

## Assessment of cyst production potential of a natural population of brine shrimp *Artemia*

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Studies on a natural population of *Artemia* in the salterns of Jamnagar indicated that the population is parthenogenetic. These shrimps reach a maximum size of 9 mm. Number of cysts per brood varies from 10-32. Adults form about 68% of the total population. Potential yield of *Artemia* cysts is about 17 kg.ha<sup>-1</sup>, and compares well with the realised yield of artificially cultured populations.

Freshly-hatched nauplii of brine shrimp form an important live feed for a wide variety of organisms. The demand for brine shrimp cysts exceeds the present supply and is considered to be one of the constraints in aquaculture<sup>1</sup>. To overcome this situation, steps are taken to artificially culture *Artemia* as well as to locate new grounds in saline lakes, lagoons and in man made solar salterns which are the natural habitats of brine shrimp.

Ecological studies of natural population of brine shrimp in India are few<sup>2-5</sup>. Except for a study in Tuticorin salt pans<sup>2</sup> no information is available on cyst yield, which will help predicting the cyst production potential and exercising a better control over the natural population. In the present study, natural population of brine shrimp located in the Singach salterns, Jamnagar (lat. 23°30'N; long. 70°12'E) has been investigated as part of a feasibility study for culture of brine shrimp on commercial scale.

Singach saltworks covers an area of 1214 ha and includes reservoir, brine tanks and crystallizers. Initially seawater (sal. 35 × 10<sup>-3</sup>) is pumped into the reservoir and travels about 405 ha when the salinity reaches 70 × 10<sup>-3</sup>. This brine water flows through 324 ha and enters condenser pans where the salinity ranges from 190 to 230 × 10<sup>-3</sup>. This concentrated brine is finally discharged into the crystallizers for extraction of salt. The salt production season is normally September/October to June.

For the present study, 5 condenser pans (1 to 5; depth 50 cm) were sampled as they supported good population of brine shrimps. Brine shrimp reproduces viviparously (i.e. release of nauplii)

when salinity was in the range of 100 to 140 × 10<sup>-3</sup>. When salinity goes above 140 × 10<sup>-3</sup>, brine shrimp resorts to oviparous mode of reproduction (i.e. production of dormant cysts).

Brine shrimps were collected during April

Table 1 – Percentage composition of different categories of brine shrimp

Condenser Pan	Nauplii	Metanauplii	Juvenile	Adult	
				Non-egg bearing	Egg bearing
April 1987					
1	—	—	55.26	15.79	28.95
2	10.00	2.06	35.00	43.14	9.80
3	—	—	14.84	14.84	70.32
4	4.62	5.22	5.04	25.62	59.50
5	—	—	38.85	28.72	32.43
March 1988					
1	5.0	12.00	27.25	23.60	32.15
2	15.00	6.2	32.00	20.00	26.80
3	3.1	5.8	10.92	14.7	65.48
4	7.9	2.84	20.37	16.26	52.63
5	9.0	8.2	30.21	24.25	28.34
April 1988					
1	10.42	8.58	36.2	14.3	30.5
2	6.7	12.40	32.8	21.0	36.1
3	2.8	3.5	8.7	16.4	68.6
4	6.3	4.0	16.7	19.0	54.0
5	1.6	7.3	25.9	29.0	36.2

1987, March and April 1988 when the cyst production was maximum, by filtering 10 l of saline water from the 5 condenser pans through 50  $\mu\text{m}$  mesh bolting nylon net from different regions of pans. Collections were made between 0700 and 0900 hrs to avoid patchiness in the distribution of shrimps caused due to wind action. Animals were sorted into nauplii, metanauplii, juveniles and adults. Length of *Artemia* was measured with an ocularmeter. Egg pouches of 50 animals were teased out and the number of eggs/brood was counted. It was found that 1 mg contained  $264 \pm 5$  dry eggs. Annual yield was calculated for 6 months—the period of occurrence and abundance of adults. Frequency of egg production was calculated once in 5 days.

Percentage composition of different stages in

brine shrimp population is given in Table 1. No male was found in the population indicating that the population is parthenogenetic. Occurrence of parthenogenetic population of brine shrimp was reported earlier<sup>2-5</sup>. The relationship between animal length and the number of eggs in the brood showed that the number of eggs varied from 10-32 in animals measuring 5-9 mm, thereby showing a linear relationship. The maximum size of the adult in the population was 9 mm.

Density of animals, number of mature animals, average number of eggs/brood and estimated annual cyst yield are shown in Table 2. The density values in the present study are higher than those reported earlier<sup>2,6-8</sup>. However, they were less than the average density reported from Hambon-tota saltern.

Table 2—Density and egg production in brine shrimp at different condenser pans

Condenser Pan No.	Density (No. $\times 10^3 \cdot \text{m}^{-3}$ )	Eggs average (No. brood <sup>-1</sup> )	No. of animals ( $\times 10^8$ )	No. of matured animals ( $\times 10^8$ )	Annual egg production ( $\times 10^8$ )	Production/ha	
						Dry wt (kg)	Less 50% (kg)
April 1987							
1	5	29	2.676	0.775	809.100	13.17	6.585
2	6	10	3.211	0.315	113.400	1.846	0.923
3	9	10	12.565	8.836	3180.960	19.850	9.925
4	18	21	33.120	19.706	14897.736	70.539	35.270
5	38	32	212.225	68.825	79286.400	123.683	61.842
March 1987							
1	4	28	2.141	0.688	262.7	5.645	2.823
2	8	18	4.282	1.148	281.8	6.055	3.028
3	12	22	16.753	10.970	3291.0	27.393	13.697
4	21	30	38.640	20.336	8319.3	51.996	25.998
5	22	20	178.716	50.648	13813.0	28.443	14.222
April 1988							
1	7	18	3.746	1.143	280.6	6.029	3.015
2	5	16	2.676	0.966	210.8	4.53	2.265
3	14	24	19.545	13.408	4388.1	36.53	18.265
4	19	28	34.960	18.878	7208.0	45.05	22.530
5	36	30	201.055	72.782	29774.5	61.31	30.655
Total					166117.39	502.069	251.043
Average					11074.492	33.471	16.736

Calculated annual cyst production in the study area amounted to 46, 24 and 31 kg dry wt. ha<sup>-1</sup> respectively in April 1987 and March and April 1988. Making an allowance of 50% as loss of cysts due to wind action, predation by birds and for those left over to tide over unfavourable conditions, still the net yield on an average would be 17 kg.ha<sup>-1</sup>. According to Persoone and Sorgeloos<sup>1</sup>, a good strain of *Artemia* biotope produces 10-20 kg.ha<sup>-1</sup> season<sup>-1</sup>. Considering this, the estimated potential is good. It was observed that due to distribution pattern of brine water in the saltern and heavy wind action, the cysts get widely distributed and there is a loss. This can be prevented by containing the population in the condenser pans by providing netting and day to day collection of released cysts.

To test whether the population of *Artemia* can establish and produce cysts in a pond where it was not present before, an area of 0.7 ha was inoculated with *Artemia* ( $4 \times 10^6$ ) nauplii (San Francisco Bay strain). At the end of 6 months production season about 15 kg of dry cysts were harvested which was approximately equivalent to 21 kg.ha<sup>-1</sup>. It is of interest to note that the calculated cyst production is closer to the realised yield.

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