

**Aspects of the biology of elasmobranchs in a subtropical embayment in
Western Australia and of chondrichthyan fisheries in Indonesia**

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Table 3.1 Number and percentage contribution of elasmobranchs and teleosts caught by gill netting at the three different unvegetated sites and one vegetated site in Herald Bight between October 1999 and September 2001. Dotted line denotes separation of elasmobranchs above and teleosts below. Values in parentheses refer to percentage contribution of each elasmobranch species to the total number of elasmobranchs recorded. Note that fewer samples were collected from seagrass than the three unvegetated sites (see Materials and Methods for rationale).

Family	Species	Total			No vegetation nearby			Unvegetated Near sparse mangroves			Near dense mangroves			Vegetated Seagrass		
		N	%	(%)	N	%	(%)	N	%	(%)	N	%	(%)	N	%	(%)
Hemiscylliidae	<i>Chiloscyllium punctatum</i>	11	2.0	(2.9)	0			0			0			11	8.8	(11.0)
Triakidae	<i>Furgaleus macki</i>	1	0.2	(0.3)	0			0			0			1	0.8	(1.0)
Hemigaleidae	<i>Hemigaleus microstoma</i>	7	1.3	(1.8)	1	1.7	(3.2)	0			0			6	4.8	(6.0)
Carcharhinidae	<i>Carcharhinus brevipinna</i>	12	2.2	(3.1)	0			0			0			12	9.6	(12.0)
	<i>Carcharhinus cautus</i>	229	42.3	(59.9)	16	27.6	(51.6)	63	54.3	(81.8)	145	59.9	(83.3)	5	4.0	(5.0)
	<i>Carcharhinus limbatus</i>	4	0.7	(1.0)	0			0			1	0.4	(0.6)	3	2.4	(3.0)
	<i>Carcharhinus plumbeus</i>	4	0.7	(1.0)	0			0			0			4	3.2	(4.0)
	<i>Negaprion acutidens</i>	41	7.6	(10.7)	11	19.0	(35.6)	9	7.8	(11.7)	21	8.7	(12.1)	0		
	<i>Rhizoprionodon acutus</i>	59	10.9	(15.4)	1	1.7	(3.2)	0			0			58	46.4	(58.0)
Sphyrnidae	<i>Sphyrna lewini</i>	1	0.2	(0.3)	1	1.7	(3.2)	0			0			0		
Rhinobatidae	<i>Rhinobatos typus</i>	8	1.5	(2.1)	1	1.7	(3.2)	4	3.4	(5.2)	3	1.2	(1.7)	0		
Pristidae	<i>Pristis zijsron</i>	1	0.2	(0.3)	0			1	0.9	(1.3)	0			0		
Dasyatidae	<i>Himantura uarnak</i>	1	0.2	(0.3)	0			0			1	0.4	(0.6)	0		
	<i>Pastinachus sephen</i>	2	0.4	(0.5)	0			0			2	0.8	(1.1)	0		
Myliobatididae	<i>Aetomylaeus vespertilio</i>	1	0.2	(0.3)	0			0			1	0.4	(0.6)	0		
Belonidae	<i>Strongylura leiura</i>	1	0.2		0			1	0.9		0			0		
Carangidae	<i>Gnathanodon speciosus</i>	5	0.9		0			0			5	2.1		0		
	<i>Scomberoides commersonianus</i>	4	0.7		0			0			4	1.7		0		
Chanidae	<i>Chanos chanos</i>	5	0.9		0			1	0.9		4	1.7		0		
Mugilidae	<i>Mugil cephalus</i>	48	8.9		5	8.6		26	22.4		17	7.0		0		
Platycephalidae	<i>Platycephalus endrachtensis</i>	4	0.7		0			0			4	1.7		0		
Pomatomidae	<i>Pomatomus saltatrix</i>	30	5.5		7	12.1		8	6.9		15	6.2		0		
Scatophagidae	<i>Selenotoca multifasciata</i>	1	0.2		0			0			1	0.4		0		
Sciaenidae	<i>Argyrosomus japonicus</i>	17	3.1		7	12.1		0			10	4.1		0		
Scombridae	<i>Scomberomorus munroi</i>	25	4.6		0			0			0			25	20.0	
Sparidae	<i>Acanthopagrus latus</i>	17	3.1		6	10.3		3	2.6		8	3.3		0		
	<i>Rhabdosargus sarba</i>	2	0.4		2	3.4		0			0			0		
Total numbers		541			58			116			242			125		

Table 6.4 Details of the various fishing methods used by both the target and non-target fisheries for elasmobranchs in south-eastern Indonesia.

Fishing Method	Landing site	Target species	Net length (m)	Mesh size (cm)	Line length (m)	# lines / boat	# hooks	Hook size	Depth (m)	Trip days	Fishing Grounds
Target Fisheries											
Demersal tangle/ gill nets	Muara Angke	dasyatids	5000–6000	50–60					30–50	50–60	Java, Banda Seas, West Sumatra
	Benoa Harbour	rhynchobatids	5000–6000	50					30–50	40	Banda and Arafura Seas
	Merauke	rhynchobatids	5000–6000	50					30–50	40	Banda and Arafura Seas
Demersal gill nets	Kedonganan	rhinobatids	1200	10					20	1–2	Jimbaran Bay
Pelagic longlines	Palabuhanratu	carcharhinids			3000–5000	1	400–600	6–10		7–15	West Sumatra and south to Aust.
	Tanjung Luar	carcharhinids			3000–5000	1	400–600	6–10		7–15	south Flores, Sumbawa and Sumba
Demersal longlines	Palabuhanratu	squaloids			2000	1	350	6	>400	1–2	offshore of landing site
	Sentolo kawat	squaloids			?	?	?	?	>200	?	offshore of landing site
	Kedonganan	squaloids			200	2	25	5 cm	>60	14	Jimbaran Bay and south of Uluwatu
	Tanjung Luar	squaloids			5000–6000?	1	1300?	5–6	>100	7–15	south Flores and Sumbawa
Non-target fisheries											
Gill nets for tuna	Muara Baru	tuna	?	?					?	21–28	south Kalimantan
	Palabuhanratu	tuna	1400–1600	12–14						7–15	Lampung, West Sumatra
	Cilacap	tuna	1000–3000	10–12						7–15	off Yogyakarta and Palabuhanratu
	Kedonganan	tuna	1200?	10						2–7	off Jimbaran Bay
	Tanjung Luar	tuna	800	14						15	south Flores and Sumbawa
Surface longlines	Muara Baru	tuna			?	?	?	?		7–15	West Sumatra
	Cilacap	tuna			20000	1	2000	3–6	>1000	8–20	off the south Java coast
Trammel nets	Palabuhanratu	teleosts	30–40	2–4					30–60	1–2	local waters
	Cilacap	penaeids	60–120	2–4					60–100	1–7	local waters
Seine nets	Merauke	penaeids	40	0.8					<1.5	<1	off local beaches
Trawling	Muara Angke	penaeids							<60	?	Java Sea
	Merauke	teleosts							30–60	60	Arafura and Banda Seas
Trapping	Muara Angke	lutjanids							?	?	offshore reefs

Table 6.2 Habitat, capture method, number landed and number measured, and size ranges of each species of chondrichthyan recorded at the landing sites in south-eastern Indonesia. Habitat: D = demersal, R = reef-dwelling, P = pelagic, M = mesopelagic, O = oceanic. Fishing method: G = gill net, L = longline, D = dropline, N = trammel net, F = fish trap, S = seine net, T = trawl, U = uncertain. * denotes potential new species; ** denotes new species where descriptions are near completion.

Family	Species	Habitat	Fishing method	Number landed	Number measured	Mean size (mm)	Maximum size (mm)	Minimum size (mm)	
Hexanchidae	<i>Heptranchias perlo</i>	D	L	14	7	883	980	750	
	<i>Hexanchus griseus</i>	D	L	7	6	3088	3750	2190	
	<i>Hexanchus nakamurai</i>	D/M	L	2	2	1010	1070	950	
Squalidae	<i>Cirrhigaleus barbifer</i>	D	L	2	2	898	995	800	
	<i>Squalus</i> sp. cf. <i>japonicus</i> *	D	L	10	10	551	601	464	
	<i>Squalus</i> sp. 1 *	D	L	20	18	653	850	460	
	<i>Squalus</i> sp. 1b *	D	L	5	5	553	730	454	
	<i>Squalus</i> sp. 2 *	D	L	6	6	595	710	520	
	<i>Squalus</i> sp. 2b *	D	L	3	2	730	730	730	
	<i>Squalus</i> sp. 2c *	D	L	15	13	621	866	550	
	<i>Squalus</i> sp. 3 *	D	L	6	7	666	780	600	
	<i>Squalus</i> sp. 3b *	D	L	367	200	565	735	140	
	<i>Squalus</i> sp. 4 *	D	L	30	30	816	945	590	
	<i>Squalus</i> sp. 4b *	D	L	1	1	900	900	900	
	Centrophoridae	<i>Centrophorus</i> sp. cf. <i>granulosa</i> *	D	L	9	7	909	1070	750
		<i>Centrophorus</i> sp. cf. <i>isodon</i> *	D	L	4	3	986	1010	970
<i>Centrophorus</i> sp. cf. <i>lusitanicus</i> *		D	L	2	5	896	930	840	
<i>Centrophorus</i> sp. cf. <i>moluccensis</i> *		D	L	4	4	665	900	540	
<i>Centrophorus</i> sp. cf. <i>niaukang</i> *		D	L	62	31	1244	1640	400	
<i>Centrophorus</i> sp. cf. <i>squamosus</i> *		D	L	19	6	997	1250	520	
<i>Centrophorus</i> sp. cf. <i>uyato</i> (Indo) *		D	L	12	5	564	822	220	
<i>Centrophorus</i> sp. cf. <i>uyato</i> (grey) *		D	L	3	3	695	750	600	
<i>Centrophorus</i> sp. 1 (long nose) *		D	L	3	3	614	750	523	
Dalatiidae	<i>Isistius brasiliensis</i>	P/M	U	0	0	-	-	-	
Orectolobidae	<i>Orectolobus</i> sp. 1 *	R	D	15	10	981	1070	889	
Hemiscylliidae	<i>Chiloscyllium indicum</i>	R	T	4	10	512	561	466	
	<i>Chiloscyllium punctatum</i>	R	T/G	247	21	789	1210	610	

Table 6.2 (continued)

Family	Species	Habitat	Fishing method	Number landed	Number measured	Mean size (mm)	Maximum size (mm)	Minimum size (mm)
	<i>Chiloscyllium</i> sp. 1 (small, ridges) *	R	N	1	3	232	323	78
	<i>Chiloscyllium</i> sp. 2 (cf. <i>punctatum</i>) *	R	G	3	1	1190	1190	1190
Ginglymostomatidae	<i>Nebrius ferrugineus</i>	D	G/L	5	2	2338	2355	2320
Stegostomatidae	<i>Stegostoma fasciatum</i>	R	T/G/L	56	6	1420	1670	1240
Odontaspidae	<i>Carcharias taurus</i>	D	L	1	0	-	-	-
Pseudocarchariidae	<i>Pseudocarcharias kamoharai</i>	P/M	L	36	14	780	1060	514
Alopiidae	<i>Alopias pelagicus</i>	O	L	168	83	2511	3260	1500
	<i>Alopias superciliosus</i>	O	L	18	6	2682	3820	1530
Lamnidae	<i>Isurus oxyrinchus</i>	P/O	L	24	12	1919	2160	1490
	<i>Isurus paucus</i>	O	L	4	3	2437	2980	2050
Scyliorhinidae	<i>Atelomycterus marmoratus</i>	R	G	12	8	540	630	430
	<i>Atelomycterus</i> sp. 1 **	R	G	14	13	486	592	395
	<i>Cephaloscyllium</i> sp. E	R	G	4	4	645	670	605
	<i>Halaelurus</i> sp. 1 (cf. <i>boesemani</i>) *	R	G	29	29	414	462	300
Triakidae	<i>Hemitriakis</i> sp. 1 (cf. <i>abdita</i>) *	D	G/L	19	11	951	1130	190
	<i>Iago</i> sp. 1 (black tips) *	D	L	1	1	650	650	650
	<i>Mustelus</i> sp. 1 (white tip) *	D	L	12	9	760	1095	490
	<i>Mustelus</i> sp. 2 (black tip) *	D	L	23	19	698	1124	244
	<i>Mustelus</i> sp. cf. <i>griseus</i> *	D	L	22	18	827	1160	540
Hemigaleidae	<i>Chaenogaleus macrostoma</i>	D	G	7	2	1040	1250	830
	<i>Hemigaleus microstoma</i>	D	G/L	74	17	875	1141	490
	<i>Hemipristis elongata</i>	D	G	11	3	1143	1160	1130
Carcharhinidae	<i>Carcharhinus albimarginatus</i>	P	G/L	30	29	1235	2433	725
	<i>Carcharhinus altimus</i>	P	L	5	4	1408	2150	830
	<i>Carcharhinus amblyrhynchoides</i>	P	G	15	1	545	545	545
	<i>Carcharhinus amblyrhynchos</i>	P	G/L	67	56	1301	2320	670
	<i>Carcharhinus amboinensis</i>	P	G	6	2	2780	2910	2650
	<i>Carcharhinus brevipinna</i>	P	G/L	183	90	999	2830	480
	<i>Carcharhinus dussumieri</i>	D	G/T	180	4	526	885	347
	<i>Carcharhinus falciformis</i>	P/O	G/L	480	209	1270	2540	620

Table 6.2 (continued)

Family	Species	Habitat	Fishing method	Number landed	Number measured	Mean size (mm)	Maximum size (mm)	Minimum size (mm)
	<i>Carcharhinus leucas</i>	D/P	G/L	5	4	770	790	730
	<i>Carcharhinus limbatus / tilstoni</i>	P	G/L	122	25	1060	2370	430
	<i>Carcharhinus longimanus</i>	O	G/L	33	19	1336	2610	660
	<i>Carcharhinus macloti</i>	P	G	8	5	636	800	480
	<i>Carcharhinus melanopterus</i>	R	G/L	31	23	1040	1420	365
	<i>Carcharhinus obscurus</i>	P/O	L	36	27	2510	2890	2075
	<i>Carcharhinus plumbeus</i>	P	G/L	6	3	1667	1830	1420
	<i>Carcharhinus sorrah</i>	P	G/L	396	81	786	1460	540
	<i>Galeocerdo cuvier</i>	D/P/O	L/T	18	9	2183	3140	1830
	<i>Lamiopsis temminckii</i>	P	G	1	1	614	614	614
	<i>Loxodon macrorhinus</i>	P	G	15	7	737	860	605
	<i>Prionace glauca</i>	O	L	149	31	2401	2880	2030
	<i>Rhizoprionodon acutus</i>	P	G	50	27	592	930	309
	<i>Rhizoprionodon oligolinx</i>	P	G	869	42	453	870	260
	<i>Rhizoprionodon taylori</i>	P	G/T	55	23	590	671	482
	<i>Scoliodon laticaudus</i>	P	G	1041	5	390	450	251
	<i>Triaenodon obesus</i>	R	G/L	34	19	1134	1510	782
Sphyrnidae	<i>Eusphyra blochii</i>	P	G	8	1	361	361	361
	<i>Sphyrna lewini</i>	P	G/L	247	69	1312	3060	390
	<i>Sphyrna mokarran</i>	P	G/L	15	1	1266	1266	1266
	<i>Sphyrna zygaena</i>	P	L	9	3	1847	2360	1350
Pristidae	<i>Pristis microdon</i>	D	G	2	1	4500	4500	4500
Rhinidae	<i>Rhina ancylostoma</i>	D	G	35	0	-	-	-
	<i>Rhynchobatus cf. australiae</i>	D	G	207	21	1084	2230	486
	<i>Rhynchobatus cf. laevis</i>	D	G	1	1	490	490	490
Rhinobatidae	<i>Rhinobatos thouini</i>	D	G	13	0	-	-	-
	<i>Rhinobatos typus</i>	D	G	21	0	-	-	-
	<i>Rhinobatos</i> sp. 1 (white spotted) **	D	G	366	230	704	940	300
	<i>Rhinobatos</i> sp. 2 (blotched) **	D	G	85	81	677	930	491
Narcinidae	<i>Narcine</i> sp. D	D	N	2	1	260	260	260

Table 6.2 (continued)

Family	Species	Habitat	Fishing method	Number landed	Number measured	Mean size (mm)	Maximum size (mm)	Minimum size (mm)
Rajidae	<i>Narcine</i> sp. 1 (<i>cf. maculatus</i>) *	D	N	1	1	140	140	140
	<i>Dipturus</i> sp. 1 *	D	L/D	1	1	430	430	430
	<i>Dipturus</i> sp. 2 *	D	L/D	4	4	938	1190	770
Plesiobatidae	<i>Plesiobatis daviesi</i>	D	L/D	7	7	654	1170	287
Dasyatididae	<i>Dasyatis cf. akajei</i>	D	G	1	1	295	295	295
	<i>Dasyatis kuhlii</i> (Bali form)	D	G/F/T	90	18	328	441	245
	<i>Dasyatis kuhlii</i> (Java form) *	D	G/F/T	5699	326	257	379	118
	<i>Dasyatis violacea</i>	O	L/G	97	20	508	590	410
	<i>Dasyatis zugei</i>	D	T	2420	194	189	277	104
	<i>Dasyatis</i> sp. 1 (grey disc, thorns) *	D	L	5	5	1602	2020	1240
	<i>Dasyatis</i> sp. 2 (plain) *	D	G	2	2	515	520	510
	<i>Dasyatis</i> sp. 3 (pale, long tail) *	D	S	18	16	121	156	91
	<i>Himantura fai</i>	D	G/L	269	30	1209	1840	630
	<i>Himantura fava</i>	D	G	6	0	-	-	-
	<i>Himantura cf. gerrardi</i> (full spot)	D	G/T	172	5	596	930	418
	<i>Himantura</i> sp. sparse spot (<i>cf. gerrardi</i>) *	D	G/T	1784	28	476	860	200
	<i>Himantura</i> sp. yellow (<i>cf. gerrardi</i>) *	D	G	67	46	456	920	198
	<i>Himantura granulata</i>	D	G	8	1	1180	1180	1180
	<i>Himantura jenkinsii</i>	D	G/L	133	14	776	990	274
	<i>Himantura toshi</i>	D	G/S	7	2	496	790	202
	<i>Himantura uarnacoides</i>	D	G	152	10	824	1110	285
	<i>Himantura uarnak</i>	D	G/L	60	16	859	1310	271
	<i>Himantura undulata</i>	D	G	64	10	892	1190	590
	<i>Himantura walga</i>	D	T	1321	88	185	221	100
<i>Himantura</i> sp. 1 *	D	N	83	14	179	236	120	
<i>Himantura</i> sp. 2 (long nose, yellow) *	D	S	5	5	358	666	195	
<i>Himantura</i> sp. 3 (<i>cf. uarnak</i>) *	D	S	1	1	274	274	274	
<i>Himantura</i> sp. ? (<i>cf. walga</i>) *	D	N	1	1	236	236	236	
<i>Pastinachus sephen</i>	D	G/S	193	19	1021	1490	280	
<i>Pastinachus</i> sp. 1 (long snout) *	D	T	14	1	394	394	394	

Table 6.2 (continued)

Family	Species	Habitat	Fishing method	Number landed	Number measured	Mean size (mm)	Maximum size (mm)	Minimum size (mm)	
	<i>Taeniura lymma</i>	D	G/D	48	7	265	350	200	
	<i>Taeniura meyeni</i>	D	G	45	8	1098	1640	810	
	<i>Urogymnus asperrimus</i>	D	G	3	0	-	-	-	
Gymnuridae	<i>Aetoplatea zonura</i>	D	G/T	179	77	464	950	280	
	<i>Gymnura japonica</i>	D	G/T	12	9	483	1080	200	
	<i>Gymnura poecilura</i>	D	T	3	1	449	449	449	
Myliobatidae	<i>Aetobatus narinari</i>	P	G/T	72	17	1136	1900	465	
	<i>Aetobatus</i> sp. cf. <i>gutattus</i> *	P	G	1	1	1010	1010	1010	
	<i>Aetobatus</i> sp.A (plain, cf. <i>flagellum</i>)	P	T	4	1	435	435	435	
	<i>Aetomylaeus maculatus</i>	D/P	T	8	3	587	715	505	
	<i>Aetomylaeus nichofii</i>	D/P	T	17	6	403	590	196	
	<i>Aetomylaeus vespertilio</i>	D/P	G	10	0	-	-	-	
	<i>Myliobatis tobijei</i>	D	G	3	3	847	1000	680	
Rhinopteridae	<i>Rhinoptera javanica</i>	P	G/T	32	16	742	1040	380	
	<i>Rhinoptera</i> sp. 1 (cf. <i>javanica</i>) *	P	G	6	2	526	540	512	
Mobulidae	<i>Manta birostris</i>	O	G/P	7	5	3950	4940	2420	
	<i>Mobula</i> cf. <i>kuhlii</i>	P/O	G	1	1	1160	1160	1160	
	<i>Mobula japonica</i>	P/O	G	78	54	1810	2400	920	
	<i>Mobula tarapacana</i>	O	G	29	23	2345	3200	1730	
	<i>Mobula thurstoni</i>	P/O	G	1	3	1028	1240	915	
	<i>Mobula</i> sp. 1 (cf. <i>japanica</i>) *	P/O	G	2	3	1072	1320	645	
Chimaeridae	<i>Hydrolagus</i> sp. 1 *	D	L	62	25	648	876	528	
Total Number of Families				29					
Total Number of Species				139					

Table 3 Comparisons of the reproductive parameters of *Dasyatis kuhlii*, *Dasyatis zugei* and *Himantura walga* with those published for a number of other *Dasyatis* species.

Genus/ Species	<i>Dasyatis</i>								<i>Himantura</i>	
	<i>zugei</i>	<i>kuhlii</i>	<i>sabina</i>	<i>sayi</i>	<i>guttata</i>	<i>longa</i>	<i>centroura</i>	<i>centroura</i>	<i>walga</i>	
Maximum disc width (mm)	F	271	379	370	730	1020	1560	1470	1910	221
	M	211	324	326	520	630	980			212
Birth disc width (mm)		70–100	120–145	100–130	150–170	160–175	400	147	355–508	80–148
Disc width at maturity (mm)	F	191.3	236.5	220	500–540	550–750	1100	660–1000	1550–1600	162.5
	M	178.3	238.8	210	300–360	550–600	800	800	1450–1500	163.1
Gestation period (months)		?	?	4–4.5	3	~3	?	4–10	9–11	?
Litter size		1–2	1	1–4	1–6	5	1–3	2–6	5	1–2
Environment		Tropical		subtropical; coastal lagoons		subtropical	subtropical	temperate	temperate	tropical
Location		Java Sea, Indonesia		Florida US		Costa Rica, Venezuela, Columbia	Baja California, Mexico	Tunisian Coasts	southeastern-US	Java Sea, Indonesia
Latitude (approx.)		12°S		28°N	30°N	12°N	22°N	35°N	27–35°N	12°S
Relevant publications		this study		Snelson <i>et al.</i> (1989); Johnson & Snelson (1996)		Thorson (1983)	Garayzar <i>et al.</i> (1994)	Capapé (1993)	Struhsaker (1969)	this study