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Catch and Effort in the Small-Scale Fisheries*

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Abstract

The gears used by the small-scale fishermen of San Miguel Bay, Philippines, are presented and classified. Numbers around the Bay and catch per effort of the various gears are estimated, along with their annual fishing effort.

San Miguel Bay catches by gear type and species groups are presented. The estimated total annual catch of fish and crustaceans from the San Miguel Bay small-scale fishery (excluding all types of trawlers) is 7,760 t, or 9.2 t/km^2.

Introduction

Although they reportedly contribute more than half of the total marine fish catch of the country, the small-scale fisheries of the Philippines have been very little studied. There are many reasons for this, some of which are difficulties in obtaining catch data (not to speak of *reliable* catch data), inaccessibility of certain fishing communities, and lack of communications between the small-scale fishery sector and the fishery research institutions.

However, obtaining reliable catch statistics is an essential condition of any scheme aiming at managing a fishery (Gulland 1980), and nobody denies that the fisheries of the Philippines are in sore need of management (Smith et al. 1980).

In the Philippines, small-scale fisheries are termed "municipal fisheries", a term derived from the fact that fishing within a distance of 3 nautical miles or 5.5 km offshore is under the jurisdiction of the municipalities. These fisheries contrast with the "commercial fisheries" (all vessels above 3

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gross tons) which are placed under the authority of the Bureau of Fisheries and Aquatic Resources (BFAR).

We use here the term "small-scale" fishery, which corresponds to what elsewhere is also called "artisanal" or "traditional" fishery. The latter term, we think, is inappropriate because small-scale fishermen, in the Philippines as elsewhere, have displayed and continue to display considerable ingenuity in adapting new, non-traditional gears to their need. The term "artisanal", on the other hand, is synonymous with our use of the term small-scale. We do not use the term "municipal", finally, because, as discussed elsewhere in this volume, the current legal definition of the "municipal" fisheries, which include trawlers of just below 3 t, lumps together radically different type of gears (low cost, low-energy and low-catch gears are lumped with such expensive, high-energy and efficient gears as "baby" trawlers) and different types of fishermen (basically poor fishermen with little access to capital are lumped with well-to-do entrepreneurs capable of investing large sums into new gears) (see Thomson 1980).

Thus, our definition of small-scale fisheries, as used here, is equivalent to municipal fisheries *minus* the "municipal baby trawlers", which we call "small trawlers" (see Vakily, this report).

Materials and Methods

Umali (1950) gives a comprehensive, if slightly dated, review of small-scale and other fishing gears in the Philippines (see also Smith et al. 1980). The small-scale gears used in San Miguel Bay differ little from those used throughout the country. Thus, to define the gears that will be discussed here, we have completed a Table (1) which lists the small-scale gears used in the Bay, their Bikol* names, and the English and Tagalog* names given in Umali (1950). Fig. 1 shows a major gear, a gill-netter, while Fig. 2 shows a variety of small-scale gears used in the Bay.

Detailed catch-per-effort data were obtained for the following gears: drift gill-nets (all three types), crab gill-nets, bottom-set gill-nets, liftnets, filter nets, fish corrals and mini trawls, by recording their catch after each trip, mainly at Cabusao, a major fishing port.

*Bikol and Tagalog are languages of the Malay family of languages, spoken in the San Miguel Bay area and in the central part of the Philippines, respectively.

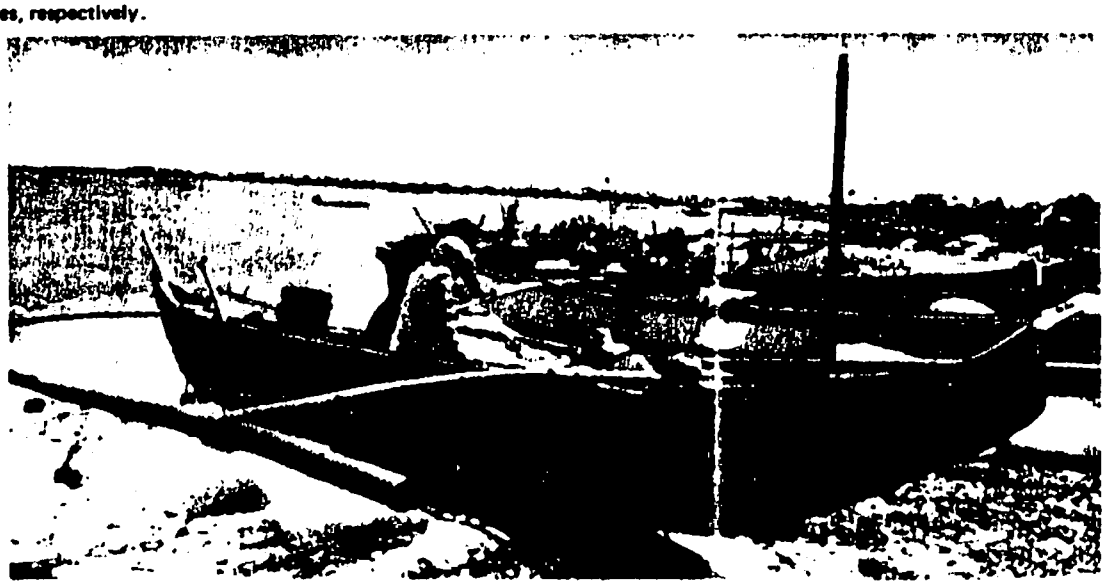

Fig. 1. A gill-netter, San Miguel Bay. Photo by J.M. Vakily.

Table 1. Small-scale gears used in the San Miguel Bay, with their English, Tagalog and Bikol names.[a]

Gear type	English name in Umali (1950)	Tagalog name	Name in San Miguel Bay area
Non-textile devices			
Spear gun	spears, harpoon	salapang, panibat	antipera
Fish trap	fish pots	bubo	bubo
Fish weir Stationary tidal weir	barricade	pangharang	sabay ambak
Fish corral	fish corral	baklad	baklad, also sagkad
Textile devices:			
Lines			
Pole and line	dropline	kawil	banwit
Longline	longline	kitang	kitang
Nets			
Liftnets	liftnet	panadiyok	bukatot
Scissor net	push net	sakag	sakag
Crab liftnet	crab liftnet	bintol	bintol
Filter net	filter net	dayakus	biakus
Beach seine	beach seine	pukot	sinsoro
Mini trawl	–	–	itik-itik, panquerna
Drift gill-net Drift gill-net Drift gill-net	drift nets	panti, paanod	panke palataw pamating
Crab gill-net	–	–	pangasag
Bottom-set gill-net	set gill-nets	palagiang-paningahan	palubog

[a]The gear classification is largely based on Umali (1950).

Stationery liftnet

Scissor net

Gill-net

Trap and multiple longline

Motorized gill-net

Multiple longline

Fig. 2. Examples of the gears used by San Miguel Bay fishermen.

Table 2. Estimated catch and effort by gill-netters in San Miguel Bay, 1980-81 (total annual catch: 4,854 t).

Type of banca / Gear used	Motorized bancas				Non-motorized bancas	
	No. of units	Catch per trip (kg)	No. of trips per year	Annual catch (t)	No. of units	Annual catch (t)
Panke (drift gill-net)	300	46	234	3,229	–	–
Other gill-nets	60	–	–	812.5	150	812.5[a]

[a]Assuming that the 150 non-motorized bancas, each manned by an average of 1.5 fishermen have the same total annual catch as the 60 motorized bancas that are manned by about 3 fishermen each.

Estimating catch per trip was performed by multiplying the number of baskets landed by 5 (kg), the mean weight of fish contained in the baskets (the woven baskets used by San Miguel Bay fishermen, called *baka-baka* are all of the same size).

The following groups of invertebrate and fish were distinguished (local names in italics): squids *(pusit)*, crabs *(kasag)*, penaeid shrimps *(pasayan)*, sergestid shrimps *(balao)*, sharks and rays *(pating* and *pagi)*, anchovies *(dilis)*, sardines *(tamban)*, sea catfish *(dupit)*, mullets *(banak)*, *Otolithes ruber (abo)*, other sciaenids *(pagotpot/arakaak)*, carangids *(salay-salay/talakitok)*, pomadasyds *(kiskisan)*, Spanish mackerels *(tangigi)*, slipmouths *(sapsap)*, cutlassfish *(lankoy)*, and miscellaneous species. Pauly (this report) gives a list of the species included in these various groups.

The total catch per trip per boat was computed, as was monthly average catch per trip of several boats per gear and species group. This sampling was conducted in conjunction with the collection of fish-price data by research assistants over a period of almost 2 years (1979-1981). The details of the collection of these data are given in several contributions in the economics module report of this project (Smith and Mines 1982).Two additional figures estimated to obtain the total effort, by gear type, applied in the Bay were: the number of trips per gear type in the course of a year, and the total number of gears of a given type used within the Bay. Number of trips was obtained, in the case of the motorized gill-netters, from observation of representative gill-netters at Cabusao, where many of the Bay's gill-netters and their catch. The annual number of trips for all other gears was based on a large number of interviews conducted during a sociological survey of the Bay's fishermen households (see contributions in the sociology module report of this project (Bailey 1982)).

The numbers of gears of various types used in the Bay were extrapolated from the household survey mentioned above, part of which consisted of a detailed inventory of assets (including gears). Gears were also counted in the villages and landing places surrounding the Bay to complement the interviews. Table 2 shows how the annual catch by gill-nets was split up between motorized and non-motorized bancas.

Results

Table 3 summarizes the catch-per-effort, effort and catch data obtained. Also, the total catch by gear was split up into major species groups to show target species (see Appendix Tables). Fig. 3 shows the seasonal fluctuations in the catch per effort of various gears.

Discussion

The approach used here of independently estimating, for each gear type, the catch per trip, annual number of trips and total number of units deployed in the Bay leads to a very high estimate of the annual catch of the small-scale fishery in San Miguel Bay of 7,760 t (excluding balao). This figure is slightly higher than the catch of the trawler fishery in the Bay (about 6,500 t/year, see Vakily, this report).

Table 3. Estimated annual catch and effort by small scale gears in San Miguel Bay, 1980-1981.

Gear	Total no.	Annual no. of trips of each gear	Annual no. of trips of all gear	Catch per trip (kg)	Total annual catch (t)	Major groups caught (%)
Panke	300	234	70,200	46	3,229	*Otolithes ruber* (48.6), Sciaenidae (29), misc. spp. (8.73)
Palataw	470	115	54,050	11.4	616	Mugilidae (52.9), Sciaenidae (22.5), misc. spp. (16.3)
Pamating	30	94	2,820	4.95	14	Sharks and rays (48.7), misc. spp. (38.1), *Arius thalassinus* (8.11)
Pangasag	257	174	44,718	5.78	268	Crabs (85.8), misc. spp. (12 1), Sciaenidae (1.70)
Palubog	288	162	46,656	15.8	737	Mugilidae (65.2), *Sardinella* spp. (34.4), Crabs (0.234)
Liftnet (bukatot)	171	53	9,063	68.8	624	*Stolephorus* spp. (79.8), misc. spp. (9.07), *Sardinella* spp. (7.65)
Filter net (biakus)[a]	60	225	13,500	21.85	(295)[a]	*Stolephorus* spp. (45.5), Leiognathidae (19.8), misc. spp. (15.0)
Filter net (biakus)[b]	60	225	13,500	19.4	262[b]	*Stolephorus* spp. (51.3), Leiognathidae (22.3), misc. spp. (16.9)
Fish corral (bakiad)	89	209	18,601	28.5	530	Misc. spp. (41.8), Crabs (18.0), Sciaenidae (13.5)
Mini trawl (itik-itik)[a]	188	191	35,908	133.1	(4,779)[a]	Balao (88.5), misc. spp. (6.49), shrimps (4.69)
Mini trawl (itik-itik)[b]	188	191	35,908	16.1	578[b]	Misc. spp. (56.4), shrimps (40.7), crabs (2.78)
Scissor net (sakag)[a]	634	150	95,100	5	(476)[a]	Balao (50), shrimps (50)
Scissor net (sakag)[b]	634	150	95,100	2.5	238[b]	Shrimps (100)
Longline (kitang)[c]	103	120	12,360	2	25	Carangidae (20), Pomadasydae (20), misc. spp. (60)
Hook and line (banwit)[c]	424	120	50,880	4	204	Misc. spp. (100)
Crab liftnet (bintol)[c]	71	132	9,372	3	28	Crabs (100)
Fish trap (bubo)[c]	106	120	12,720	4	51	Misc. spp. (100)
Spear gun (antipara)[c]	51	156	7,966	4	32	Pomadasydae (25), misc. spp. (75)
Fish weir (sabay)[c]	5	168	840	72	60	Shrimps (50), misc. spp. (50)
Stationary tidal weir (ambak)[c]	2	144	288	7	2	Mugilidae (33), misc. spp. (67)
Beachseine (sinsoro)[c]	11	308	3,388	80	271	Carangidae (34), *Sardinella* spp. (33), *Stolephorus* spp. (33)
				Total	7,759	(excluding balao)
				Total	4,472	(balao only)

[a]Total catch, including balao.
[b]Total catch, excluding balao.
[c]Based on information provided by A.E. Esporlas.

A shortcoming of this method was that it was not possible to use seasonally oscillating estimates of effort since such data were unavailable for most gears. Rather, the seasonally oscillating estimates of catch per effort (e.g., catch per trip) were multiplied with an effort figure (number of trips) that was assumed to be evenly distributed throughout the year. Given that fishermen may tend to increase their effort in times when catch per effort is high and reduce it when catch per effort is low, the method used here may result in an underestimation of catches during the peak fishing season, and an overestimation of catches during the off-season, hence an underestimation of seasonal catch fluctuations.

On the other hand, the procedure adopted (to which there was no real alternative, given the nature of the available data) will be unbiased with regard to annual catch estimates if the under- and overestimates compensate each other.

The status of the small-scale fisheries is discussed in the context of the overall San Miguel Bay fishery by Pauly (this report).

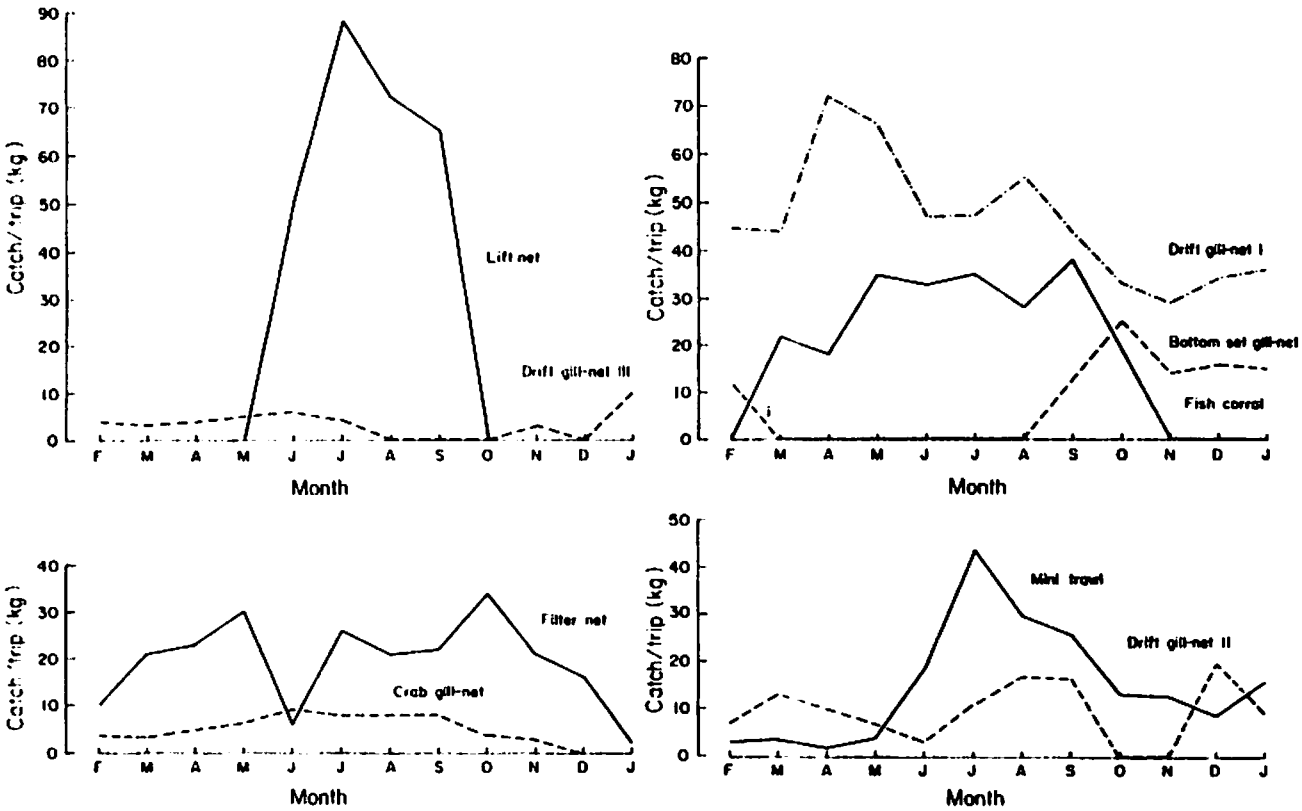

Fig. 3. Seasonal fluctuation in the catch per effort of some selected small-scale gears, San Miguel Bay, 1980-1981.

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Appendix Table Ia. Catch per trip (kg) of fish corral (sagkad) (total annual catch: 630 t).[a]

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	x̄
Sharks and rays	-	-		-	-	0.409	-	-	-	-	-	-	0.409	0.051
Stolephorus spp. (Dilis)	-	-		-	3.15	0.731		-		-	-	-	3.88	0.485
Sardinella spp. (Tamban)	-	-		8.10	0.630	0.719	0.697	1.24	3.73	-	-	-	15.1	1.89
Arius thalassinus (Dupit)	-	0.154	0.174	-	-	0.983	0.233	2.08	-	-	-	-	3.62	0.452
Mugilidae (Banak)	-	-				0.467		0.799	-	-	-	-	1.27	0.159
Sciaenidae (Pagotpot/Alakaak)	-	4.36	1.57	-	4.16	4.13	0.619	9.84	4.15	-	-	-	30.8	3.86
Carangidae (Salay-salay/Talakitok)	-	-		-	5.17	5.73	8.14	1.20	0.828	-	-	-	21.1	2.64
Leiognathidae (Sapsap)	-	-		-	0.630	1.60	1.55	-		-	-	-	3.78	0.472
Trichiuridae (Lankoy)	-	-		-	-	0.427		-	-	-	-	-	0.427	0.053
Scomberomorus commersonii (Tanggi)	-	-		-	-	0.192		-	-	-	-	-	0.192	0.024
Misc. spp.	-	15.5	12.7	19.9	13.4	9.05	11.7	11.6	1.65	-	-	-	96.5	11.9
Squids	-	-		-	0.126	-	0.038	-		-	-	-	0.164	0.020
Crabs	-	1.29	1.05	4.32	5.42	9.35	4.69	10.5	4.36	-	-	-	41.0	5.12
Penaeid shrimps	-	0.803	0.667	2.70	0.260	1.25	0.312	0.786	4.25	-	-	-	11.0	1.38
Total catch	-	22.1	18.1	35.0	32.9	36.0	27.9	38.1	19.0	-	-	-	228	28.5

[a]Dashes here and in subsequent tables mean zero catch.

Appendix Table Ib. Catch per trip (kg) of liftnet (bukatot) (total annual catch: 624 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	x̄
Stolephorus spp. (Dilis)	-	-	-		47.6	60.2	61.4	60.4	-	-	-	-	219	55.0
Sardinella spp. (Tamban)	-	-	-		-	17.9	3.20	-	-	-	-	-	21.1	5.27
Sciaenidae (Pagotpot/Alakaak)	-	-	-		-	-	0.038	-	-	-	-	-	0.038	0.010
Leiognathidae (sapsap)	-	-	-		1.26	1.74	-	-	-	-	-	-	3.00	0.750
Misc. spp.	-	-	-		-	4.30	6.60	14.1	-	-	-	-	25.0	6.25
Squids	-	-	-		1.26	3.84	0.796	0.577	-	-	-	-	6.47	1.62
Crabs	-	-	-		-	-	0.076	-	-	-	-	-	0.076	0.019
Total catch	-	-	-		50.0	88.0	72.1	65.1	-	-	-	-	275	68.8

Appendix Table Ic. Catch per trip (kg) of filter net (biakos) (total annual catch: 262 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	x̄
Stolephorus spp. (Dilis)	4.00	21.0	10.3	13.4	-	-	-	19.3	29.8	21.0	-	0.096	119	9.92
Sardinella spp. (Tamban)	-	-	-	-	5.33	-	-	-	-	-	-	-	5.33	0.444
Mugilidae (Banak)	-	-	-	-	-	-	-	-	-	-	2.63	1.99	4.62	0.377
Sciaenidae (Pagotpot/Alakaak)	1.78	-	-	-	-	-	-	-	-	-	-	-	1.78	0.148
Leiognathidae (Sapsap)	-	-	12.3	16.1	-	13.0	10.5	-	-	-	-	-	51.9	4.32
Trichiuridae (Lankoy)	0.444	-	-	-	-	-	-	-	-	-	-	-	0.444	0.037
Misc. spp.	3.78	-	-	-	-	13.0	10.5	-	-	-	11.8	0.256	39.3	3.28
Penaeid shrimps	-	-	0.343	0.447	0.889	-	-	2.68	4.14	-	1.68	0.128	10.3	0.859
Balao	-	-	-	-	17.8	-	-	-	-	-	-	11.6	29.4	2.45
Total catch (excl. Balao)	10.0	21.0	22.9	29.9	6.20	26.0	21.0	22.0	33.9	21.0	16.0	2.40	232	19.4

Appendix Table Id. Catch per trip (kg) of mini trawl (itik-itik) (total annual catch, excl. balao: 578 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sciaenidae (Pagotpot/Alakaak)	-	-	-		-	-	0.078	-	-	-	-	-	0.078	0.006
Misc. spp.	-	-	-	-	13.3	31.6	15.1	12.1	3.88	8.93	5.71	12.6	103	8.60
Squids	-	-	-	-	-	-	0.078	-	-	-	-	-	0.078	0.006
Crabs	-	-	-		-	0.528	1.33	2.94	0.268	-	-	-	5.07	0.422
Penaeid shrimps	2.97	3.30	2.00	3.98	5.40	11.9	13.4	10.9	9.37	4.24	3.48	3.51	74.4	6.20
Balao	193	173	109	87.0	65.5	-	-	16.1	92.7	203	189	275	1,403	117
Total catch (excl. Balao)	2.97	3.30	2.00	3.98	18.7	44.0	30.0	25.9	13.5	13.2	9.19	16.1	1.83	15.2

Appendix Table Ie. Catch per trip (kg) of panke (total annual catch 3,229 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sardinella spp. (Tamban)	6.12	3.21	1.57	0.920	1.77	0.850	2.18	1.50	1.78	-	-	3.91	23.8	1.98
Arius thalassinus (Dupit)	0.510	0.606	0.484	-	0.606	0.724	0.868	0.757	-	-	-	-	4.56	0.380
Mugilidae (Banak)	0.528	-	0.489	0.608	-	1.38	0.868	0.747	1.28	-	-	1.71	7.61	0.634
Otolithes ruber (Abo)	19.3	19.4	34.2	34.3	17.7	17.5	21.8	16.9	15.2	24.5	34.0	13.6	268	22.3
Sciaenidae (Pagotpot/Alakaak)	8.10	13.6	22.9	19.6	20.8	18.8	18.4	15.4	8.26	4.60	-	11.9	160	13.3
Carangidae (Salay-salay/Talakitok)	0.869	1.25	1.74	2.38	0.769	0.708	0.770	1.04	-	-	-	0.547	10.1	0.842
Trichiuridae (Lankoy)	2.86	1.61	3.10	2.59	-	0.505	-	-	-	-	-	0.828	11.5	0.958
Scomberomorus commersonii (Tangigi)	0.431	-	0.601	0.525	0.801	1.15	1.81	0.543	0.928	-	-	1.10	7.89	0.658
Misc. spp.	5.70	4.38	5.76	3.02	3.37	4.99	8.82	6.24	4.27	-	-	1.66	48.2	4.02
Crabs	-	-	-	-	0.551	0.716	0.955	0.614	-	-	-	-	2.84	0.237
Penaeid shrimps	0.178	-	0.718	1.88	0.930	-	0.718	0.507	1.57	-	-	0.580	7.09	0.591
Total catch	44.6	44.0	71.6	65.8	47.3	47.3	55.2	44.2	33.3	29.0	34.0	36.8	552	46.0

Appendix Table If. Catch per trip (kg) of palataw (total annual catch 616 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sardinella spp. (Tamban)	-	-	0.160	-	-	-	-	4.00	-	-	-	-	4.16	0.416
Arius thalassinus (Dupit)	-	-	-	-	-	-	-	0.471	-	-	-	-	0.471	0.047
Mugilidae (Banak)	6.50	7.11	2.56	0.600	3.50	5.09	8.33	9.71	-	-	10.0	7.25	60.6	6.06
Otolithes ruber (Abo)	-	-	-	-	-	-	1.00	1.19	-	-	-	2.25	4.44	0.444
Sciaenidae (Pagotpot/Alakaak)	0.500	2.44	3.00	6.40	-	2.73	-	0.714	-	-	10.0	-	25.8	0.258
Carangidae (Salay-salay/Talakitok)	-	-	0.280	-	-	0.454	-	0.471	-	-	-	-	1.20	0.120
Trichiuridae (Lankoy)	-	-	0.160	-	-	-	-	-	-	-	-	-	0.160	0.016
Misc. spp.	-	3.33	3.42	-	-	2.73	8.00	-	-	-	-	-	17.5	0.175
Crabs	-	-	0.140	-	-	-	-	-	-	-	-	-	0.140	0.014
Total catch	7.00	12.9	9.72	7.00	3.50	11.0	17.3	16.6	-	-	20.0	9.50	114	11.4

Appendix Table Ig. Catch per trip (kg) of pamating (total annual catch: 14 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sharks and rays	1.59	1.88	2.17	0.950	6.00	4.50	–	–	–	2.17	–	–	19.3	2.41
Arius thalassinus (Dupit)	–	0.792	1.67	0.750	–	–	–	–	–	–	–	–	3.21	0.401
Mugilidae (Banak)	0.227	0.058	–	–	–	–	–	–	–	0.667	–	–	0.952	0.119
Sciaenidae (Pagotpot/Alakaak)	–	–	–	0.750	–	–	–	–	–	–	–	–	0.750	0.094
Misc. spp.	2.65	0.917	–	1.88	–	–	–	–	–	–	–	9.67	15.1	1.89
Crabs	–	–	–	0.325	–	–	–	–	–	–	–	–	0.325	0.041
Total catch	4.47	3.65	3.84	4.66	6.00	4.50	–	–	–	2.84	–	9.67	39.6	4.95

Appendix Table Ih. Catch per trip (kg) of pangasag (total annual catch: 258 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sharks and rays	–	0.231	–	0.037	–	–	–	–	–	–	–	–	0.268	0.027
Sciaenidae (Pagotpot/Alakaak)	0.143	0.385	0.232	0.222	–	–	–	–	–	–	–	–	0.982	0.098
Misc. spp.	2.95	1.35	1.83	0.216	0.140	0.044	–	–	0.468	–	–	–	7.00	0.700
Crabs	0.607	0.738	2.72	6.05	8.77	7.96	7.22	8.25	3.82	3.45	–	–	49.6	4.96
Total catch	3.70	2.71	4.78	6.52	8.91	8.00	7.22	8.25	4.29	3.45	–	–	57.8	5.78

Appendix Table Ii. Catch per trip (kg) of palubog (total annual catch: 737 t).

Taxonomic group	F	M	A	M	J	J	A	S	O	N	D	J	Σ	$\bar{x}$
Sardinella spp. (Tamban)	6.00	–	–	–	–	–	–	6.67	4.33	5.17	5.41	5.00	32.6	5.43
Mugilidae (Banak)	6.00	–	–	–	–	–	–	6.33	20.1	9.17	10.2	10.0	61.8	10.3
Misc. spp.	–	–	–	–	–	–	–	–	0.222	–	–	–	0.222	0.037
Crabs	–	–	–	–	–	–	–	–	0.222	–	–	–	0.222	0.037
Total catch	12.0	–	–	–	–	–	–	13.0	24.9	14.3	15.6	15.0	94.8	15.8