan	Nano	Dropline	13	4
414	715	Mandioli Utara	Halmahera Selatan	Nano	Dropline	17	5
415	715	Pasar Tembal	Halmahera Selatan	Nano	Dropline	30	13
416	715	Puau Obilatu	Halmahera Selatan	Nano	Dropline	10	3
417	715	Pulau Obi	Halmahera Selatan	Nano	Dropline	62	18
418	715	Buli	Halmahera Timur	Nano	Dropline	7	7
419	715	Halmahera Timur	Halmahera Timur	Nano	Dropline	48	78
420	715	Desa Trikora	Kaimana	Nano	Dropline	10	10
421	715	Kampung Air Merah	Kaimana	Nano	Dropline	33	33
422	715	Kampung Air Tiba	Kaimana	Nano	Dropline	10	10
423	715	Namatota	Kaimana	Medium	Dropline	2	49
424	715	Namatota	Kaimana	Medium	Longline	2	30
425	715	PU. Kaimana	Kaimana	Large	Longline	1	30
426	715	PU. Kaimana	Kaimana	Medium	Longline	2	43
427	715	Pasar Galala	Kota Tidore Kepulauan	Nano	Dropline	10	10
428	715	Desa Sawai	Maluku Tengah	Nano	Dropline	55	61
429	715	PP. Kema	Minahasa Utara	Large	Dropline	3	130
430	715	PP. Kema	Minahasa Utara	Medium	Dropline	11	320
431	715	Desa Geser	Seram Bagian Timur	Nano	Dropline	44	62
432	715	Desa Kilfura	Seram Bagian Timur	Nano	Dropline	31	27
433	715	Desa Kiltay	Seram Bagian Timur	Nano	Dropline	25	25
434	715	Desa Namalena	Seram Bagian Timur	Nano	Dropline	26	26
435	715	Desa Pantai Pos, Bula	Seram Bagian Timur	Nano	Dropline	10	17
436	715	Desa Pantai Pos, Bula	Seram Bagian Timur	Nano	Longline	10	17
437	715	Desa Waru	Seram Bagian Timur	Nano	Longline	2	3
438	715	Pulau Parang	Seram Bagian Timur	Nano	Dropline	10	17
439	715	Desa Kali Remu	Sorong	Nano	Dropline	2	6
440	715	Desa Kali Remu	Sorong	Nano	Trap	1	3
441	715	Jembatan Puri Sorong	Sorong	Medium	Dropline	4	75
442	715	Jembatan Puri Sorong	Sorong	Small	Dropline	3	20
443	715	PP. Sorong	Sorong	Medium	Dropline	9	170
444	715	PP. Sorong	Sorong	Medium	Longline	1	17
445	715	PP. Sorong	Sorong	Medium	Trap	10	153
446	715	PP. Sorong	Sorong	Nano	Dropline	3	11
447	715	PP. Sorong	Sorong	Small	Trap	2	18
448	715	Bajugan	Tolitoli	Nano	Dropline	10	6
449	716	Biduk-biduk	Berau	Medium	Dropline	1	22
450	716	Biduk-biduk	Berau	Nano	Dropline	23	69
451	716	Desa Tanjung Batu	Berau	Nano	Dropline	64	192
452	716	Giring-giring	Berau	Nano	Dropline	22	66
453	716	Labuan Cermin	Berau	Nano	Dropline	1	3
454	716	P. Derawan	Berau	Nano	Trap	4	7
455	716	Pantai Harapan	Berau	Nano	Dropline	20	60
456	716	Tanjung Batu	Berau	Nano	Trap	6	18
457	716	Tanjung Batu	Berau	Small	Trap	1	8
458	716	Teluk Sulaiman	Berau	Nano	Dropline	29	87
459	716	Desa Sampiro	Bolaang Mongondow Utara	Nano	Dropline	11	4
460	716	Desa Bulontio	Gorontalo Utara	Nano	Dropline	11	5
461	716	Desa Buluwatu	Gorontalo Utara	Nano	Dropline	21	16
462	716	Desa Huntokalo	Gorontalo Utara	Nano	Dropline	10	3
463	716	Desa Tihengo	Gorontalo Utara	Nano	Dropline	26	7
464	716	Desa Dalako Bembanehe	Kepulauan Sangihe	Nano	Dropline	4	2

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	716	Desa Lipang	Kepulauan Sangihe	Nano	Dropline	5	2
466	716	Desa Paruruang	Kepulauan Sangihe	Nano	Dropline	16	8
467	716	Desa Parururang	Kepulauan Sangihe	Nano	Dropline	5	2
468	716	Kampung Lipang	Kepulauan Sangihe	Nano	Dropline	5	1
469	716	Sangihe	Kepulauan Sangihe	Nano	Dropline	2	0
470	716	Tariang Baru	Kepulauan Sangihe	Nano	Longline	4	3
471	716	Buhias	Kepulauan Sitaro	Nano	Dropline	153	124
472	716	Mahongsawang Tagulandang	Kepulauan Sitaro	Nano	Dropline	8	4
473	716	Mongsawang	Kepulauan Sitaro	Nano	Dropline	16	6
474	716	Pulau Biaro	Kepulauan Sitaro	Nano	Dropline	29	7
475	716	Desa Damau	Kepulauan Talaud	Nano	Dropline	8	3
476	716	Dusun Bawunian	Kepulauan Talaud	Nano	Dropline	26	29
477	716	Belakang BRI, Selumit Pantai	Tarakan	Nano	Longline	46	138
478	716	Belakang BRI, Selumit Pantai	Tarakan	Small	Longline	4	20
479	716	Mamburungan Dalam	Tarakan	Nano	Dropline	48	144
480	717	Biak	Biak	Nano	Dropline	1796	1793
481	717	Desa Nikakamp	Biak	Nano	Dropline	4	7
482	717	Desa Tanjung Barari	Biak	Nano	Dropline	5	4
483	717	Fanindi Pantai	Manokwari	Nano	Dropline	10	26
484	717	Kampung Arowi 2	Manokwari	Nano	Dropline	4	9
485	717	Kampung Borobudur 2	Manokwari	Nano	Dropline	12	30
486	717	Kampung Fanindi	Manokwari	Nano	Dropline	20	22
487	717	Kampung Kimi	Nabire	Nano	Dropline	1	1
488	717	Kampung Smoker	Nabire	Nano	Dropline	4	9
489	717	Kampung Waharia	Nabire	Nano	Dropline	2	2
490	717	Pasar Kalibobo	Nabire	Nano	Dropline	1	4
491	717	PP. Sanoba	Nabire	Nano	Dropline	4	14
492	717	Wasior	Teluk Wondama	Nano	Dropline	19	23
493	718	PP. Nizam Zachman	Jakarta Utara	Large	Longline	4	205
494	718	Namatota	Kaimana	Large	Longline	1	72
495	718	Dusun Wamar Desa Durjela	Kepulauan Aru	Medium	Longline	4	73
496	718	PP. Bajomulyo	Kepulauan Aru	Large	Gillnet	1	82
497	718	PP. Benjina	Kepulauan Aru	Large	Longline	2	92
498	718	PP. Dobo	Kepulauan Aru	Large	Gillnet	8	527
499	718	PP. Dobo	Kepulauan Aru	Large	Longline	10	596
500	718	PP. Dobo	Kepulauan Aru	Medium	Dropline	93	1658
501	718	PP. Dobo	Kepulauan Aru	Medium	Gillnet	5	121
502	718	PP. Dobo	Kepulauan Aru	Medium	Longline	10	185
503	718	PP. Dobo	Kepulauan Aru	Nano	Dropline	11	30
504	718	PP. Dobo	Kepulauan Aru	Nano	Longline	8	23
505	718	PP. Dobo	Kepulauan Aru	Small	Dropline	7	56
506	718	PP. Dobo	Kepulauan Aru	Small	Longline	1	7
507	718	PP. Kaimana	Kepulauan Aru	Large	Longline	1	51
508	718	PP. Klidang Lor	Kepulauan Aru	Large	Gillnet	1	73
509	718	PP. Mayangan	Kepulauan Aru	Large	Longline	19	1405
510	718	PP. Merauke	Kepulauan Aru	Large	Longline	4	397
511	718	PP. Nizam Zachman	Kepulauan Aru	Large	Gillnet	1	92
512	718	PP. Pekalongan	Kepulauan Aru	Large	Gillnet	1	115
513	718	PU. Dobo	Kepulauan Aru	Large	Gillnet	3	285
514	718	PU. Dobo	Kepulauan Aru	Large	Longline	36	2670
515	718	Saumlaki	Kepulauan Tanimbar	Nano	Dropline	37	109
516	718	Saumlaki	Kepulauan Tanimbar	Small	Dropline	1	5
517	718	Saumlaki	Kepulauan Tanimbar	Small	Longline	5	37
518	718	PP. Bajomulyo	Merauke	Large	Gillnet	1	91
519	718	PP. Merauke	Merauke	Large	Gillnet	48	3873
520	718	PP. Merauke	Merauke	Large	Longline	2	213
521	718	PP. Merauke	Merauke	Medium	Gillnet	5	138
522	718	PP. Nizam Zachman	Merauke	Large	Gillnet	13	841

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
523	718	PP. Nizam Zachman	Merauke	Large	Longline	1	60
524	718	PP. Poumako	Merauke	Medium	Gillnet	3	88
525	718	PP. Tegal	Merauke	Large	Gillnet	1	148
526	718	PP. Bajomulyo	Mimika	Large	Longline	1	82
527	718	PP. Dobo	Mimika	Large	Gillnet	1	75
528	718	PP. Mayangan	Mimika	Large	Gillnet	1	129
529	718	PP. Merauke	Mimika	Large	Gillnet	2	123
530	718	PP. Merauke	Mimika	Medium	Gillnet	2	49
531	718	PP. Muara Angke	Mimika	Large	Gillnet	1	92
532	718	PP. Nizam Zachman	Mimika	Large	Gillnet	1	88
533	718	PP. Paumako	Mimika	Large	Gillnet	1	30
534	718	PP. Paumako	Mimika	Medium	Gillnet	2	58
535	718	PP. Pekalongan	Mimika	Large	Gillnet	1	112
536	718	PP. Pomako	Mimika	Medium	Gillnet	1	16
537	718	PP. Poumako	Mimika	Large	Gillnet	2	60
538	718	PP. Poumako	Mimika	Medium	Gillnet	12	284
539	718	PP. Poumako	Mimika	Small	Gillnet	3	28
540	718	Timika	Mimika	Medium	Longline	3	88
541	718	PP. Bajomulyo	Pati	Large	Longline	1	119
542	718	Bagansiapiapi	Probolinggo	Large	Longline	1	40
543	718	PP. Dobo	Probolinggo	Large	Longline	2	142
544	718	PP. Mayangan	Probolinggo	Large	Gillnet	3	124
545	718	PP. Mayangan	Probolinggo	Large	Longline	34	2103
546	718	PP. Mayangan	Probolinggo	Medium	Longline	7	199
547	718	Probolinggo	Probolinggo	Large	Longline	20	1460
548	718	PP. Lappa	Sinjai	Large	Dropline	1	35
549	718	PP. Lappa	Sinjai	Medium	Dropline	10	235
550	718	PP. Bajomulyo	Tual	Large	Longline	1	87
		TOTAL				11536	62678

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.

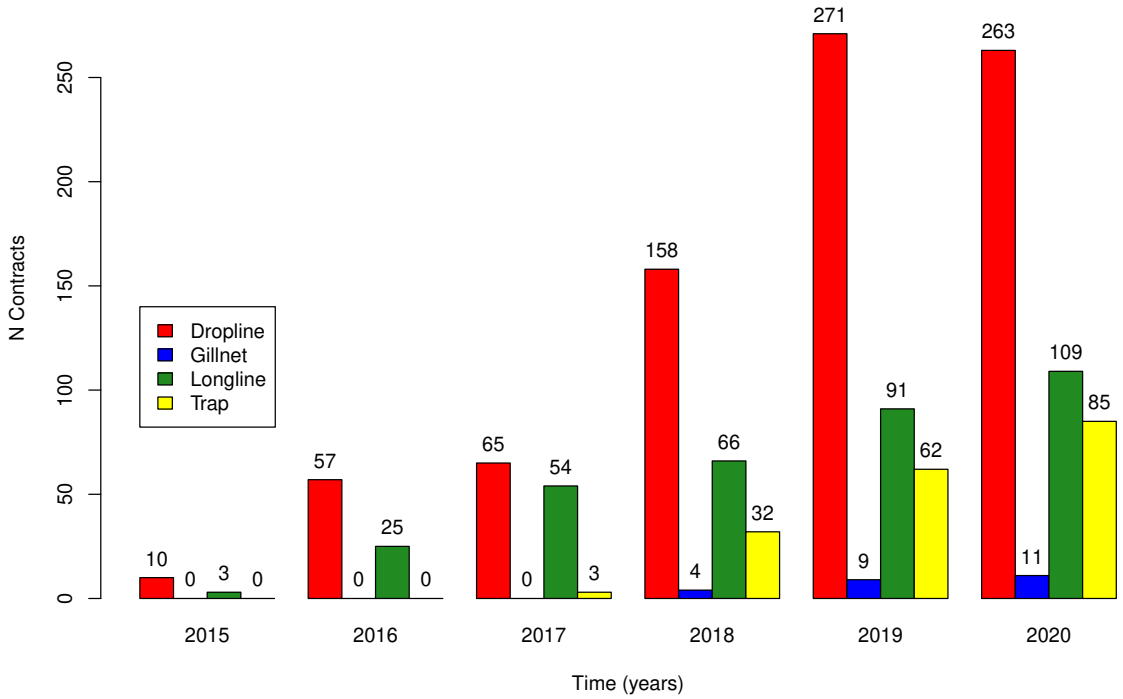

Figure 2.3: Number of CODRS contractors by gear type actively fishing in Indonesian waters.

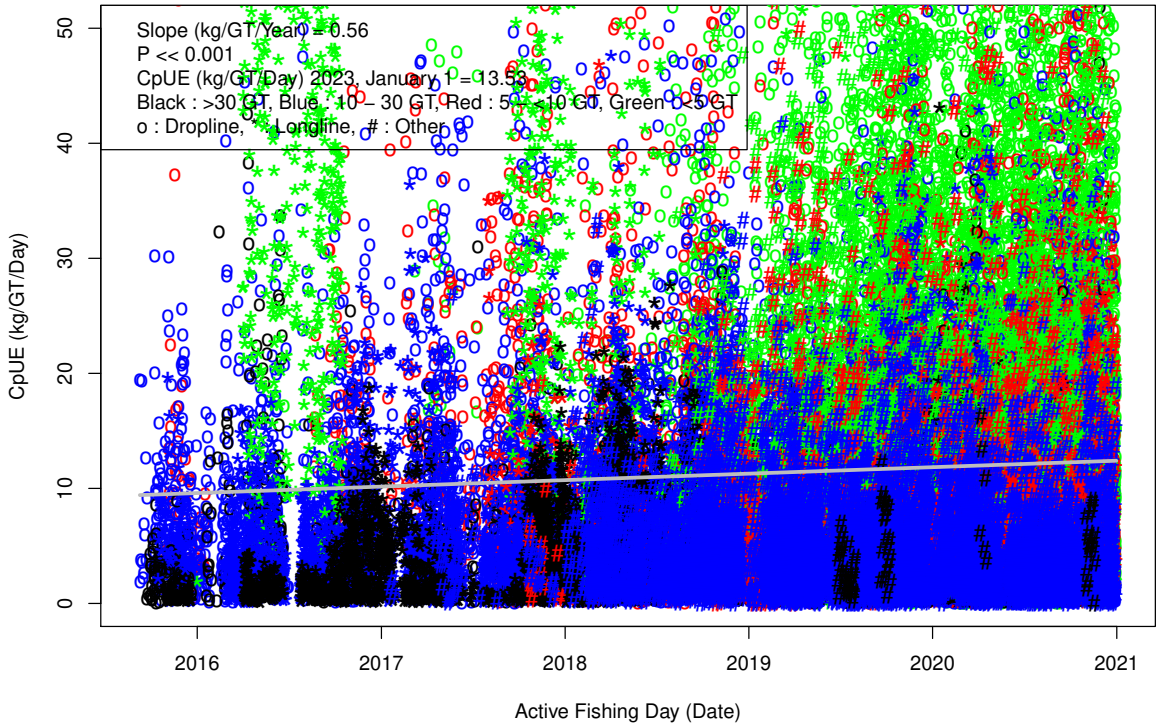

Figure 2.4: Catch-per-unit-effort (CpUE, in kg/GT/day) in deepwater demersal fisheries in Indonesia, all species combined. Each point represents the total catch of any fishing day recorded by a CODRS vessel, divided by the gross tonnage (hull) of that vessel. The regression line is based on these points, 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	Total
Nano	138	39	NA	15	192
Small	57	20	1	34	112
Medium	65	30	9	36	140
Large	3	20	1	NA	24
Total	263	109	11	85	468

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
Nano Dedicated	201	235	224	194
Nano Seasonal	100	118	112	97
Small Dedicated	213	258	247	277
Small Seasonal	107	129	124	139
Medium Dedicated	204	213	258	219
Medium Seasonal	102	107	129	110
Large Dedicated	166	237	151	185
Large Seasonal	83	119	75	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	Total
Nano Dedicated	3610	695	4	227	4536
Nano Seasonal	3085	525	2	19	3631
Small Dedicated	504	118	6	653	1281
Small Seasonal	757	30	7	0	794
Medium Dedicated	267	145	39	324	775
Medium Seasonal	140	80	12	0	232
Large Dedicated	5	189	91	1	286
Large Seasonal	1	0	0	0	1
Total	8369	1782	161	1224	11536

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	Total
Nano Dedicated	4737	1048	4	722	6510
Nano Seasonal	5249	957	9	24	6239
Small Dedicated	3412	799	48	4198	8457
Small Seasonal	4672	222	45	0	4940
Medium Dedicated	4007	3003	946	5821	13776
Medium Seasonal	2408	1026	185	0	3619
Large Dedicated	195	11916	6961	31	19103
Large Seasonal	35	0	0	0	35
Total	24715	18970	8198	10795	62678

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 in 2020

Total Catch	Dropline	Longline	Gillnet	Trap	Total
Nano Dedicated	19438	3607	21	1719	24785
Nano Seasonal	10504	855	17	10	11386
Small Dedicated	11409	2187	117	16564	30276
Small Seasonal	8463	299	104	0	8865
Medium Dedicated	7396	5006	1268	4712	18382
Medium Seasonal	1404	778	261	0	2443
Large Dedicated	642	13897	7882	90	22511
Large Seasonal	20	0	0	0	20
Total	59275	26630	9669	23096	118670

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 in 2020.

Species	571	572	573	711	712	713	714	715	716	717	718	Indonesia
Lutjanus malabaricus	26	47	1780	5089	7857	966	97	283	19	64	6602	22830
Pristipomoides multidens	204	339	4108	2297	4434	494	213	737	85	686	5289	18886
Aphareus rutilans	0	829	730	0	16	2091	403	3929	208	865	1	9073
Epinephelus coioides	1195	64	91	2154	1427	210	78	33	31	56	254	5593
Etelis radiosus	0	482	392	0	0	58	54	513	1188	1036	0	3724
Pristipomoides typus	4	347	1333	244	624	117	51	170	0	99	154	3143
Atrobucca brevis	0	0	0	0	0	0	0	0	0	0	2961	2961
Epinephelus areolatus	100	80	366	1098	799	231	30	34	4	86	83	2910
Pristipomoides filamentosus	0	993	610	0	21	57	84	627	158	30	22	2602
Pristipomoides sieboldii	0	1478	884	1	0	32	7	60	96	8	0	2566
Diagramma pictum	14	24	152	1707	322	226	25	29	12	1	1	2514
Etelis boweni	0	190	182	3	0	147	380	787	43	578	2	2312
Caranx sexfasciatus	55	195	176	45	116	924	72	349	153	143	38	2266
Plectropomus maculatus	0	11	0	1478	656	39	18	23	2	1	32	2261
Lutjanus erythropterus	0	29	219	143	1091	101	6	410	3	4	154	2160
Etelis coruscans	0	119	329	0	0	39	129	560	121	455	0	1752
Lutjanus sebae	0	4	219	509	243	134	19	11	0	6	535	1680
Lethrinus olivaceus	0	312	121	398	81	126	240	77	67	110	27	1560
Lutjanus johnii	34	86	10	846	288	18	3	10	17	0	112	1423
Diagramma labiosum	0	0	13	0	0	0	0	0	0	0	1348	1362
Total Top 20 Species	1632	5630	11713	16011	17976	6011	1909	8642	2208	4229	17617	93578
Total Top 100 Species	2075	7777	15247	18167	20027	8759	3375	11611	3407	6640	21585	118670

Table 2.8: Top 20 Species by Volume in Indonesian Deepwater Demersal Fisheries with % Immature Fish in the Catch in 2020.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	22830	19	19	66	31	High
Pristipomoides multidens	18886	16	35	51	25	High
Aphareus rutilans	9073	8	43	56	27	High
Epinephelus coioides	5593	5	48	20	6	Med
Etelis radiosus	3724	3	51	71	33	High
Pristipomoides typus	3143	3	53	53	29	High
Atrobucca brevis	2961	2	56	13	6	Med
Epinephelus areolatus	2910	2	58	4	1	Low
Pristipomoides filamentosus	2602	2	60	84	61	High
Pristipomoides sieboldii	2566	2	63	11	4	Med
Diagramma pictum	2514	2	65	46	15	High
Etelis boweni	2312	2	67	62	30	High
Caranx sexfasciatus	2266	2	69	16	4	Med
Plectropomus maculatus	2261	2	70	19	4	Med
Lutjanus erythropterus	2160	2	72	50	23	High
Etelis coruscans	1752	1	74	78	48	High
Lutjanus sebae	1680	1	75	84	44	High
Lethrinus olivaceus	1560	1	77	8	2	Low
Lutjanus johnii	1423	1	78	70	34	High
Diagramma labiosum	1362	1	79	0	0	Low
Total Top 20 Species	93578	79	79	44	24	High
Total Top 100 Species	118670	100	100	39	21	High

Table 2.9: Top 20 Species by Volume in Indonesian Dropline Fisheries with % Immature Fish in the Catch in 2020.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidens	8923	15	15	55	27	High
Aphareus rutilans	7588	13	28	55	26	High
Lutjanus malabaricus	7171	12	40	58	26	High
Etelis radiosus	3426	6	46	71	33	High
Pristipomoides sieboldii	2446	4	50	11	4	Med
Pristipomoides filamentosus	2311	4	54	84	61	High
Pristipomoides typus	2167	4	57	54	31	High
Etelis boweni	2082	4	61	62	30	High
Etelis coruscans	1607	3	64	78	48	High
Caranx sexfasciatus	1601	3	66	17	4	Med
Lutjanus erythropterus	1510	3	69	44	19	High
Epinephelus areolatus	1480	2	71	2	0	Low
Paracaesio kusakarii	1175	2	73	47	23	High
Seriola rivoliana	1082	2	75	31	8	High
Lethrinus olivaceus	964	2	77	6	1	Low
Caranx tille	707	1	78	4	1	Low
Elagatis bipinnulata	648	1	79	10	3	Med
Lutjanus gibbus	558	1	80	33	16	High
Lutjanus argentimaculatus	542	1	81	14	6	Med
Lutjanus bohar	508	1	82	58	17	High
Total Top 20 Species	48494	82	82	44	25	High
Total Top 100 Species	59275	100	100	38	23	High

Table 2.10: Top 20 Species by Volume in Indonesian Longline Fisheries with % Immature Fish in the Catch in 2020.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	5806	22	22	27	11	Med
Pristipomoides multidens	5208	20	41	48	25	High
Atrobucca brevis	2773	10	52	13	6	Med
Epinephelus coioides	820	3	55	15	4	Med
Pristipomoides typus	783	3	58	44	21	High
Lethrinus laticaudis	764	3	61	0	0	Low
Aphareus rutilans	717	3	63	76	40	High
Caranx ignobilis	626	2	66	5	3	Low
Gymnocranius grandoculis	587	2	68	33	12	High
Lutjanus sebae	587	2	70	49	20	High
Epinephelus areolatus	504	2	72	6	2	Low
Lethrinus olivaceus	472	2	74	2	1	Low
Caranx sexfasciatus	440	2	75	3	0	Low
Pomadasys kaakan	408	2	77	4	1	Low
Lethrinus lentjan	385	1	78	20	9	Med
Diagramma pictum	378	1	80	4	1	Low
Aprion virescens	359	1	81	21	8	Med
Lutjanus erythropterus	314	1	82	18	6	Med
Lutjanus vitta	271	1	83	31	17	High
Lutjanus argentimaculatus	249	1	84	10	4	Low
Total Top 20 Species	22452	84	84	23	13	Medium
Total Top 100 Species	26630	100	100	22	13	Medium

Table 2.11: Top 20 Species by Volume in Indonesian Gillnet Fisheries with % Immature Fish in the Catch in 2020.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Pristipomoides multidens	3600	37	37	31	18	High
Lutjanus malabaricus	2691	28	65	28	13	Med
Diagramma labiosum	1208	12	78	0	0	Low
Caranx bucculentus	425	4	82	0	0	Low
Epinephelus latifasciatus	189	2	84	NA	NA	
Atrobucca brevis	166	2	86	NA	NA	
Lutjanus sebae	156	2	87	64	44	High
Protonibea diacanthus	140	1	89	NA	NA	
Caranx ignobilis	83	1	90	11	5	Med
Aphareus rutilans	78	1	90	4	1	Low
Lethrinus laticaudis	74	1	91	NA	NA	
Glaucosoma buergeri	71	1	92	NA	NA	
Lutjanus johnii	54	1	92	0	0	Low
Diagramma pictum	54	1	93	0	0	Low
Caranx sexfasciatus	42	0	93	1	0	Low
Lutjanus argentimaculatus	42	0	94	2	1	Low
Pristipomoides typus	38	0	94	NA	NA	
Lethrinus olivaceus	38	0	95	0	0	Low
Caranx tille	37	0	95	0	0	Low
Epinephelus coioides	34	0	95	NA	NA	
Total Top 20 Species	9220	95	95	22	12	Medium
Total Top 100 Species	9669	100	100	22	12	Medium

Table 2.12: Top 20 Species by Volume in Indonesian Trap Fisheries with % Immature Fish in the Catch in 2020.

Species	Weight MT	Weight %	Cumulative % Weight	Immature % Number	Immature % Weight	Risk Immature
Lutjanus malabaricus	7162	31	31	85	54	High
Epinephelus coioides	4320	19	50	21	6	Med
Plectropomus maculatus	1903	8	58	20	5	Med
Diagramma pictum	1719	7	65	52	20	High
Pristipomoides multidens	1155	5	70	68	39	High
Lutjanus johnii	1116	5	75	74	39	High
Epinephelus areolatus	910	4	79	6	2	Low
Aphareus rutilans	690	3	82	NA	NA	
Lutjanus vitta	488	2	84	52	33	High
Lutjanus sebae	478	2	86	94	69	High
Lethrinus lentjan	411	2	88	5	2	Low
Lutjanus erythropterus	313	1	89	75	56	High
Epinephelus bleekeri	244	1	91	12	3	Med
Caranx sexfasciatus	184	1	91	8	2	Low
Pristipomoides typus	156	1	92	79	53	High
Pristipomoides filamentosus	116	1	92	NA	NA	
Etelis boweni	109	0	93	NA	NA	
Lutjanus argentimaculatus	104	0	93	14	6	Med
Lutjanus russelli	100	0	94	31	14	High
Lethrinus olivaceus	87	0	94	45	22	High
Total Top 20 Species	21763	94	94	57	30	High
Total Top 100 Species	23096	100	100	56	30	High

Table 2.13: CpUE in kg/GT/day for Top 20 Species by Volume in Indonesian Deep Water Demersal Fisheries with Species Distribution by WPP in 2020.

Species	571	572	573	711	712	713	714	715	716	717	718	Indonesia
Lutjanus malabaricus	0.17	0.10	1.88	1.91	3.98	1.38	0.65	0.80	0.13	0.17	1.68	1.92
Pristipomoides multidens	1.32	0.69	4.34	0.86	2.25	0.71	1.41	2.08	0.61	1.78	1.34	1.59
Aphareus rutilans	0.00	1.69	0.77	0.00	0.01	2.99	2.68	11.09	1.49	2.25	0.00	0.76
Epinephelus coioides	7.72	0.13	0.10	0.81	0.72	0.30	0.52	0.09	0.22	0.15	0.06	0.47
Etelis radiosus	0.00	0.99	0.41	0.00	0.00	0.08	0.36	1.45	8.53	2.69	0.00	0.31
Pristipomoides typus	0.03	0.71	1.41	0.09	0.32	0.17	0.34	0.48	0.00	0.26	0.04	0.26
Atrobucca brevis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.25
Epinephelus areolatus	0.65	0.16	0.39	0.41	0.41	0.33	0.20	0.10	0.03	0.22	0.02	0.24
Pristipomoides filamentosus	0.00	2.03	0.64	0.00	0.01	0.08	0.56	1.77	1.14	0.08	0.01	0.22
Pristipomoides sieboldii	0.00	3.02	0.93	0.00	0.00	0.05	0.05	0.17	0.69	0.02	0.00	0.22
Diagramma pictum	0.09	0.05	0.16	0.64	0.16	0.32	0.16	0.08	0.09	0.00	0.00	0.21
Etelis boweni	0.00	0.39	0.19	0.00	0.00	0.21	2.53	2.22	0.31	1.50	0.00	0.19
Caranx sexfasciatus	0.35	0.40	0.19	0.02	0.06	1.32	0.48	0.99	1.10	0.37	0.01	0.19
Plectropomus maculatus	0.00	0.02	0.00	0.55	0.33	0.06	0.12	0.06	0.02	0.00	0.01	0.19
Lutjanus erythropterus	0.00	0.06	0.23	0.05	0.55	0.14	0.04	1.16	0.02	0.01	0.04	0.18
Etelis coruscans	0.00	0.24	0.35	0.00	0.00	0.06	0.86	1.58	0.87	1.18	0.00	0.15
Lutjanus sebae	0.00	0.01	0.23	0.19	0.12	0.19	0.13	0.03	0.00	0.01	0.14	0.14
Lethrinus olivaceus	0.00	0.64	0.13	0.15	0.04	0.18	1.60	0.22	0.48	0.29	0.01	0.13
Lutjanus johnii	0.22	0.18	0.01	0.32	0.15	0.03	0.02	0.03	0.12	0.00	0.03	0.12
Diagramma labiosum	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.11
Total Top 20 Species	10.54	11.50	12.38	6.01	9.11	8.59	12.70	24.39	15.86	10.99	4.47	7.87
Total Top 100 Species	13.40	15.88	16.12	6.82	10.15	12.51	22.45	32.77	24.47	21.97	5.48	9.98

Table 2.14: Spawning Potential Ratio (SPR) by WPP for the Top 20 Species in the Catch (by Volume in 2020) in the Indonesian Deep Water Demersal Fisheries.

Species	571	572	573	711	712	713	714	715	716	717	718
Lutjanus malabaricus	6	0	6	3	5	11	13	3	0	NA	7
Pristipomoides multidens	18	6	11	7	19	30	16	11	NA	8	11
Aphareus rutilans	NA	7	26	NA	NA	10	8	4	7	8	NA
Epinephelus coioides	5	5	NA	10	8	7	17	NA	2	NA	12
Etelis radiosus	NA	2	8	NA	NA	11	3	8	18	5	NA
Pristipomoides typus	41	7	9	4	11	11	8	11	NA	8	15
Atrobucca brevis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
Epinephelus areolatus	15	16	16	10	14	7	12	11	NA	6	16
Pristipomoides filamentosus	NA	0	4	NA	NA	0	9	8	1	0	42
Pristipomoides sieboldii	NA	14	17	NA	NA	8	22	8	3	NA	NA
Diagramma pictum	17	5	18	7	7	28	100	8	3	NA	NA
Etelis boweni	NA	4	7	NA	NA	14	7	5	NA	4	NA
Caranx sexfasciatus	58	100	33	NA	41	31	53	33	NA	NA	53
Plectropomus maculatus	NA	NA	NA	31	78	12	23	NA	18	NA	100
Lutjanus erythropterus	NA	18	64	2	8	8	NA	23	6	NA	100
Etelis coruscans	NA	3	2	NA	NA	1	7	3	4	4	NA
Lutjanus sebae	NA	NA	5	0	1	2	NA	NA	NA	NA	4
Lethrinus olivaceus	NA	29	NA	22	NA	24	21	23	NA	NA	87
Lutjanus johnii	8	30	NA	12	4	40	NA	NA	1	NA	21
Diagramma labiosum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9

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 close to US$ 1.3 Billion has been estimated for the trade in 100 target species in the Indonesian deep demersal fisheries, based on 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	22830	30	70	7.43	18.77	350854	27.3	27.3
2	Pristipomoides multidens	18886	30	70	4.20	15.74	231885	18.0	45.3
3	Plectropomus maculatus	2261	30	70	6.47	38.93	66012	5.1	50.5
4	Epinephelus coioides	5593	30	70	8.62	13.02	65437	5.1	55.6
5	Etelis radiosus	3724	50	50	3.32	23.13	49244	3.8	59.4
6	Pristipomoides filamentosus	2602	50	50	2.47	29.49	41580	3.2	62.6
7	Epinephelus areolatus	2910	30	70	4.37	18.29	41078	3.2	65.8
8	Etelis coruscans	1752	50	50	6.63	35.17	36609	2.8	68.7
9	Lutjanus erythropterus	2160	30	70	5.78	20.19	34268	2.7	71.3
10	Etelis boweni	2312	50	50	3.32	23.13	30570	2.4	73.7
11	Pristipomoides typus	3143	30	70	2.24	11.77	28011	2.2	75.9
12	Aphareus rutilans	9073	80	20	2.21	6.47	27782	2.2	78.1
13	Lutjanus sebae	1680	30	70	6.48	20.05	26841	2.1	80.2
14	Diagramma pictum	2514	40	60	7.30	9.54	21727	1.7	81.8
15	Lutjanus johnii	1423	30	70	7.74	10.96	14226	1.1	82.9
16	Atrobucca brevis	2961	30	70	3.32	3.69	10596	0.8	83.8
17	Lethrinus olivaceus	1560	40	60	5.31	7.68	10505	0.8	84.6
18	Paracaesio kusakarii	1320	40	60	2.65	11.21	10279	0.8	85.4
19	Plectropomus leopardus	372	30	70	5.08	34.45	9526	0.7	86.1
20	Diagramma labiosum	1362	40	60	5.97	7.66	9511	0.7	86.9
21	Pristipomoides sieboldii	2566	80	20	2.32	8.87	9314	0.7	87.6
22	Caranx sexfasciatus	2266	100	0	4.09	5.12	9268	0.7	88.3
23	Lutjanus argentimaculatus	936	30	70	6.14	10.88	8856	0.7	89.0
24	Lutjanus timorensis	565	30	70	3.32	20.19	8547	0.7	89.7
25	Lutjanus vitta	981	30	70	4.98	9.45	7957	0.6	90.3
26	Lethrinus lentjan	1067	40	60	5.31	6.53	6448	0.5	90.8
27	Gymnocranius grandoculis	1168	40	60	3.98	6.45	6382	0.5	91.3
28	Epinephelus bleekeri	641	30	70	4.31	11.86	6149	0.5	91.8
29	Aprion virescens	860	60	40	3.47	11.10	5611	0.4	92.2
30	Lethrinus laticaudis	1072	60	40	3.98	6.45	5325	0.4	92.6
31	Lutjanus bohar	705	30	70	2.65	8.87	4939	0.4	93.0
32	Lutjanus gibbus	703	70	30	4.35	11.21	4503	0.4	93.4
33	Seriola rivoliana	1229	100	0	3.65	6.45	4485	0.3	93.7
34	Caranx ignobilis	1221	100	0	3.65	5.12	4455	0.3	94.0
35	Paracaesio xanthura	551	40	60	2.65	11.21	4293	0.3	94.4
36	Pinjalo lewisi	575	60	40	4.31	11.21	4064	0.3	94.7
37	Lutjanus boutton	434	30	70	2.65	11.21	3754	0.3	95.0
38	Epinephelus latifasciatus	388	30	70	4.31	11.86	3723	0.3	95.3
39	Cephalopholis sonnerati	364	30	70	4.23	11.86	3482	0.3	95.6
40	Elagatis bipinnulata	710	100	0	4.64	6.45	3295	0.3	95.8
41	Caranx tille	944	100	0	3.32	5.12	3133	0.2	96.1
42	Pomadasys kaakan	452	50	50	3.32	8.00	2559	0.2	96.2
43	Variola albimarginata	169	30	70	5.64	17.30	2337	0.2	96.4
44	Carangoides chrysophrys	588	100	0	3.65	5.94	2145	0.2	96.6
45	Symphorus nematophorus	219	30	70	6.45	11.21	2144	0.2	96.8
46	Protonibea diacanthus	388	30	70	3.32	6.45	2138	0.2	96.9
47	Caranx bucculentus	585	100	0	3.65	5.12	2134	0.2	97.1
48	Lutjanus russelli	243	50	50	6.37	11.01	2115	0.2	97.3
49	Paracaesio stonei	224	40	60	2.65	11.21	1741	0.1	97.4
50	Lutjanus rivulatus	221	40	60	2.65	11.21	1721	0.1	97.5
	SUB-TOTAL	113473					1253559		

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	173	30	70	4.31	11.86	1656	0.1	97.7
52	Hyporthodus octofasciatus	171	30	70	4.31	11.86	1641	0.1	97.8
53	Paracaesio gonzalesi	202	40	60	2.65	11.21	1569	0.1	97.9
54	Pinjalo pinjalo	222	60	40	4.31	11.21	1567	0.1	98.0
55	Erythrocles schlegelii	468	100	0	3.32	6.45	1554	0.1	98.2
56	Carangoides gymnostethus	212	100	0	7.30	5.12	1550	0.1	98.3
57	Rachycentron canadum	268	40	60	1.99	8.32	1549	0.1	98.4
58	Epinephelus amblycephalus	148	30	70	4.31	11.86	1424	0.1	98.5
59	Epinephelus malabaricus	144	30	70	3.65	11.86	1355	0.1	98.6
60	Lethrinus amboinensis	267	60	40	3.98	6.45	1327	0.1	98.7
61	Sphyraena barracuda	292	50	50	1.99	6.45	1230	0.1	98.8
62	Lethrinus nebulosus	167	40	60	3.98	6.75	943	0.1	98.9
63	Cephalopholis miniata	99	30	70	3.98	11.86	940	0.1	99.0
64	Epinephelus morrhua	96	30	70	4.31	11.86	918	0.1	99.0
65	Lipocheilus carnolabrum	111	40	60	2.65	11.21	862	0.1	99.1
66	Epinephelus heniochus	86	30	70	4.31	11.86	821	0.1	99.2
67	Glaucosoma buergeri	152	40	60	3.32	6.45	790	0.1	99.2
68	Gymnocranius griseus	129	40	60	3.98	6.45	707	0.1	99.3
69	Lethrinus rubrioperculatus	114	40	60	3.98	7.68	704	0.1	99.3
70	Cephalopholis sexmaculata	67	30	70	4.31	11.86	645	0.1	99.4
71	Carangoides fulvoguttatus	174	100	0	3.65	5.12	634	0.0	99.4
72	Epinephelus retouti	60	30	70	4.31	11.86	572	0.0	99.5
73	Epinephelus poecilonotus	59	30	70	4.31	11.86	567	0.0	99.5
74	Epinephelus radiatus	57	30	70	4.31	11.86	550	0.0	99.6
75	Wattsia mossambica	111	90	10	3.98	6.45	470	0.0	99.6
76	Sphyraena putnamae	109	50	50	1.99	6.45	459	0.0	99.6
77	Argyrops spinifer	101	90	10	3.32	10.15	405	0.0	99.7
78	Sphyraena forsteri	106	50	50	1.16	6.45	402	0.0	99.7
79	Lutjanus lemniscatus	47	50	50	4.31	11.21	364	0.0	99.7
80	Caranx lugubris	96	100	0	3.65	5.12	352	0.0	99.8
81	Carangoides coeruleopinnatus	104	100	0	3.32	5.12	346	0.0	99.8
82	Etelis carbunculus	25	50	50	3.32	23.13	333	0.0	99.8
83	Parascolopsis eriomma	166	100	0	1.99	6.45	330	0.0	99.8
84	Epinephelus bilobatus	32	30	70	4.31	11.86	310	0.0	99.9
85	Epinephelus chlorostigma	28	30	70	4.31	11.86	264	0.0	99.9
86	Cookeolus japonicus	70	90	10	2.65	6.45	211	0.0	99.9
87	Seriola dumerili	51	100	0	3.65	7.42	184	0.0	99.9
88	Epinephelus multinotatus	18	30	70	4.31	11.86	173	0.0	99.9
89	Epinephelus miliaris	18	30	70	4.31	11.86	169	0.0	99.9
90	Epinephelus undulosus	15	30	70	4.31	11.86	146	0.0	99.9
91	Epinephelus stictus	14	30	70	4.31	11.86	133	0.0	100.0
92	Pristipomoides argyrogrammicus	31	80	20	2.32	8.87	113	0.0	100.0
93	Pristipomoides zonatus	26	90	10	2.32	22.29	112	0.0	100.0
94	Pristipomoides flavipinnis	34	90	10	2.32	8.87	101	0.0	100.0
95	Cephalopholis igarashiensis	7	30	70	4.31	11.86	70	0.0	100.0
96	Saloptia powelli	7	30	70	4.31	11.86	66	0.0	100.0
97	Ostichthys japonicus	24	90	10	1.99	6.45	58	0.0	100.0
98	Lutjanus bitaeniatus	9	90	10	3.32	8.87	33	0.0	100.0
99	Dentex carpenteri	9	90	10	3.32	6.45	31	0.0	100.0
100	Carangoides malabaricus	5	100	0	3.65	5.67	17	0.0	100.0
	SUB-TOTAL	5196					31727		
	TOTAL	118670					1285286		

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 long 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.

Risk of overfishing is high for most of the deep demersal species which are commonly targeted on deep slopes and continental shelve areas throughout Indonesia, and which are readily caught with various types of gear. Fishing mortality in many target 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 species seem to be excluded from this general pattern. Larger specimen of the largest target species have become extremely rare in our region.

Most of the target species in the deep demersal fisheries are 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 or lower risk. Fishing effort and fishing mortality have been too high in recent years. Time trends show continued deterioration of the stocks of most target species, especially the Lutjanids, across most Indonesian fishing grounds and fisheries management areas. There are some exceptions in WPP 573 for major target species and in other WPP 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 changes all the time, potentially obscuring trends in CpUE.

Overall we are currently looking at a high risk of overfishing for all major target species in Indonesia, combined with a worrisome trend of deterioration in the stocks, based on size based stock assessments from deep demersal fisheries. The groupers seem to be somewhat less vulnerable to the deep demersal fisheries than the snappers. This may be because most groupers are staying closer to high rugosity bottom habitat, which is avoided by trap and long line vessels due to risk of entanglement, while drop line fishers are targeting schooling snappers that are hovering higher in the water column, above the grouper habitat.

Fishing mortality (from deep demersal fisheries) in large mature groupers may be somewhat 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.

For those grouper species which spend all or most of their life cycle in deep water habitats, the relatively low vulnerability to the deep slope hook and line fisheries is very good news. For other grouper species which spend major parts of their life cycle in shallower habitats, like coral reefs or mangroves or estuaries for example, the reality is that their populations in general are not in good shape due to excessive fishing pressure by small scale fisheries in those shallower habitats. This situation is also evident for a few snapper species such as for example the mangrove jack.

Overall there is a clear scope for some straightforward fisheries improvements supported by relatively uncomplicated fisheries management policies and regulations. Our first recommendation for industry-led fisheries improvements is for traders to adjust trading limits (incentives to fishers) species by species 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 target species in the deep demersal fisheries 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 fishing 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 shows that habitat separation between size groups is evident for many species, while size selectivity of specific hook sizes is obvious. Captains know about this from experience.

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

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

Government policies and regulations 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 deep demersal 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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