STATUS OF THE PENAEID SHRIMP RESOURCE IN SARAWAK

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ABSTRACT

The data obtained from the surveys carried out in 1980, 1982, 1990 and 1995 within the 12 nautical miles territorial waters were used in this study. The coastal water of Sarawak was divided into 3 sub-areas: I, II and III. The biomass of shrimp estimated over the years has decreased significantly except for 1995 survey that showed an increase. The estimated current potential yield of shrimp resource was 5,552 tonnes. The number of trawlers in operation now is very much higher than the estimated numbers able to exploit the shrimp resource on sustainable basis. It was recommended that the used of 20 strings trammel net be encouraged in the untrawlable grounds of sub-areas II and III.

ABSTRAK

Penganggaran stok sumber udang adalah menggunakan data survei menggunakan pukat tunda udang di perairan sehingga 12 batu nautika dari pantai pada tahun 1980, 1982, 1990 dan 1995. Analisa data adalah mengikut tiga pecahan kawasan; I, II dan III. Penurunan ketara pada nilai biomas udang dalam tempoh 15 tahun pada setiap kawasan kecuali pada pecahan kawasan I menunjukan peningkatan pada tahun 1995. Anggaran potensi tangkapan udang ialah 5552 tan. Untuk perairan dengan dasar rata, bilangan bot yang beroperasi pada masa ini adalah jauh melebihi anggaran bilangan bot yang diperlukan untuk eksploitasi secara mapan. Pukat hanyut tiga lapis dengan 20 utas setiap unit boleh ditambah bilangannya di pecahan kawasan II dan III yang berbatu.

1.0 Introduction

Commercial exploitation of penaeid shrimp in Sarawak began in the early seventies with the introduction of trawl gear. It was intensified in the eighties with the improvement in mechanization and the introduction of low-opening twin-outrigger trawl and the use of net drum. Since then effort level reached more than 1,000 trawlers of all sizes, which contributing to annual landings of around 19,000 tonnes until 1990. After the peak in 1989/1990, the catches were fluctuated and recorded lowest at 11,000 tonnes in 1998 (Anon., 1998). The bulk of the landings was attributed to <40GRT trawlers which dominate the fisheries.

Prawn is the main-stay of the coastal fisheries of Sarawak. Although the coastal water of Sarawak is large, the major portions of it are rough grounds unsuitable for bottom trawling. The landings of shrimp increase from October onward and reached the peak during the monsoon months of January, February and March (Hadil, 1994). The monsoon landings contributing to the bulk of the annual production.

Fisheries Research Institute, Sarawak Branch (Bejie 1981 & 1982, Yong 1990, Hadil 1995) has carried out prawn resource surveys since 1980. Analysis of these data shows that although prawn species distribution has not changed very much, the catch rates have decreased tremendously. This report represents the outcome of the analysis of the four survey data covering the period of 15 years from 1980 to 1995.

2.0 Materials and Methods

2.1 Source of data

The data obtained from the surveys carried out in 1980, 1982, 1990 and 1995 were used in this study. These surveys were carried out within the 12 nautical miles area from the coastline using the research vessel, KK MALONG except in 1995.In 1995 a twin outriggered commercial trawler, SF1-88 with a gross tonnage of 135 fitted with a Cummins 620Hp engine was chartered to carry out the survey. The catch rates (kg/hr) data from the above 4 surveys were compiled. These catch rates were log transformed to conform to normal distribution. The average catch rate data from 1995 survey was also corrected for mesh-size difference by using mesh-size ratio. In term of trawl net, KK MALONG uses a smaller net with head rope length of 31.8m and mesh size of 32mm. While the head rope length and mesh size of SF1-88 was 114.8m and 38mm respectively (Hadil, 1995).

2.2 Estimation of density and biomass

The biomass assessment was done using the swept-area method mentioned in Sparre (1985). Biomass is equal to (c/f) .A/(a.q), where c/f is the average catch rate, A, the area within the survey zone, a, is the effective trawl swept area and q is the catchability coefficient.

The swept area, a, was calculated using the formula, a= t.v.h.x, where t-time (hr) taken for one haul, v-trawling speed, h- head rope length and x is the net-opening coefficient. This formula was chosen since the horizontal net opening is unknown. The x value of 0.7 was used as suggested by South China Sea Development Programme (1978). The trawling speed adopted for the shrimp surveys of 1980 and 1990 was 2.8 nm/hr (5.2 km/hr) and that used for 1982 and 1995 was 2.0 nm/hr (3.7 km/hr).

The density was estimated using the formula, d= (c/f)/(a.q), where the value of q suggested for the surveys of 1980,1982 and 1990 was 0.6 and the value of 1.0 was used for data taken in 1995 by the commercial trawler. The reason for the choice in the values of q was on the assumptions that commercial trawler caught all (100%) of the fishes along it path and only 60% were caught by research vessel. This is to reflect the more efficient gear in commercial fishing than in the research fishing.

2.3 Estimation of potential yield

The potential yield, MSY was derived using the Cadima formula, MSY = 0.5 (Y + MBc), where Y is the yield of shrimps landed by trawlers of all sizes, M is the natural mortality rate and Bc is the current biomass estimated. This formula was used since the resource was known to be exploited since early seventies. Hadil (2000b) gave an estimate for instantaneous natural mortality, M, for adolescent and juvenile banana shrimp, *Penaeus merguiensis* at 3.01 and 2.69 per year for male and female shrimp respectively. Yong *et al*. (1990) estimated the M value for the banana shrimp of Sarawak at 2.143 per year. However, Garcia (1985) point towards an average natural mortality rate for penaeids of the order of 2.4 +/- 0.3 per year for adults. A compromised value of M=3 was taken in the final assessment.

In trying to conform to regional jurisdiction of the Marine Fisheries of Sarawak, the coastal waters of Sarawak was divided into 3 sub-areas (I, II & III) and subsequently divided into trawlable and untrawlable area. The untrawlable area is an area with reef and hard coral ground.

3.0 Results and discussion

3.1 Trend in Catch rate

Table 1: The average catch rate [kg/hr +/- Standard Deviation] of shrimp caught in the 1980, 1982, 1990 and 1995 trawl surveys.

	Sub-Area I	n	Sub-Area II	n	Sub Area III	n	Sub-Area IV	n
@ 1980	6.92 +/- 1.87	4	1.54 +/- 2.99	38	0.16 +/- 3.74	22		
@ 1982	3.36 +/- 8.39*	9	0.93+/- 8.39	23	0.39 +/- 9.91**	24	0.51 +/- 3.19	13
@ 1990	1.36 +/- 4.70	26						
b 1995	16.37 +/- 4.62	12	0.46 +/- 10.18	16	0.51 +/- 7.97	12		

***4 Stations with zero shrimp catch** **@ head rope 31.8m, K.K MALONG**
****8 Stations with zero shrimp catch** **b head rope 114.8m, commercial trawler**
n- number of stations sampled (Transformed for mesh size difference)

Catch rates from shrimp surveys using bottom trawl show the productivity of the area. In Sarawak, trawl nets accounted for 75% of the total shrimp landings (Hadil 1994a). Table 1 shows that the shrimp average catch rates fluctuated over the years. The overall highest average catch rate of shrimp ever recorded was in 1995 survey of sub-area I. This was possible probably due the fact that the catching efficiency of commercial trawl was high. But for sub-area I the average catch rate has decreased slightly over the years with the exception of 1995. Considering the smaller size of the net used in the earlier surveys than in 1995, the decreased in the average catch rates has been tremendous for sub-area II and III.

3.2 Trend in density and biomass

Table 2: Trend of density (D) and biomass (B) for shrimp (tonnes/km²) estimated from the trawl surveys carried out in 1980, 1982, 1990 and 1995.

Year/ catchability coefficient, q	Sub-Area							
	I		II		III		IV	
		B	D	B	D	B	D	B
1980 q = 0.6	0.140	1087.16	0.031	130.68	0.003	12.26		
1982 q = 0.6	0.048	376.21	0.013	56.24	0.006	21.29	0.007	2.57
1990 q = 0.6	0.020	152.34						
1995 q = 1.0	0.055	427.24	0.002	8.41	0.002	7.50		

The highest overall density of shrimp using the catchability coefficient of 0.6 was in sub-area I during the 1980 survey. Table 2 has shown that synonymous with the trend in catch rate, the

density for sub-areas I, II and III have decreased over the years. Sub-area I was the most productive shrimps ground. Hadil (1994b) reported that shrimps were more abundant in this western Sarawak water, appropriately termed as 'Kuching Bay'. The suitability of this area is probably due to the presence of seagrass beds with coastal fringes covered by mangrove forests that are conducive for shrimp habitation (Hadil 1994b). The biomass distribution in the three sub-areas indicated that more than 80% of the shrimp resource was found in sub-area I. But over the years, the density and biomass of shrimp in sub-area I has declined by about 61% in 1995 relative to that of 1980. The biomass of shrimp estimated over the years has decreased significantly except for 1995 survey that showed an increase. The increase in biomass was probably due to the usage of commercial vessel and gear for the shrimp survey.

3.3 Current Potential Yield (CPY)

The trawl landing for 1995 was 9775 tonnes and the estimated current potential yield, CPY was 5,552 tonnes. The estimate was derived from using assumptions for values like the catchability coefficient (q), natural mortality (M) and yield from the shrimp fishery (Y), which was estimated from the landings of commercial trawlers. In such a situation, a change in either one of the three variables used will change the estimate of potential yield. The choice of value use in the determination of the potential yield should not yield too optimistic results bearing in mind the precautionary approach to fisheries that has been recommended. Hadil (1994a) using the Surplus Production Model with catch data from trawlers of various size categories estimated that the Maximum Sustainable Yield, MSY of Sarawak shrimp resource was 11,000 tonnes.

Assuming that the Sarawak shrimp resource was evenly distributed, and based on the catch performance of 20T/unit trawler/year (Anon. 1998) and 2.5T/20 strings trammel net/year (Hadil 2000a), the number of licence was derived as shown in Table 3. The number of 40GRT trawlers in operation in 1998 was 778 units. The number of 40GRT trawler recommended to exploit the shrimp resource at sustainable basis was estimated at 233 units. But earlier estimate using the Surplus Production Model (Hadil 1994a) suggested that the shrimp trawl fishery could be sustained if the effort level is reduced to 800 trawlers. Knowing the weaknesses of Surplus Production Model which relies solely on landings data which may be over or under reporting, the recommended 800 units of effort should be treated with cautioned. The other reason to be taken into consideration is that over the years, technological advancement in the use of Global Positioning system, GPS, echo-sounders and net hauler has tremendously increased fishing efficiency and total fishing effort.

Comparing the number of licences derived based on current potential yield, and that in operation, it shows that, over exploitation has occurred in all the sub-areas. The assessment using the Dynamic Pool Model (Yong *et. al* 1990) has shown that the shrimp fishery is highly exploited. The shrimp resource in Sarawak has reached the Maximum Sustainable Yield around the 1979-1980 period. The further increase in trawl effort after 1981 resulted in fluctuation in the shrimp catch (Hadil 1994a) and the scenario was probably due to recruitment over-fishing. In the study of the banana shrimp, Hadil (2000b) has recorded very low exploitation rate at maximum Yield-per-recruit of the shrimp. This result indicated that the gear in used for example trawl which is low in selectivity, is relatively damaging to the shrimp resource. In sub-areas I and II the number of trawlers was > 3 times as recommended and that the figure was slightly double for sub-area III. In order to balance this shrimp exploitation, it was recommended that trammel net be used especially in untrawlable ground. The number of 20 strings trammel net recommended to exploit the shrimp resource in untrawlable ground was

358. The figures derived as shown by Table 3 suggested likewise especially for sub-area II and III where trawlable area was limited.

4.0 Conclusion

4.1 Potential for a new investment

The increase in the use of trammel net in untrawlable areas should be encouraged. The case study in area of Lawas and Limbang (Hadil, 2000b) has proved that the return from trammel net fishery was very good with an average yield of 2.5 tonnes per year (of banana shrimp) per boat, equivalent to about RM37, 500 per year per fisherman. The number of trammel netters in Limbang and Lawas was 410 in 1998 (Anon. 1998).

In the culture of shrimp notably tiger shrimp, *Penaeus monodon*, the collection of live shrimp for broodstock from Kuala Baram, Miri should be encouraged and given impetus to. Hadil (2000b) has shown that the Maximum Sustainable Yield, MSY for Kuala Baram tiger shrimp resource was 4,362 and 5,720 kilogrammes for male and female shrimp respectively. The wholesale price of live tiger shrimp in Miri at present was RM15 and RM50 per tail for male shrimp weighing more than 80 grammes and female shrimp weighing more than110 grammes respectively. If these tiger shrimp were to be harvested alive for hatcheries, the estimated optimum annual returns to the local fishermen would be about RM3.4 millions. In the year 2001, twenty-two trawlers were harvesting tiger shrimp.

4.2 Propose management measures

Over exploitation of the shrimp resource can lead to depletion in the resource, thus the livelihood of the coastal fishermen will be affected. Though it is hard to reduce the existing number of trawlers in operation, it is recommended that no new permit should be issued and that those that stop fishing are not allowed to transfer their licences. By doing so, trawling will be minimized in the 0 to 5 miles zone. The use of trammel nets as recommended should be increased especially for small boat with outboard engine.

Localised enforcement should be carried out, especially in areas and season where shrimps are abundant. The trammel net shrimp fishery of Lawas (Hadil 2000b) has thrived prosperously for the past 30 years with constant surveillance and enforcement by Marine Fisheries Department of Sarawak.

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