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Distribution, Abundance and Biological Studies of Economically Important Fishes in the South China Sea, Area I: East Coast of Peninsular Malaysia

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ABSTRACT

This paper presents species distributions, composition and biological parameters of major fish species caught from the east coast of Peninsular Malaysia during the one week surveys made in pre- and post-Northeast monsoon seasons. The fish species rankings changed over time and at different depth strata. The catch rates were decreased toward deeper water. An appearance of smaller fish group was greater during the post-Northeast than pre-Northeast monsoon season. Fish populations occurred at both seasons were represented from different spawning group. Their growths were isometric form in weight.

Key words: Catch and size composition, pre- and post-Northeast monsoon, growth in weight.

Introduction

The total productions of the fisheries sector of Malaysia in 1994 amounted to 1,181,763 MT, valued at Malaysian Ringgit 2.99 billion constituting about 1.61% of the national GDP. Of the total production, 90.15% was contributed by marine fisheries that employs over 79,800 fishers (DOF, 1995).

The total production of demersal fish of Malaysia in 1994 was estimated at nearly 182,884 MT. The west coast of Peninsular Malaysia was contributed at around 33.4% of the demersal fish, while 28.8% was by the east coast of Peninsular Malaysia. The remaining 22.7% and 15.1% were landed from Sabah and Sarawak waters respectively.

The pelagic fish are also important marine resource of Malaysia. In 1994, they were estimated at around 373,979 MT or 35.9% of the total marine catch of Malaysia (DOF, 1995). The production of pelagic fish on the east coast of Peninsular Malaysia was 128,445 MT as compared to the west coast with 143,960 MT, Sarawak with 25,169 MT and Sabah with 76,405 MT (Mansor, *in press*).

A number of demersal surveys (Anon, 1967; Pathansali *et al.*, 1974; Jothy *et al.*, 1975; Lam *et al.*, 1975; Lamp and Shaari, 1976; Mohsin *et al.*, 1986, 1987, 1988, 1990; DOF, 1987; Ahmad-Adnan, 1990) and acoustic surveys (Amin *et al.*, 1984; Leong and Abdul-Hamid, 1984; DOF, 1987) have been conducted in the South China Sea, particularly in Malaysian waters. Most of the surveys were conducted to determine the distribution and abundance of the demersal and pelagic species.

The firsts trawl survey (Pathansali *et al.*, 1974) has identified suitable areas for trawling, effects of hydrography regime and bottom characteristics to species distribution. In 1985-1987, the demersal and acoustic surveys were conducted simultaneously in conjunction with the deep sea fishing plan that was implemented in 1987 (DOF, 1987).

This paper attempts to discuss the distribution, abundance, species composition and biological parameters of some economically important fish species following the one week survey conducted by Malaysian fisheries research vessel on the east coast of Peninsular Malaysia, on pre- and post-

Northeast monsoon seasons.

Materials and Methods

Sampling methods

The survey was carried out on the east coast of Peninsular Malaysia between 23rd and 29th September 1995 (pre-Northeast monsoon) and between 8th and 17th May 1996 (post-Northeast monsoon) using a research vessel of the Fisheries Research Institute of Malaysia.

Samples were collected using a German designed high-opening trawl net. The net has a cod-end mesh size of 25 mm and cover net mesh size of 40 mm. The net was towed at 3 knots for one hour duration at a specific station.

During the survey the total catch of each haul were sorted out into commercial fish and trash fish without considering size categories. Subsequently the commercial fish species were sorted into demersal fishes, pelagic fishes, penaeid prawns, crabs, cephalopods, jelly fish and true trash fishes *i.e.* those have no commercial values. Each category of fish species was then weighed to the nearest kilogram using a digital hanging scale. The total lengths (TL) of individual fish were measured to the nearest mm for size compositions' studies.

The fish species from each sampling station were kept frozen and brought back to the laboratory for further examination. The following measurements were made in the laboratory: i) total length (TL) and total body weight (W) of individual fish to the nearest millimetre and gram respectively, ii) sex and maturity stage and gonad weight for estimating maturity in fish species.

Statistical analysis

The TL data were grouped in 10 mm classes. The frequency distribution patterns for a number of fish species in the combined samples from entire sampling stations were examined. The Bhattacharya's method that is available in the FiSAT module (Gayaniilo *et al.*, 1994) was applied on the length frequency distribution of the fish species for cohort segregation.

Length/weight relationships were determined for each fish species. Equations of the form $W=aL^b$, where a and b are constants of regression, were fitted by transforming the data into logarithms and deriving the regression line by the least squares method (Sparre and Venema, 1992).

Results

Trawling activities in the east coast of Peninsular Malaysia have shown that demersal fishes were the most abundant, followed by trash fish, cephalopods and pelagic fish. They were similarly observed during the pre- and post-Northeast monsoon seasons (Table 1). Higher percentages of catches of trash fish were recorded during North-east monsoon, as compared to the demersal which was during the pre-Northeast monsoon. The higher catch of *Dasyatis* spp. from one of the station during post-Northeast monsoon season was made and this had contributed to a higher value of standard deviation.

The average catch rates of major components of fishes by depth stratum are tabulated in Table 2 and Table 3. Greater varieties of fish species were caught in the deeper water with different ranking of abundance. Their rankings in abundance in both seasons were also changed. Mullidae was the major family caught from the survey area followed by Nemipteridae, Priacanthidae, Synodontidae and small amount from of other families.

Smaller size group of fish tend to arrive in the area during the post-Northeast monsoon (Figs. 2a and b) rather than in pre-Northeast (Figs 1a and b). They were consisting of more than one spawning group. The mean lengths of each cohort of these species are as shown in Table 4 and 5.

Table 1. Catch composition of fishery group caught from the east coast of Peninsular Malaysia at pre-Northeast monsoon (September 1995) and post-Northeast monsoon (May 1996).

Fishery group	Pre-Northeast monsoon			Post-Northeast monsoon		
	Kg/hr	S.D.	%	Kg/hr	S.D.	%
Demersal fish	35.08	24.52	65.87	39.03	38.05	53.29
Pelagic fish	2.07	1.94	3.89	1.85	2.57	2.53
Panaeid prawn	0.25	0.47	0.47	0.45	0.48	0.61
Cephalopods	3.88	2.31	7.29	6.53	3.99	8.92
Trash fish	11.98	9.45	22.49	25.38	35.89	34.65
Total catch	53.26	33.61		73.24	58.40	

Table 2. Catch rates (kg/hr) distribution of fish species by depth caught from the east coast of Peninsular Malaysia during the pre-Northeast monsoon season, in order of abundance.

Species name	Family	Depth(meters)				Mean
		30-40	40-50	50-60	60-70	
<i>Upeneus bensasi</i>	Mullidae			5.71	3.49	4.60
<i>Gerres</i> spp.	Gerreidae			7.78	0.88	4.33
<i>Nemipterus thosaporni</i>	Nemipteridae			4.87	3.31	4.09
<i>Pentaprion longimanus</i>	Gerreidae			6.97	0.90	3.93
<i>Priacanthus macracanthus</i>	Priacanthidae			3.32	3.98	3.65
<i>Priacanthus tayenus</i>	Priacanthidae			2.93	3.74	3.34
<i>Loligo</i> spp.	Loliginidae	1.46		3.54	1.33	2.11
<i>Nemipterus nemurus</i>	Nemipteridae			1.92	2.24	2.08
<i>Parupeneus heptacanthus</i>	Mullidae	0.04			4.00	2.02
<i>Saurida tumbil</i>	Synodontidae			1.20	1.93	1.56
<i>Upeneus sulphureus</i>	Mullidae			2.47	0.35	1.41
<i>Sepia</i> spp.	Sepiidae	0.04		1.81	1.82	1.22
<i>Saurida undosquamis</i>	Synodontidae			1.37	1.07	1.22
<i>Carangoides malabaricus</i>	Carangidae			1.38	0.28	0.83
<i>Lutjanus vitta</i>	Lutjanidae			0.83		0.83
<i>Alutera monocerus</i>	Monacanthidae			1.12	0.43	0.77
<i>Selaroides leptolepis</i>	Carangidae	1.27			0.01	0.64
<i>Lutjanus lutjanus</i>	Lutjanidae			0.49	0.77	0.63
<i>Gymnocranius griseus</i>	Pentapodidae			0.50	0.65	0.58
<i>Nemipterus peronii</i>	Nemipteridae			0.79	0.28	0.54
<i>Carangoides gymnostelthus</i>	Carangidae	1.20		0.35	0.02	0.52
<i>Decapterus maruadsi</i>	Carangidae	0.12			0.86	0.49
<i>Scolopsis</i> spp.	Scolopsidae			0.60	0.22	0.41
<i>Nemipterus nematophorus</i>	Nemipteridae			0.40	0.16	0.28
<i>Nemipterus tambuloides</i>	Nemipteridae			0.06	0.43	0.25
Average catch (kg/hr)		0.69		2.29	1.38	

Table 3. Catch rates (kg/hr) distribution of fish species by depth caught from the east coast of Peninsular Malaysia during the post-Northeast monsoon season, in order of abundance.

Species name	Family	Depth(meters)					Mean
		20-30	30-40	40-50	50-60	60-70	
<i>Dasyatis zugei</i>	Dasyatidae	1.10	59.70	1.25	1.07		15.78
<i>Upeneus bensasi</i>	Mullidae	5.30	3.00	5.40	4.23	2.85	4.16
<i>Nemipterus nemurus</i>	Nemipteridae		0.13	3.00	4.97	6.75	3.71
<i>Loligo</i> spp.	Loliginidae	0.40	5.32	5.19	2.90	2.75	3.31
<i>Sepia</i> spp.	Sepiidae	1.80	6.86	1.72	3.59	0.89	2.97
<i>Tracheynocephalus myops</i>	Synodontidae	3.50	1.80				2.65
<i>Pristipomoides multidens</i>	Lutjanidae			0.02	3.75	1.88	
<i>Saurida undosquamis</i>	Synodontidae	0.22	0.36	2.70	3.13	2.85	1.85
<i>Nemipterus furcosus</i>	Nemipteridae	0.02	4.60	1.95	0.06		1.66
<i>Pentaprion longimanus</i>	Pentapodidae			3.77	0.06	0.26	1.36
<i>Nemipterus thosaporni</i>	Nemipteridae			0.07		2.58	1.32
<i>Selaroides leptolepis</i>	Carangidae	0.24	0.80	3.79	1.12	0.30	1.25
<i>Priacanthus tayenus</i>	Priacanthidae		0.90	1.99	0.71	1.25	1.21
<i>Nemipterus nematophorus</i>	Nemipteridae					1.00	1.00
<i>Lutjanus malabaricus</i>	Lutjanidae				1.00	1.00	
<i>Octopus</i> spp.	Octopodidae	0.02	3.26	0.52	0.02		0.95
<i>Nemipterus bathybius</i>	Nemipteridae					0.59	0.59
<i>Nemipterus tambuloides</i>	Nemipteridae					0.52	0.52
<i>Synodus hoshinonis</i>	Synodontidae	0.09	0.14	0.61	0.67	0.90	0.48
<i>Lutjanus lutjanus</i>	Lutjanidae	1.10	0.04	0.17		0.44	
<i>Gynocranius elongatus</i>	Pentapodidae		0.72			0.06	0.39
<i>Alutera monoceros</i>	Monacanthidae		0.12	0.14	0.78	0.30	0.33
<i>Scolopsis taeniopterus</i>	Scolopsidae	0.45	0.26	0.60	0.27	0.07	0.33
<i>Thennus orientalis</i>	Scyllaridae	0.70	0.20	0.13	0.48	0.08	0.32
<i>Sepioteuthis lessoniana</i>	Loliginidae	0.05	1.04	0.02	0.14	0.33	0.32
Average catch (kg/hr)		1.07	5.02	1.83	1.88	1.45	

The length-weight relationships of the dominant species caught during the survey are summarised in Table 6 and 7. The b values obtained for many of species were close to or bigger than 3 indicating parabolic growth in weight.

Discussion

Sea bed and environmental conditions play a significant role in determining the distribution of fish species (Bailey, 1992). The sea beds of the east coast of Peninsular Malaysia have been classified as sandy due to patchy coral reefs stretching from the North to the South of the coast (Chuang, 1961). The east coast of Peninsular Malaysia can be also classified as coral area, uneven mud-clay grounds and trapped fishing but change in the sea bed is always occur as a result of strong tidal, coastal current and wave action (Jothy *et al.*, 1975).

Previous surveys (Pathansali *et al.*, 1974; Jothy *et al.*, 1975; Lam *et al.*, 1975; Lamp and Shaari, 1976; Ahmad-Adnan, 1990) concluded that progressive decline in yield occurred in the deeper zones. The depths from 21 to 40 meters usually were more productive area. The fish resources off the east coast of Peninsular Malaysia appear to be poor beyond the 40 mile's line. This was due to poor of chlorophyll *a*, zooplankton and fish larvae (Mohsin *et al.*, 1987). Present studies indicated that the averages catch at different depth strata was lower towards deeper area.

The demersal species caught in this survey was found to be dominated by the family Nemipteridae, Priacanthidae, Mullidae and Synodontidae, while the pelagic fish was the family Carangidae. All these family groups seem to be dominated in all demersal surveys but in different ranking. Their catch rates were not effected by seasons which was also indicated by Adnan (1996), where Loliginidae and Mullidae were the most abundant species followed by Synodontidae and Nemipteridae.

Many of the fish species collected during this one week survey in pre-Northeast and in post-Northeast 1996 were from more than one spawning group. The smaller size groups of immature fish tend to be the majority of fish caught in the area. The populations of the larger groups of fish were found to be less abundant as they are vulnerable to fishing pressure or are probably emigrating for spawning activities in the areas close to shore. Appearance of smaller fish group in the survey area during the post-Northeast monsoon season had also reported by Mansor and Abdullah (1995). They believed to have been effected by the mixing of the northeast and southeast current which influence

Table 4. Summary of cohort's analysis by application of the Bhattacharya's method on fish species collected from the east coast of Peninsular Malaysia in pre-Northeast monsoon season.

Species name	Number of cohort	Mean length (mm) of cohort	S.D.	R ²
<i>Nemipterus thosaporni</i>	2	136.7	8.83	0.96
		200.4	12.98	0.99
<i>Nemipterus nemurus</i>	2	153.6	18.57	0.99
		211.5	12.52	0.99
<i>Priacanthus macracanthus</i>	3	138.6	13.94	0.89
		173.8	11.21	0.79
		250.8	15.53	0.94
<i>Upeneus bensasi</i>	2	130.8	11.97	0.86
		202.1	12.69	0.99
<i>Priacanthus tayenus</i>	2	152.8	24.74	0.93
		207.1	14.45	0.84
<i>Paurpeneus pleurospilus</i>	1	196.7	12.76	0.85
<i>Selaroides leptolepis</i>	1	134.1	9.57	0.85
<i>Saurida undosquamis</i>	2	224.4	10.93	0.87
		289.1	15.26	0.84
<i>Nemipterus bathybius</i>	1	124.2	14.28	0.65
<i>Saurida tumbil</i>	1	232.8	11.32	0.63
<i>Caranx</i> spp.	2	138.7	14.55	0.69
<i>Pentaprion longimanus</i>	1	108.9	10.65	0.99
<i>Decapterus russelli</i>	1	183.6	9.96	0.72

Table 5. Summary of cohort's analysis by application of the Bhattacharya's method on fish species caught in the east coast of Peninsular Malaysia during the post-Northeast monsoon season.

Species name	Number of cohort	Mean length (mm) of cohort	S.D.	R ²
<i>Upeneus bensasi</i>	1	132.5	12.158	0.98
<i>Nemipterus nemurus</i>	2	138.6	12.204	0.91
		171.3	13.148	0.77
<i>Selaroides leptolepis</i>	2	117.8	7.671	0.95
		153.9	8.256	0.90
<i>Pentaprion longimanus</i>	1	117.4	8.522	0.96
<i>Saurida undosquamis</i>	2	119.7	16.437	0.99
		213.8	21.853	0.73
<i>Nemipterus furcosus</i>	2	115.4	14.080	0.92
		176.9	7.016	0.99
<i>Priacanthus tayenus</i>	3	107.6	9.790	0.96
		149.3	7.047	0.92
		219.1	19.798	0.77
<i>Synodus hoshinonis</i>	1	166.4	14.370	0.90
<i>Dasyatis zugei</i>	1	190.9	13.946	0.92
<i>Nemipterus thosaporni</i>	1	135.0	18.091	0.78
<i>Trachinocephalus myops</i>	1	125.9	9.930	0.93
<i>Lutjanus lutjanus</i>	2	88.7	9.780	0.93
		160.0	8.970	0.96
<i>Gymnocranius griseus</i>	2	97.4	9.183	0.86
		170.0	9.320	0.68
<i>Scolopsis taeniopterus</i>	1	161.9	18.230	0.92
<i>Parupeneus heptacanthus</i>	2	132.6	16.675	0.89
		174.7	11.410	0.81
<i>Caesio chrysozona</i>	1	126.6	7.505	0.99
<i>Aluterus monoceros</i>	1	160.9	24.005	0.99
<i>Nemipterus tambuloides</i>	2	129.1	13.061	0.75
		173.5	6.920	0.88

plankton blooms. Furthermore, influxes of nutrient from the land during raining season has activate the process.

Details community analysis of a series surveys' data will give better understanding on the fish community in the South China Sea area.

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Table 6. Summary of the length-weight relationships of major species caught from the east coast of Peninsular Malaysia in pre-Northeast monsoon season.

Species name	N	Sizes range	Weights range	a S.E.		b S.E.		R ²
		(mm)	(gm)					
<i>Nemipterus thosaporni</i>	367	87-215	7-113	-4.5866	0.0324	2.8532	0.0279	0.97
<i>Nemipterus nemurus</i>	203	98-236	11-157	-4.9610	0.0433	3.0229	0.0361	0.96
<i>Priacanthus macracanthus</i>	193	120-270	22-234	-4.8818	0.0333	2.9987	0.0333	0.98
<i>Upeneus bensasi</i>	123	140-260	34-212	-5.2980	0.0269	3.1793	0.0512	0.97
<i>Priacanthus tayenus</i>	106	117-250	23-175	-4.3206	0.0340	2.7429	0.0467	0.97
<i>Parupeneus pleurospilus</i>	64	150-280	41-268	-4.8762	0.0360	2.9262	0.0859	0.95
<i>Nemipterus bathybius</i>	46	120-185	21-79	-4.7302	0.0328	2.9260	0.0911	0.96
<i>Nemipterus nematophorus</i>	28	104-212	13-110	-4.8805	0.0411	2.9801	0.1049	0.97
<i>Nemipterus peronii</i>	27	152-240	40-186	-5.3775	0.0200	3.1984	0.0361	0.98
<i>Nemipterus tambuloides</i>	27	153-240	39-164	-4.9795	0.0330	3.0212	0.1488	0.94

Table 7. Summary of the length-weight relationships of major fish species caught from the east coast of Peninsular Malaysia in the post-Northeast monsoon season

Species name	N	Sizes range	Weights range	a S.E.		b S.E.		R ²
		(mm)	(gm)					
<i>Nemipterus nemurus</i>	440	105-223	16-135	-4.6354	0.0726	2.8809	0.0726	0.94
<i>Saurida undosquamis</i>	234	83-340	5-385	-5.0010	0.0910	2.9196	0.0430	0.98
<i>Selaroides leptolepis</i>	227	90-180	Sep-67	-5.0494	0.0747	3.0355	0.0353	0.98
<i>Pentaprion longimanus</i>	221	79-143	4-40	-5.1041	0.1436	3.1143	0.0693	0.90
<i>Nemipterus thosaporni</i>	204	98-202	11-104	-4.7759	0.1026	2.9474	0.0478	0.95
<i>Upeneus bensasi</i>	158	61-182	2-64	-4.9891	0.1593	3.0147	0.0741	0.91
<i>Synodus hoshinonis</i>	155	103-305	7-257	-5.5931	0.1307	3.1994	0.0589	0.95
<i>Nemipterus furcosus</i>	155	80-243	7-192	-4.5782	0.1303	2.8466	0.0619	0.93
<i>Dasyatis zugei</i>	139	126-301	48-662	-3.2829	0.2185	2.4541	0.0959	0.83
<i>Priacanthus tayenus</i>	120	85-253	11-137	-3.8518	0.0799	2.5285	0.0368	0.97
<i>Trachynocephalus myops</i>	85	102-276	9-168	-5.1535	0.1010	3.0230	0.0459	0.98
<i>Lutjanus lutjanus</i>	68	73-170	4-79	-5.1324	0.1220	3.1294	0.0614	0.98
<i>Gymnocranius griseus</i>	52	66-190	8-128	-4.4218	0.1228	2.8513	0.0611	0.97
<i>Parupeneus heptacanthus</i>	51	99-279	12-316	-5.5047	0.1182	3.2649	0.0534	0.99
<i>Nemipterus nematophorus</i>	48	103-180	16-78	-4.6788	0.2028	2.9022	0.0955	0.95
<i>Caesio chrysozona</i>	40	103-140	11-28	-5.0926	0.3462	3.0562	0.1654	0.90
<i>Nemipterus tambuloides</i>	35	110-191	17-81	-4.4610	0.1762	2.7845	0.0814	0.97
<i>Scolopsis taeniopterus</i>	31	142-224	45-146	-4.5414	0.3034	2.8664	0.1367	0.94

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