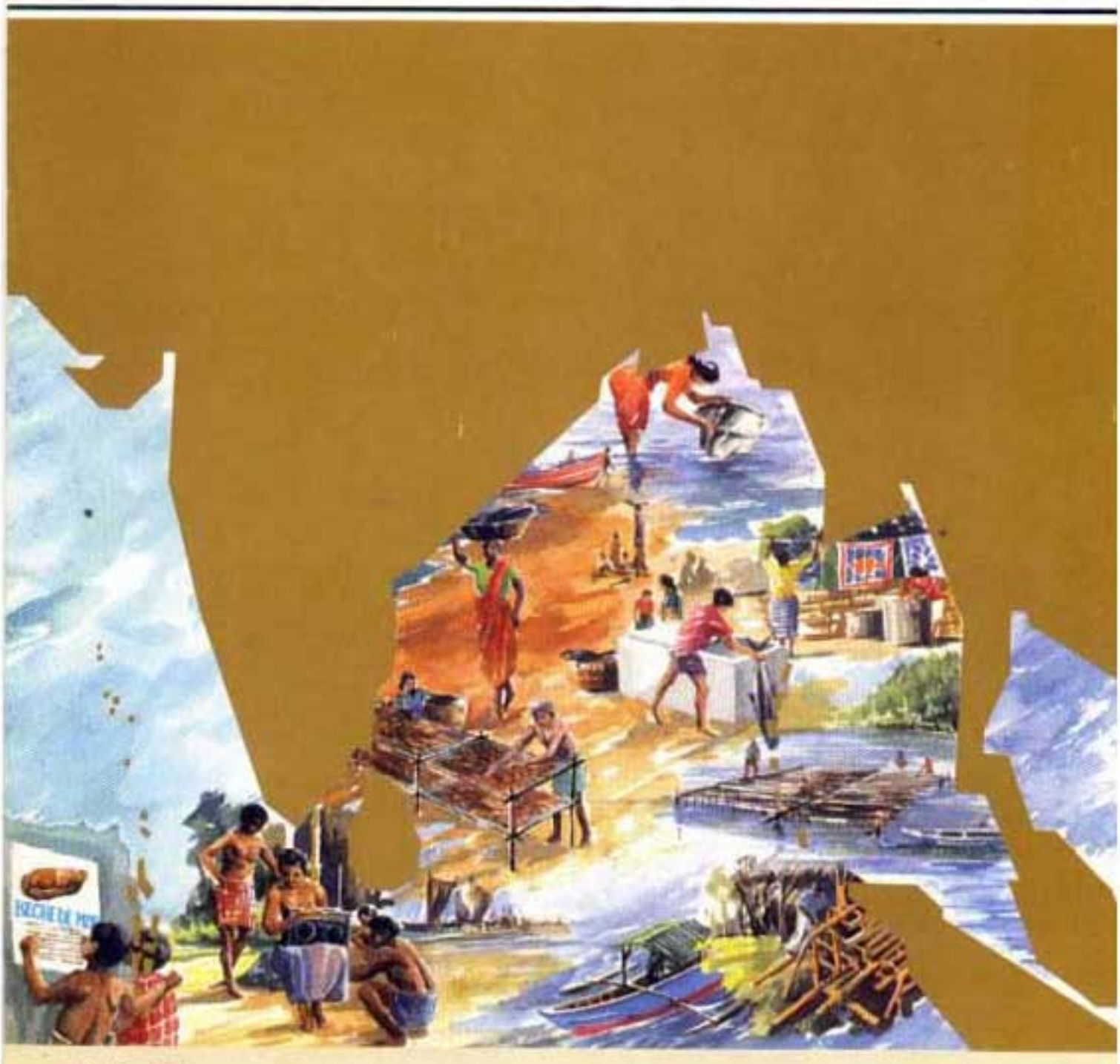
BOBP/WP/98

Biosocioeconomics of Fishing for Shrimp in Kuala Sepetang, Malaysia



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Biosocioeconomics of fishing for shrimp in Kuala Sepetang, Malaysia

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The shrimp fishery is one of the most important components of the marine capture fishery along the west coast of Peninsular Malaysia. Although the percentage of shrimp by weight in the total landings in this area is not high, shrimp are important to the capture fishery due to their high value. Kuala Sepetang, in the district of Larut-Matang, is one of the main shrimp landing centres in Perak. In 1992, a research project to assess the biosocioeconomics of the shrimp fishery in this area was implemented jointly by the Department of Fisheries, Malaysia, and the Bay of Bengal Programme (BOBP). The project involved biological and socioeconomic data-collection for a period of one year. The reporting was funded by the United Nations Development Programme.

The main objectives of this project were to analyze the relative perfomances of the different shrimp fishing gear, assess their biosocioeconomics and suggest optimum levels of exploitation of the resource. The findings of the project, it is hoped, will be useful in formulating future policy guidelines and management measures with regard to the exploitation of the limited shrimp resources. The methodologies used in this project will also help to improve the capabilities of national staff in future biosocioeconomic assessments.

The Bay of Bengal Programme (BOBP) is a multiagency regional fisheries programme which covers seven countries around the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new technologies, methodologies and ideas to help improve the conditions of small-scale fisherfolk communities in member countries. The BOBP is sponsored by the governments of Denmark, Sweden and the United Kingdom, and also by the UNDP (United Nations Development Programme). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

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CONTENTS

1. *INTRODUCTION*

The shrimp fishery is one of the most important components of the marine capture fishery along the west coast of Peninsular Malaysia. Although the percentage of shrimp by weight in the total landings in this area is not high, shrimp are important to the capture fishery due to their high value. The total shrimp landings on the west coast of Peninsular Malaysia were 72,181 tin 1990 (Anon., 1991) and 66,625 t in 1991 (Anon., 1992), amounting to 14.1 per cent and 16.6 per cent of the total marine landings by weight. But their wholesale value was 40 per cent (RM 353.4 million*) and 39.5 per cent (RM 334.6 million) respectively.

Perak is the most productive state for shrimp on this coast. The total shrimp landings in the state in 1991 were 28,640 t, of which 26,706 t (93.25%) were penaeid shrimp. This amounts to nearly half the total shrimp and penaeid shrimp landings on the west coast of Peninsular Malaysia in 1991.

Kuala Sepetang, in the district of Larut-Matang, is one of the main shrimp landing centres in Perak. It is situated in an extensive mangrove area, which is said to be one of the best-managed mangrove forest systems in the region (Khoo, 1989). In 1992, a research project to assess the biosocioeconomics of the shrimp fishery in this area was implemented jointly by the Department of Fisheries, Malaysia, and the Bay of Bengal Programme (BOBP). The project involved biological and socioeconomic data collection for a period of one year.

The main objectives of this project were to analyze the relative performances of the different shrimp fishing gear, assess their biosocioeconomics and suggest optimum levels of exploitation of the resource. The findings of the project, it is hoped, will be useful in formulating future policy guidelines and management measures with regard to the exploitation of the limited shrimp resources. The methodologies used in this project will also help to improve the capabilities of national staff in future biosocioeconomic assessments.

The project, apart from carrying out biological analysis, also took into consideration the socioeconomics of the fishing community and of those involved in fishery-related activities. It is hoped that this approach will enhance the perspective of fisheries managers while formulating management policies.

Data-collection studies were carried out on the four major fishing gear types involved in harvesting the shrimp resources in the area. These are trawis (TWL), pushnets (PN), trammelnets (TRN) and bagnets (BN). All four fishing gear use mechanized vessels for fishing or transportation. TWL and PN are active fishing gear, whereas the other two are passive. The overall fishing area is quite limited in size, and so the different fishing gear for shrimp are interactive. All major fishing gear operating in this area were, therefore, investigated to give an overall picture of the shrimp resources off Kuala Sepetang.

A few large-size trawlers also operate in Kuala Sepetang, but these were not taken into account for the purpose of biological data analysis as they mainly target finfish. These trawlers should be regarded as 'fish trawlers' as distinct from 'shrimp trawlers', although the licenses issued to them do not categorize them so. These vessels are licensed to fish away from the coast and beyond the main shrimp fishing grounds. Landing of shrimp from these vessels can be considered as incidental. Fisherfolk operating these boats were, however, included in the socioeconomic data-collection to give a clearer picture of the fishing community.

Biological and socioeconomic data-collection, and part-processing of the collected data, was undertaken by a field biologist, a field economist and two field data-collectors who were employed specifically for this project. Their work was carried out under the guidance and supervision of staff from the Department of Fisheries (DOF), Malaysia, and consultants from BOBP.

* US $ 1 = Ringilt Malaysia 2.50 appx.

2. *METHODOLOGY*

2.1 *Bioeconomic data-collection*

Biological data collected from May 1992 to May 1993 included catch and species composition, length-frequency data of selected shrimp species, and prices of the various commercial categories of shrimp. Data were collected by sampling fishing vessels operating the different fishing gear. Fishing effort with different fishing gear was estimated. These data were then used to estimate production and revenue from the various fishing gear and the growth parameters of the selected shrimp species. Subsequently, this information was utilized to assess the shrimp stocks in the area. Details of the sampling procedures employed are given below.

CATCH AND SPECIES COMPOSITION DATA

Catch data were obtained from direct observations at landing centres as well as from records maintained at these centres. Catch data from records were used for periods when direct observations of the landings could not be made.

Shrimp catches landed by the vessels are usually sorted at sea into commercial categories. These categories are based on size and/or species of the shrimp. There are, however, some variations between categories for different fishing gear. Species composition by weight for each fishing gear was obtained by sampling these categories twice a month.

Apart from sampling the catches at the landing centres, species composition data were also collected on board fishing vessels, particularly trawlers and pushnetters. This enabled data-collection on by-catch not usually landed at the landing centres. By-catch of trammelnets are discarded at sea, so samples for species composition studies were requested and obtained from the operators of this gear. As operators of bagnets do not sort their catch at sea, species composition of the by-catch from this gear was obtained at the sorting sites.

By-catch sampling commenced much later than for shrimp, and its production, during months when data were not available, could only be estimated.

Prices of the various categories of shrimp and by-catch were obtained at the landing centres.

LENGTH-FREQUENCY DATA COLLECTION

Carapace length-frequency measurements of selected shrimp species were also carried out at the same time. The main species selected were Banana shrimp *(Penaeus merguiensis),* Jinga shrimp *(Metapenaeus affinis),* Yellow shrimp *(Merapenaeus brevicornis),* Rainbow shrimp *(Parapeneopsis scuiptilis)* and Spear shrimp *(Parapeneopsis hardwickii).*

The selection of these species was based on their abundance and their importance to the overall shrimp fishery in the study area. They are also representative of the major genera and sizes of shrimp found in the area. Manpower and time constraints did not permit more species to be investigated.

ESTIMATION OF FISHING EFFORT

Fishing effort with the various gear was obtained from interviews with the fishing gear-operators and shrimp-collectors as well as from direct observations of the vessels engaged in fishing. Direct observations of fishing effort using bagnets were not possible as this gear is operated off a small fishing village on an island some distance from Kuala Sepetang. Effort, therefore, had to be estimated based on interviews with the operators of this gear. Correct estimation of fishing effort is very important, as monthly production figures for each species are dependent on it.

2.2 *Bioeconomic analysis*

CATCH AND SPECIES COMPOSITION

Catch and species composition data were treated separately for each fishing gear due to the differences in fishing efficiency of each gear and the different criteria used for sorting the shrimp into various commercial categories.

Catch weights of each commercial shrimp category for each fishing gear type were pooled. The average catch rates (kg/vessel/day or kg/bagnet/day) of the respective categories were then computed. The values thus obtained were then multiplied by the estimated number of fishing vessels or bagnet operators operating each day and the number of fishing days per month to give monthly production of each shrimp category by gear.

The percentage composition by weight, of the sample, was used to estimate the composition by weight of each species in a category for the catch from the sampled vessel.

The values obtained from all sampled vessels for each month were then pooled to calculate the average percentage composition by weight of each species within each category. This was used to obtain the monthly production of the species composition within each category for each fishing gear.

The same procedure as mentioned above was also applied to the by-catch data of each gear to provide estimates of the production of each species found in this category.

LENGTH-FREQUENCY

The sample length-frequencies for each category were raised to the catch of the boat sampled and then raised to the total catch of the fleet at the centre.

The monthly length-frequency of each category caught by different fishing gear was again pooled to give the overall length-frequency distribution of each selected species. Estimates of growth parameters for each species are likely to be more accurate as the length-frequency data are representative of the entire population of the species.

GROWTH PARAMETERS, POPULATION ANALYSIS AND PREDICTIONS OF FUTURE YIELD AND VALUE

The monthly length-frequencies of each selected species were used to estimate their respective growth parameters, *i.e.* K and L, by using the ELEFAN I programme of the Compleat ELEFAN software package version 1.11.

The natural mortality (M) and fishing mortality (F) values for each species by gear and also for all gear combined were estimated by using the ELEFAN II programme. The same programme was also used to estimate the lengths at capture, L_{50} and L_{75}, and the recruitment patterns of the various selected species.

Estimates of the population sizes of the selected species were obtained by applying the back calculating method of the length-based Virtual Population Analysis routine (VPA II) in ELEFAN III to the catch-at-length data of these species.

Relative yield per recruit (Y/R) estimations were obtained by using the knife-edge selection method available in ELEFAN II. By applying the weighted price (RM/kg) of each species to their respective yield per recruit values, estimates of relative revenue per recruit were made.

A length-based Thompson and Bell analysis was also carried out for each fishing gear, using the Length-based Fish Stock Assessment (LFSA) software package. This analysis was done to forecast yield and revenue of the selected species for predicted changes in fishing effort, using inputs of growth parameters, maximum fishing mortality for each species for each fishing gear, recruitment size of each species for each fishing gear obtained from the individual VPA II analysis and prices for each length class.

A comparison was also carried out of the yield and revenue of *Penaeus merguiensis* caught by trawlers alongside other fishing gear and if pushnets and bagnets were banned.

2.3 *Socioeconomic data collection*

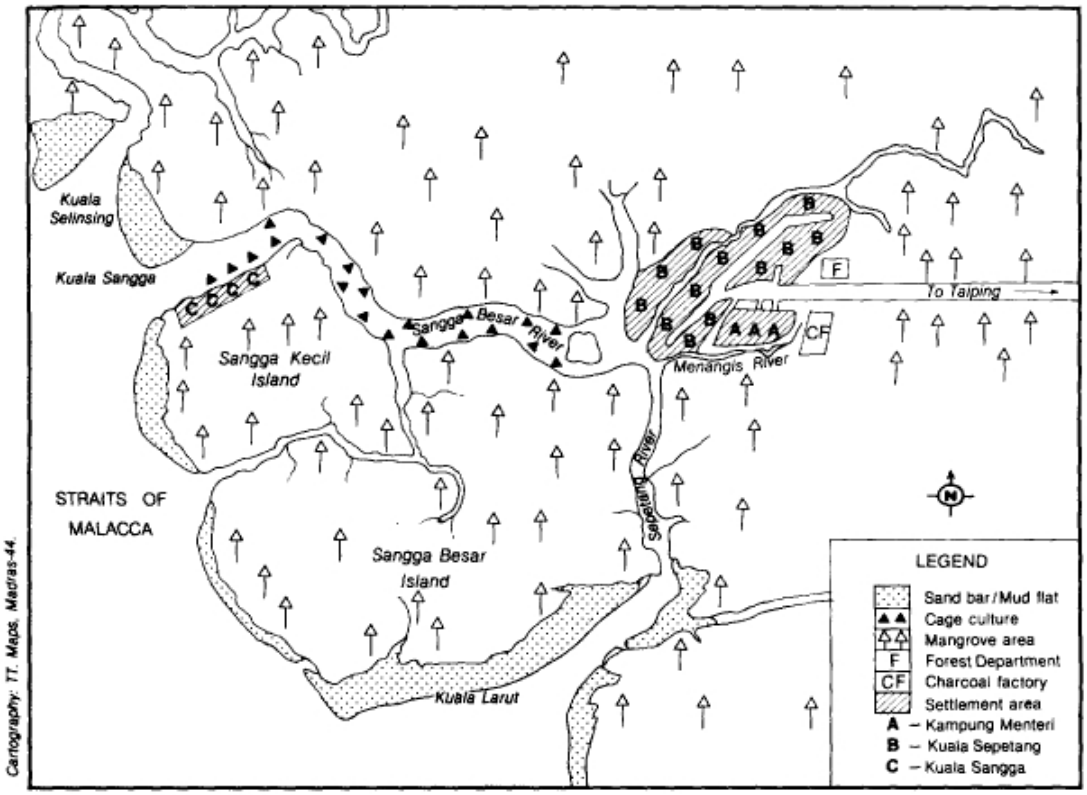
Before conducting a socioeconomic survey, a village profile study and a frame survey were carried out to identify the general characteristics of the area and the types of households in it. Based on their economic activities and ethnic groups, the area was geographically divided into three villages (see Figure 1),

- Kuala Sepetang,

  Kampung Menteri; and

- Kuala Sangga.

Fig 1. Map of study area in Malaysia, showing the three villages



A socioeconomic survey was conducted by sampling 21-26 per cent of the households in each village. The total number of households in each village and the number of samples taken for the survey are shown in Table 1.

Table 1: Distribution of total and sample households and population by village

Village	Estimated total households (HH)	Sample Households No.	%	Sample Population M	F	T	Avg. no. of persons per HH	Estimated total population M	F	T
Kuala Sepetaug	930	226	24	704	672	1376	6.1	2901	2769	5670
Kampung Menteri	200	42	21	139	138	277	6.6	662	658	1320
Kuala Sangga	50	13	26	48	43	91	7.0	185	165	350
Total/Overall	1180	281	24	891	853	**1744**	**6.2**	**3748**	**3592**	**7340**

The households in these villages were stratified according to their economic activities, *viz.:*

- fishing;
- fishery-related; and
- nonfishery.

A household could have one or more of these income-generating activities.

Fishing households were again stratified according to the types of fishing gear and class of fisherfolk, *i.e.* owner, crew.

A frame survey of the number of vessels and gear in the area was conducted and, based on this, a stratified random sampling survey, covering every fishing gear involved in shrimp fisheries in the area, was conducted from June 1992 to May 1993 to estimate

- operational costs,
- the sharing system, and
- income to owner, skipper and crew.

Incomes from the four fishing gear involved in the shrimp fishery were estimated from monthly production and recorded prices. Incomes from 'fish trawlers' were included to give a more complete picture of income derived from fishing and the interaction among the various fisheries in the area.