15 PRELIMINARY ASSESSMENT OF THE JAMAICAN PENAEID SHRIMP FISHERIES OF KINGSTON HARBOUR

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15.1 Introduction

The penaeid shrimp fisheries of Jamaica occur mainly in the Kingston Harbour. The Harbour may be divided into three distinct areas, Hunts Bay, the Main Basin and the Outer Harbour. The sediments of Hunts Bay and the Main Basin are predominantly mud with an average depth of 3 m for Hunts Bay and between 10–14m for the Main Basin. The Outer Harbour is comprised of more firm and sandy sediments. Depth in this area varies between 10–15 m. The Kingston Harbour is influenced by two rivers and several gullies. The major ones being the Rio Cobre River, the Duhaney River and the Sandy Gully.

Two fleets exploit the white shrimp (*Penaeus schmitti*) stock. These fleets are of two types. Type 1 are wooden canoes using mono-filament nylon gillnets of 1.4–1.9cm mesh size and Type 2, fibreglass (FRP) boats that use hand operated trawls of 1.9cm mesh size. The monofilament nylon gillnets function as encircling nets and are operated for four to six hours per outing. The nets are set for approximately two to three minutes before being hauled into the canoe. Trawl nets are operated for approximately twelve hours with a drag time of approximately forty-five minutes. The FRP boats are powered by 40 HP engines.

The fleets fish predominantly in two distinct areas with some degree of overlap. The Type 1 fleets fish in Hunts Bay and tend to follow the stock in its migration to the deeper waters of the Outer Harbour. The Type 2 fleets fish in the Main Basin and Outer Harbour and marine areas adjacent to these sites. However fishing is concentrated in the Main Basin and Outer Harbour.

Stock assessment of the penaeid shrimp fisheries of the Kingston Harbour is important in order to provide sound advice for the management of the fishery. Presently the fishery is open access. Persons that operate in this fishery have few skills and rely on this fishery for a substantial portion of their livelihood. It is important that sound data collection, management and analytical systems are implemented to provide guidance to policy and decision makers in order to facilitate the introduction of management measures.

15.2 Data

Sampling for landings and effort and biological data was conducted randomly, at least twice per month, over a period of 31 months. Data are available from the Kingston Harbour fishery from September 1996 – March 1999.

The number of vessels sampled over the period reflected approximately 72% of landings of the Type 1 fleet and 80% of landings of the Type 2 fleet. The data were recorded from the landing site using trip interview sheets. These recorded: area fished, depth fished, time spent fishing, number of fishing days, gear type, mesh size and landings by species. The sampled landings and effort data were raised to estimate total landings for the *Penaeus schmitti* fishery. Total landings in a month were estimated as follows:

Total landings = [(Number of boats landed)/(number of boats sampled)]

* (sampled catch) * (number of fishing days for the month).

The biological data recorded total length, carapace length, tail length with and without telson and weight for the whole animal. A portion of the landings was sampled. The total landings and effort were recorded in addition to the sample weight. Shrimps are landed whole and unsorted.

15.3 Methods

The sampled catch per unit effort (CPUE) of both gear types was calculated on a monthly basis. The CPUE of both fleets was standardised using the Robson (1966) analysis of variance procedure. China nets were selected as the standard gear for the estimation of relative fishing power. This was due to the data set being more complete for this gear. The CPUE in September 1996 was used as the standard date in the relative abundance estimation.

The standardised CPUE of the trawl fleet was obtained by dividing the CPUE of the trawl fleet by the estimated relative fishing power. Then the average of the standardised CPUE of both the fleets was determined.

The monthly average standardised CPUE were plotted against cumulative catch in order to determine depletion trends. These depletion points were used in a DeLury-Type Depletion Model after Chien and Condrey (1985), to determine the catchability coefficient, q. Based on the results obtained for q, the monthly biomass and fishing mortality were determined as

Biomass = std. CPUE/q

Fishing mortality = fishing effort * q

These methods are described in more detail in Section 13 describing the assessment of Trinidad groundfish.

15.4 Results

The relative fishing power of Type 2 vessels is 2.498 times that of Type 1 vessels. The fishing power of the Type 2 boat is higher than that of the Type 1 boat primarily due to the nature of operation of both fishing gears. The Type 1 boats use monofilament gillnets, which function as encircling nets. This method is not efficient for targeting benthic organisms such as shrimps. Catch per unit of effort is most strongly influenced by the skill of the fisherman in locating the shrimp and handling the gear. The Type 2 vessels are powered by 40 HP engines and use bottom trawls. These boats are able to sweep a wider area in less time than the monofilament gillnets and therefore exert a higher fishing power per unit time fished.

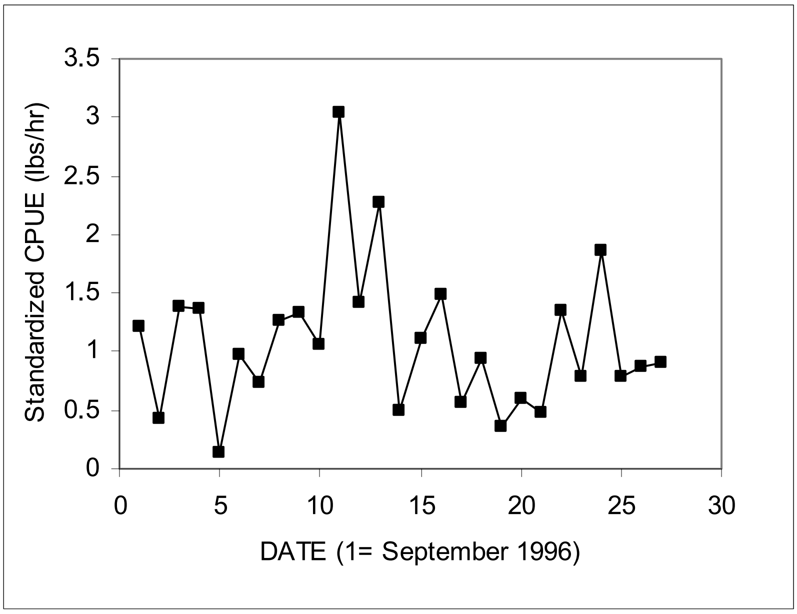

Figure 15.1 Monthly standardised CPUE for the *P. schmitti* fishery in Kingston Harbour

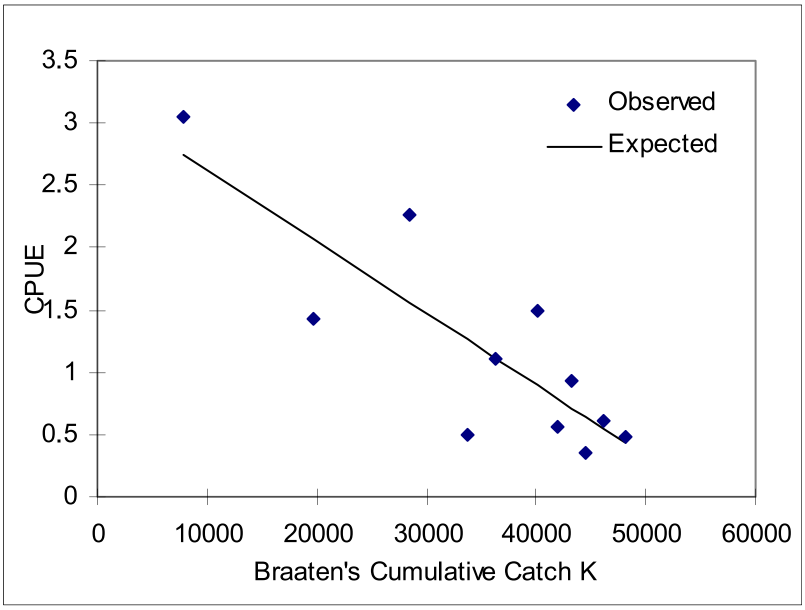

Figure 15.2 Determination of the catchability coefficient after Chien and Condrey (1985)

A plot of seasonal standard CPUE showed a decreasing trend from month 11–21 (August 1997–August 1998) that approximated a depletion trend (Fig. 15.1). Based on the appearance of this graph, a DeLury-Type linear regression was fitted to the CPUE on cumulative catch including a correction for M (Fig. 15.2). Following the Chien and Condrey (1985) method, the catchability coefficient, q, was estimated as a function of average effort, the slope of the DeLury type regression fitted above and M, the natural mortality rate. Natural mortality was estimated at 0.16 month^{-1}. This gave an estimate of the catchability coefficient to be 1.146 10^{-5} per unit of standardised effort (Fig. 15.2). This indicates that 0.1146 of the biomass of the exploitable portion of the stock will be caught per 10 000 hours fished.

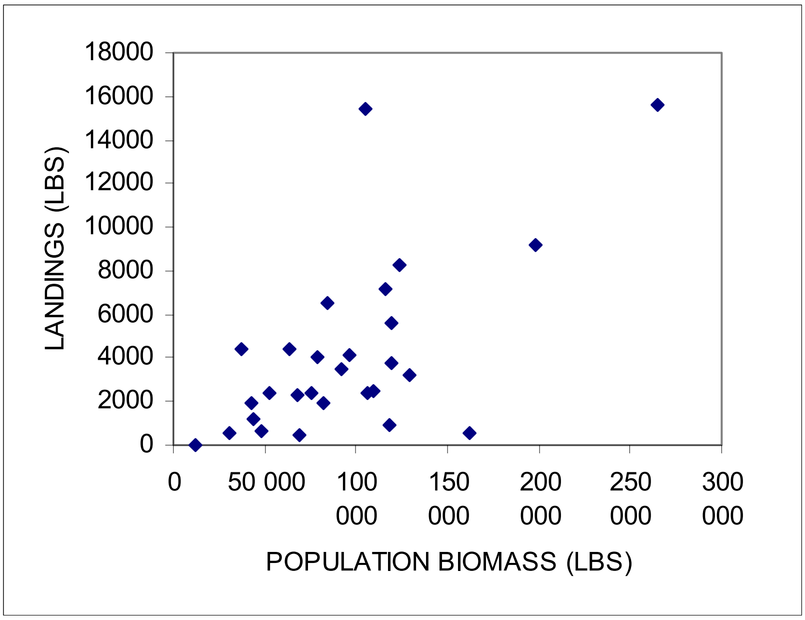

Figure 15.3 Total landings plotted against estimated population biomass

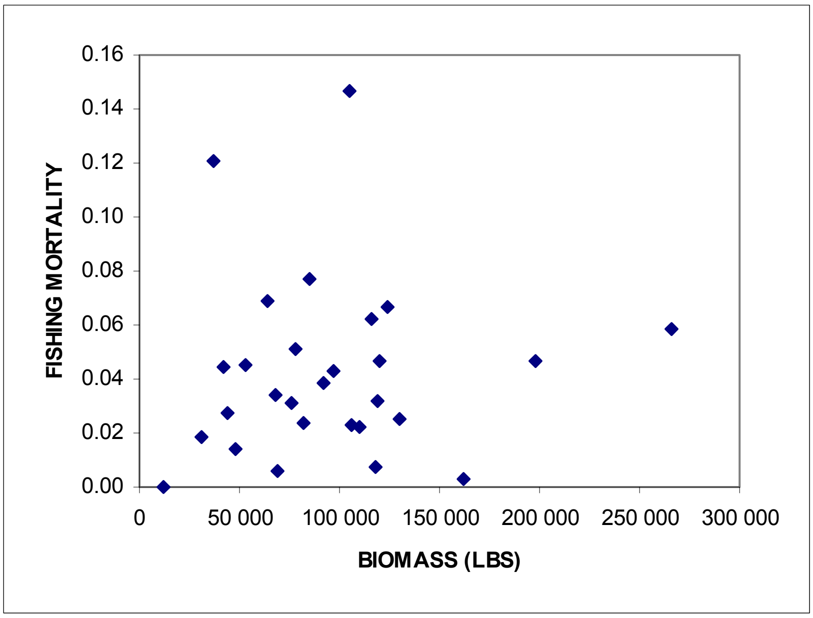

Figure 15.4 Fishing mortality plotted against estimated stock biomass

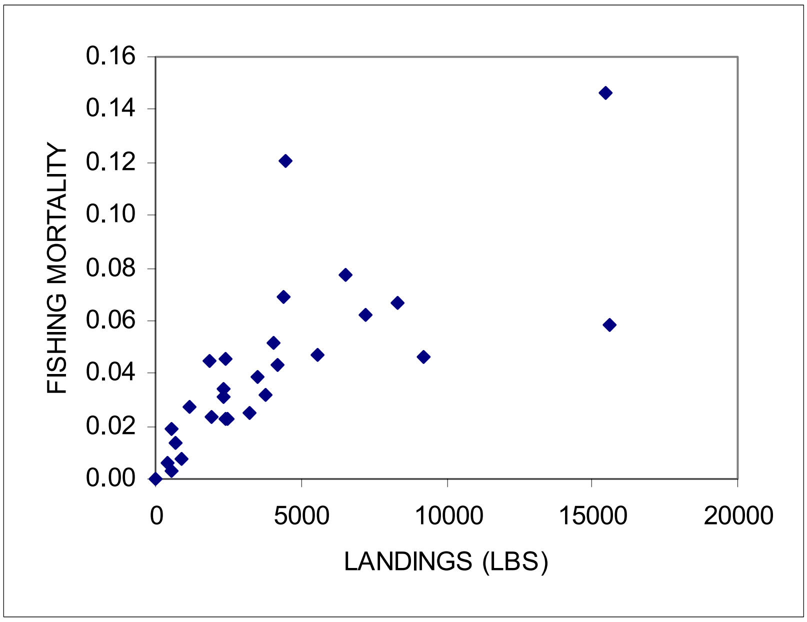

Figure 15.5 Fishing mortality plotted against landings

There has a general increasing trend with population biomass (Fig. 15.3). This indicates that the fishery is capturing a level of biomass according to what is made physically available to it at a given time during the fishing season. There is no clear correlation between fishing mortality and population biomass, although some general and fuzzy increasing trend in fishing mortality rate with population biomass is apparent (Fig. 15.4). There is a clearer relationship between fishing mortality rate and landings (Fig. 15.5). It is noted that at high levels of landings, the fishing mortality rate may reach above 0.14 month^{-1}, which is close to the natural mortality rate.

15.5 Discussion

Figure 15.2 assumes that the decline in CPUE is caused by a stock depletion. The data show a rather high variability in spite of the trend. The catchability coefficient q, is a function of the efficiency of the gear or fleet in operation and is a factor of several variables. These include seasonality, time of day fished, areas being targeted, abundance of stock, efficiency of fishing gear etc. The q estimate may be an average of a highly dynamic seasonal parameter. This condition will have significant impacts on the results provided in Figures 15.3 – 15.5, which are based on the average value.

15.6 Conclusions and recommendations

It may be concluded that the restricted fishery for *Penaeus schmitti* in the Kingston Harbour is being exploited at levels commensurate with the available abundance. It appears that the fishery is exerting levels of fishing mortality which are still below those that may result in maximum production from the stock. However, it is noted that in a few instances the fishing mortality rate approached the rate of monthly natural mortality thought appropriate for this species (i.e. M = 0.16 $month^{-1}$). Therefore, it is concluded that any further expansion of fishing effort should be cautiously implemented as the new effort may quickly drive the stock to full utilisation.

It is recommended that more rigorous data collection system be implemented. This will facilitate the use of more accurate stock assessment methods. Data on the size structure of the landings by gear, sex and month should continue to be collected. In addition, appropriate information on the level of effort exerted temporally and spatially over the stock will provide for better future estimates of fishing power, hence a better base to standardise fishing effort.