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Night-time Movement of Fish in Coastal Waters of Terengganu

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ABSTRAK

Corak pergerakan waktu malam 15 spesies ikan di perairan Terengganu ditunjukkan berasaskan tangkapan pukat hanyut pada dua musim monsun berlainan. Pukat hanyut yang dilabuhkan pada sudut tepat dengan pantai dihanyutkan arus menghala ke utara atau selatan selari dengan pantai pada kelajuan antara 0.33 hingga 1.78 km/jam. Tiga belas daripada 15 spesies didapati tertangkap ketika melawan arus. Pemerhatian ke atas perkembangan gonad beberapa spesies pelagik matang yang berhijrah menunjukkan spesies tersebut sedang berhijrah untuk bertelur ke kawasan bertelur yang berdekatan. Corak pergerakan pada waktu siang dan pada jangka panjang masih tidak di ketahui.

ABSTRACT

The night-time movement pattern of 15 fish species in Terengganu waters was inferred from the driftnet catch obtained from experimental driftnetting in two monsoon seasons. Nets shot perpendicular to the coast drifted northward or southward parallel to the coast at 0.33-1.78 km/h. Thirteen out of 15 species caught were enmeshed significantly against the current. Observations on gonad development of some migratory pelagic species showed that these species were on spawning migration to nearby known spawning areas. Daytime and long-term movement patterns remain unknown.

INTRODUCTION

Driftnets are usually set to cross the course of migrating or moving fish schools. In Terengganu waters where the migration and movement pattern of fish is unknown, driftnets are shot in the direction of the wind, which is usually perpendicular to the coastline, and later adjusted to the current, for safe and easy operation of the net and vessel. As the surface sea current is reported to be parallel with the coastline (Saadon and Yaacob 1991), the nets are set in a direction perpendicular to the coastline. In Terengganu waters, an average of 300 fish aggregating devices (FADs) groups can be found in 200 square nautical miles of coastal waters. The presence of these FADs, which are scattered randomly in the water, effectively restricts driftnetting operations to several hours before hauling. A driftnet set in the area can catch fish species associating with the FADs as well as species not associated with them

The objective of the study was to examine the night-time movement pattern of fish in the coastal waters and its relationship to the current. The movement pattern of fish can be inferred from the driftnet catch. Fish are enmeshed on one side of the driftnet when the movement pattern of fish is directional, and on both sides when non-directional (Suzuki 1970).

MATERIALS AND METHODS

Experimental driftnettings were conducted in August and November 1994, using the 13-m vessel RV UNIPERTAMA I at 8 nautical miles off

Terengganu. The two periods were chosen to coincide with ether the southwest monsoon in May-October or the northeast monsoon in November-March. The driftnets consisted of yellow multifilament nylon netting of 64.5 m length and 10.8 m depth with 7.6 cm mesh size, and green netting of 21.6 m length and 10.8 m depth with 10.2 cm mesh size. The net was hung with depth-adjustment lines of 5.4 m length. The nets were shot from the stern before sunset, moored to the drifting boat and hauled 1.5-2.5 h later. Positions and directions of the net at shooting and hauling were obtained with a digital radar (FURUNO FR 602D) and a magnetic compass respectively. Measurement of current direction was by a digital direct reading current meter (OSK 3210). During hauling, the fish species caught and their enmeshed direction were recorded. In several species, stages of gonad development were observed onboard.

RESULTS AND DISCUSSION

In the ten driftnetting operations conducted (Table 1), 15 fish species were caught. The number of fish enmeshed against the current was significantly larger than those enmeshed with the current. The difference was statistically significant for all species except *Echeneis naucrate* and *Chiloscyllium griseum* (Table 2).

As the direction of the net was roughly perpendicular to the coast in each trial, the movement pattern of the fish caught could then be related to the direction of the current. Several studies conducted showed that while the current meanders, the current vector is practically parallel with the coast, flowing southward from November till March and northward from May till October (Liew *et al.* 1987; Saadon and Yaacob 1991).

Fish migration or movement with the current is known in *Cypselurus opisthopus hiraii* in the Japan Sea (Kojima 1961) and in the waters off Amakusa, Japan (Tsukahara *et al.* 1957), *Anguilla anguilla* in the southern North Sea (Walker *et al.* 1978; Arnold and Cook 1982) and several other fish in the North Pacific Ocean (McKeown 1984). The present study showed fish swimming against the current during both monsoon seasons. All the species caught except *Echeneis naucrate* and *Chiloscyllium griseum* showed a tendency to swim against the current.

Observations on gonad maturity showed poorly developed gonads in August in *Euthynnus affinis*, *Auxis thazard* and *Decapterus maruadsi*. Well-

TABLE 1
Shooting and hauling positions, drift of net and direction of current off the Terengganu coast

Date	Shooting		Hauling		Drift of net		Direction of current
	Time	Position	Time	Position	Direction	Speed (km/h)	
26 Aug	1823	5°06.4'N 103°21.0'E	2025	5°07.4'N 103°20.5'E	333°	1.00	Northerly
27 Aug	1900	5°06.1'N 103°22.5'E	2105	5°07.6'N 103°22.2'E	348°	1.39	Northerly
28 Aug	1830	5°07.0'N 103°22.7'E	2000	5°08.1'N 103°22.6'E	355°	1.30	Northerly
30 Aug	1900	5°07.5'N 103°21.8'E	2100	5°09.0'N 103°21.7'E	000°	1.39	Northerly
31 Aug	1917	5°07.2'N 103°21.2'E	2140	5°06.4'N 103°20.8'E	206°	0.69	Northerly
1 Nov	1855	5°34.4'N 103°10.1'E	2110	5°34.0'N 103°10.1'E	180°	0.33	Southerly
2 Nov	1853	5°35.2'N 103°11.0'E	2100	5°34.5'N 103°11.0'E	180°	0.61	Southerly
6 Nov	1900	5°07.6'N 103°22.7'E	2105	5°08.1'N 103°21.0'E	296°	1.78	Southerly
7 Nov	1855	5°05.4'N 103°19.2'E	2055	5°06.4'N 103°18.2'E	308°	1.67	Southerly
8 Nov	1902	5°19.2'N 103°18.0'E		5°18.7'N 103°18.7'E	148°	1.60	Southerly

TABLE 2
Species and number of fish caught, enmeshed direction
(A and B denote enmeshed directions with or against the current respectively)

Date	26 Aug		27 Aug		28 Aug		30 Aug		31 Aug		1 Nov		2 Nov		6 Nov		7 Nov		8 Nov		Total		
Fish species	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	X^2
Euthynnus affinis	6	6	9	15	-		9	39	-		-		0	21	0	11	-		0	10	24	102	48.29
Auxis thazard	9	42	9	0	-		0	3	-		-		0	13	-		-		-		18	58	21.05
Priacanthus macracanthus	-		9	42	-		0	9	0	2	-		-		0	12	-		-		9	65	42.38
Decapterus maruadsi	-		6	24	-		0	3	-		-		1	8	-		2	4	-		9	39	18.75
Echeneis naucrate	-		6	3	-		6	3	0	1	3	0	2	5	2	5	-		-		23	17	0.90*
Therapon jarbua	-		-		-		0	3	-		-		0	3	-		-		5	0	5	6	4.00
Scomberomorus commerson	-		-		-		-		0	1	-		0	4	-		2	7	-		2	12	7.14
Formio niger	-		-		-		-		0	1	-		0	7	-		-		-		0	8	8.00
Rachycentron canadus	-		-		-		-		-		0	11	-		-		0	4	-		0	15	15.00
Rastrelliger kanagurta	-		-		-		-		-		0	5	0	7	-		-		0	4	0	18	18.00
Megalaspis cordyla	-		-		-		-		-		0	26	0	19	-		-		-		0	45	45.00
Holocentrus diadema	-		-		-		-		-		-		-		0	10	-		-		0	10	10.00
Chiloscyllium griseum	-		-		-		-		-		2	2	-		3	0	-		-		5	2	1.29*
Caranx sexfasciatus	-		-		-		-		-		-		-		-		0	11	-		0	11	11.00
Chirocentrus dorab	-		-		-		-		-		-		-		-		0	4	-		0	4	4.00
Total	15	48	39	84	-		15	60	0	5	5	44	3	87	5	38	4	30	5	14	95	412	204.85
X^2	17.29		16.46		-		27.00		5.00		31.04		78.40		27.22		19.88		4.26		204.85		

* Not significant at $p<0.05$

developed gonads were observed in the above species as well as *Rastrelliger kanagurta* during November. *Megalaspis cordyla* had undeveloped gonads during both months.

Gonad development in migratory fish species gives information about the spawning migration. It is very likely that *Euthynnus affinis, Auxis thazard, Decapterus maruadsi* and *Rastrelliger kanagurta* were on their spawning migration northward against the southerly current to the nearest known spawning areas off the coast of Thailand in the northern section of the Gulf of Thailand (Chullasorn and Martosubroto 1986). On the other hand, *Euthynnus affinis, Auxis thazard* and *Decapterus maruadsi*, with poorly developed gonads during the southwest monsoon, could have been moving against the northerly current searching for food or were associating with FADs. *Megalaspis cordyla*, with undeveloped gonads, may have a spawning season outside the experimental periods (Chullasorn and Martosubroto 1986). For a proper understanding of the movement and migration pattern of the coastal pelagic migratory species, detailed studies employing other gear during the daytime and long-term movements of fish are needed.

CONCLUSION

As the current is parallel to the coast irrespective of the season, better catches could be achieved by setting the nets perpendicular to the coastline. The catch from driftnets could be used to understand the movement and spawning migration patterns of migratory pelagic species in coastal waters, which could be used for better resource management strategies.

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