A Survey on the Catches of Squilla along Kerala Coast

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A stratified random sampling procedure with a centre-day as the sampling unit was found suitable for estimation of squilla landings and catches along the Kerala coast. About 75% of the annual catches were in the period December to April. A time stratification of quarters (3 month period) or one with two seasons (good and lean seasons) were found to yield almost the same annual estimates. The estimated catches of squilla along the Kerala coast for the year 1987 worked out to 32,124 tons with a percentage error of 9.

Squilla is a shell fish obtained as a by-catch in trawlers. Commercial utilization of squilla is very much limited at present and therefore most of the catches are not brought to the shore. Central Institute of Fisheries Technology has perfected methods for extraction of protein from squilla; also the shell can be utilized for the preparation of good quality chitin. This has attracted many entrepreneurs, but there is no data available at present on the availability, season and location of landings of squilla. This communication gives an account of a sample Survey conducted to collect these information.

Materials and Methods

The centres along the Kerala coast where squilla landings take place were listed by conducting a preliminary survey in 1986-87. Number of boats that land at these centres were noted. It was found that if only squilla was caught, the fishermen used to discard it at the sea, but if caught along with prawn no trouble was taken to sort it out at the sea. The quantity of squilla landed at a centre, often depends on its demand as a manure for coconut trees. The crew of the boat were interviewed to get information on the quantity of squilla discarded at the sea. Exclusive catches of squilla in the first few hauls (two to three hauls usually) were discarded, as informed by them. The preliminary survey also gave information on the daily catch-landings (the quantity landed and the quantity discarded at sea) separately. As already stated, good landings were observed in the centres where the demand as a manure was good, for instance, the centres Munambam and Neendakara in Kerala. Daily catches of squilla varied between 5 to 17 tons in selected centres.

For estimating squilla catches, data collected from the preliminary survey were utilized for stratification. The average daily catches for different centres were worked out and based on this, three strata were formed. The four centres Neendakara, Sakthikulangara, Munambam and Pudiyappa, where the catches landed were good and the catches discarded in the sea were also of the same order were grouped to form stratum I. Fisheries Harbour, Cochin was also included in this stratum. The centres Ponnani and Munakkakadavu were grouped into stratum II where discarded catch was less and catch landed was more. The centres Vizhinjam, Valanjavazhi, Ambalappuzha, Beypore and 16 others were grouped into stratum III where discarded catch was more and catch landed was less. A stratum-wise list of centres is given below:

List of centres where squilla is caught:

Stratum I

1. Neendakara
2. Sakthikulangara
3. Munambam
4. Cochin
5. Pudiyappa

Stratum II

1. Munakkakadavu
2. Ponnani

Stratum II

1. Vizhinjam
2. Valanjavazhi
3. Ambalappuzha
4. Beypore
5. Quilandi
6. Badagara
7. Mahe
8. Tellichery
9. Thalai
10. Thalangara
11. Azheekal
12. Azhikkara (Mappila Bay)
13. Mattool
14. Cheruvathoor
15. Kanhangad
16. Pallikkara
17. Kasaba
18. Neeleswar
19. Kasargod
20. Ullal.

A centre-day was taken as the sampling unit (Krishnankutty *et. al.*, 1973; Varghese *et. al.*, 1981). As there was no fishing on sundays and important local holidays, the total number of effective centre-days were worked out excluding holidays. A quarter of 3 months was taken as the stratum over time. The number of centre-days sampled depended on the intensity of catch (Krishnankutty *et. al.*, 1973; Varghese *et. al.*, 1981). Thus a stratified random sampling plan was adopted to estimate the catches discarded in the sea and the catches landed along the coast. About 25 centre-days were observed during a quarter. About one half of the total number of sampled centre-days were from stratum I and the rest selected almost equally from stratum II and III.

Method of Estimation

The following notations are introduced to present the estimation of landings, catches discarded, total catch and their respective variances.

N - Number of centre days in the $(s, t)^{th}$ space-time stratum, for s = 1 to 3 and t = 1 to 4

n - number of samples selected from the $(s,t)^{th}$ space-time stratum

$C_i^{(1)}$ - catch landed at the i^{th} unit selected in the sample.

$C_i^{(d)}$ - catch discarded at the i^{th} unit selected in the sample.

Estimated landings and catches appropriate for the sampling plan are:

$$C_{st}^{(1)} = \frac{N}{n} \sum_{i=1}^{n} C_i^{(1)}$$, the estimated total landings for the $(s, t)^{th}$ space-time stratum

$$C_{st}^{(d)} = \frac{N}{n} \sum_{i=1}^{n} C_i^{(d)}$$, the estimated discarded catch for the same stratum.

and $C_{st} = C_{st}^{(1)} + C_{st}^{(d)}$, the total catch for the $(s, t)^{th}$ space-time stratum.

Summing over the space-stratum the estimates for the t^{th} quarter are obtained as :

$$C_{.t}^{(1)} = \sum_{s=1}^{3} C_{st}^{(1)}$$

$$C_{.t}^{(d)} = \sum_{s=1}^{3} C_{st}^{(d)}$$ and

$$C_{.t} = C_{.t}^{(1)} + C_{.t}^{(d)} = \sum_{S=1}^{3} C_{st}$$

Finally $C = \sum_{s=1}^{3} \sum_{t=1}^{4} C_{st}$, the total annual catch for Kerala coast

Estimated variances are :

$$V_{st}^{(1)} = \frac{N(N-n)}{n} \frac{1}{n-1} \left\{ \sum_{i=1}^{n} C_i^{(1)2} - \left(\sum_{i=1}^{n} C_i^{(1)} \right)^2 / n \right\},$$

estimated variance of $C_{st}^{(1)}$

Table 1. *Estimates with appropriate notations for catches and variances for First Quarter of 1987*

	Estimated landings (tonnes)	Estimated catches discarded (tonnes)	Total catches (tonnes)	Estimated variances of catches landed	Estimated variances of catches discarded	Estimated variances of squilla catches
	$C_{11}^{(l)}$	$C_{11}^{(d)}$	C_{11}	$V_{11}^{(l)}$	$V_{11}^{(d)}$	V_{11}
Stratum I	1711.9	3,737.7	5,449.6	19,199	172,349	1,91,548
	$C_{21}^{(l)}$	$C_{21}^{(d)}$	C_{21}	$V_{21}^{(l)}$	$V_{21}^{(d)}$	V_{21}
Stratum 2	973.9	24.3	998.2	1,59,791	198	1,59,989
	$C_{31}^{(l)}$	$C_{31}^{(d)}$	C_{31}	$V_{31}^{(l)}$	$V_{31}^{(d)}$	V_{31}
Stratum 3	1393.4	6,371.0	7,764.4	5,41,561	2,302,796	2,844,357
	$C_{.1}^{(l)}$	$C_{.1}^{(d)}$	$C_{.1}$	$V_{.1}^{(l)}$	$V_{.1}^{(d)}$	$V_{.1}$
Total	4,079.2	10,133.0	14,212.2	720,551	2,475,343	3,195,894

Table 2. *Estimated squilla landings and catches along the Kerala coast in 1987*

Period	Estimated landings (tonnes)	Estimated catches discarded in the sea (tonnes)	Estimated catches (tonnes)
I Qr (Jan. - Mar.) 1987	4,079	10,133	14,212
II Qr (Apr. - Jun.) 1987	1,986	1,892	3,878
III Qr (Jul. - Sep.) 1987	1,007	2,579	3,656
IV Qr (Oct. - Dec.) 1987	6,130	4,248	10,378
Total for 1987	13,272	18,852	32,124

$$V_{st}^{(d)} = \frac{N(N-n)}{n} \frac{1}{n-1}\left\{\sum_{i=1}^{n} C_i^{(d)2} - \left(\sum_{i=1}^{n} C_i^{(d)}\right)^2 \Big/ n\right\},$$

estimated variance of $C_{st}^{(d)}$

and $V_{st} = V_{st}^{(l)} + V_{st}^{(d)}$, estimated varianace of C_{st}.

Summing over the space-stratum the estimates for the t^{th} quarter are obtained as :

$$V_{.t}^{(l)} = \sum_{S=1}^{3} V_{st}^{(l)} \qquad V_{.t}^{(d)} = \sum_{S=1}^{3} V_{st}^{(d)}$$

and $V_{.t} = V_{.t}^{(l)} + V_{.t}^{(d)} = \sum_{S=1}^{3} V_{st}$

Finally $V = \sum_{S=1}^{3} \sum_{t=1}^{4} V_{st}$,

the estimated variance of total annual catch C, for Kerala coast.

Results and Discussion

Data for the four quarters of 1987 were collected as per the sampling plan and from these the landings and the catches discarded in the sea were estimated. Then the total catches were compiled. To illustrate the method described

above, the estimates with the appropriate notations for the first quarter of 1987 for landings and catches and their variances are given in Table 1. The estimated landings and catches are presented in Table 2.

The annual landings were estimated at 13,272 tonnes and the annual catches discarded in the sea at 18,852 tonnes. The annual catches of squilla along the Kerala coast during 1987 was estimated at 32,124 tonnes. Thus only about 40% of the total catch of squilla is landed. The percentage error of the estimated total catch ($\sqrt{v}/c \times 100$) worked out to 9. The standard error of the estimate, $\sqrt{v}$, was 2,905 tonnes. Thus the procedure provides with an estimate of reasonable accuracy.

The period January to March and October to December accounted for about 77% of the annual catch. The period December to April was found to be the peak season for squilla. Adopting the same method of estimation of landings, catches and variances and by simply changing the size (time size) of the space-time strata, estimates for the peak season, that is, December to April and the lean season, namely, May to November were also worked out. This can be interpreted as the method of post stratification discussed by Sukhathme & Sukhathme (1970). The estimates were 23,995 tonnes for the catches during the peak season December to April 1987 and 8,192 tonnes for the catches during the lean season May to November, 1987, leading to an estimated total catch of 32,187 tonnes for the year December 1986 to November 1987, which is very well comparable with the estimate 32,124 tonnes, obtained for the calendar year 1987. (About 75% of the annual catches were in the period December to April) Thus it appears that a quarter-wise stratification or one based on the peak and lean season as mentioned above would yield more or less the same annual estimates.

In conclusion, there are about 30 centres along the Kerala coast where squilla are landed at present. Some of the centres among these land about 5 to 17 tonnes of squilla per day. All the catches are not landed; about 60% of the total catch is discarded in the sea. If commercial production of protein and of good quality chitin from squilla is taken up the price of squilla may pick up, which in turn will induce the fishing boats to land all the catches of squilla. Opening up of commercial units may also help fishing for squilla which will improve the economics of operation of fishing boats.

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