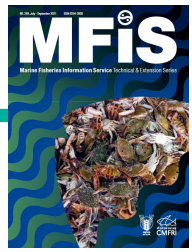

Jellyfish fishery along Odisha coast: An Overview

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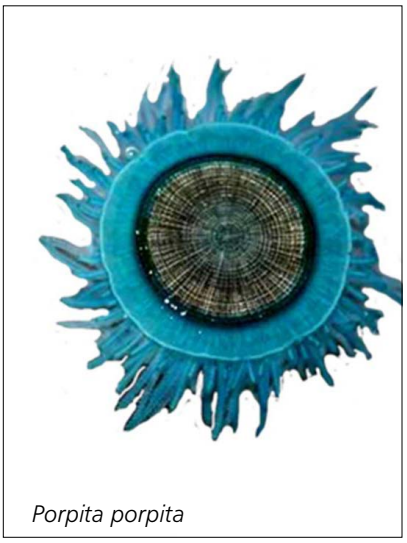
Jellyfish are potentially important marine resources that can become problematic when abundant. Globally, 19 nations are currently involved in fishing of jellyfish, with estimated average landings of about 900,000 tonnes annually with China being the highest producer and consumer of jellyfish, contributing approximately 60% of current global capture production. Jellyfish fisheries are usually characterized by large inter-annual fluctuations in abundance, biomass, and short fishing seasons of less than a few months. Mostly scyphomedusae jellyfish have been caught and processed as human food for centuries in Asian countries, because of their large, tough and rigid bodies with a thick umbrella that gives a product with the desirable crunchy texture when processed (Brotz et al., 2017). In India, harvesting of edible jellyfish started in 1980, mainly for exports. Only four species of edible jellyfish (*Crambionella annandalei, Crambionella orsini, Catostylus perezi* and *Rhopilema hispidum*) are favoured for processing in the coastal states of Andhra Pradesh, Gujarat, Kerala and Tamil Nadu, and the processed products are exported mostly to Southeast Asian countries. By catching these jellyfishes, an additional income in the range of 20-25 percent of their annual income is received by the small scale fishermen (Behera *et al*., 2020). The present study gives an overview of the fishery for jellyfish *C. annandalei* along Odisha coast using information collected through a survey and sampling from Puri (19°47'43.062'N, 85°49'38.5788'E), Pentakaota (19°48'6.6924'N, 85°50'59.4096'E), Astaranga (19°58'27.1344'N, 86°20'20.9976'E), Chandrabhaga (19°52'4.8108'N, 86°47'17.6916'E), and Khirisahi (19°42'49.5432'N, 85°34'45.7284'E) landing centres when mass swarming of the species during December to April led to targeted fisheries.Jellyfish usually occur as by-catch in trawls, shore seines and gillnets along the Odisha coast. Several jellyfish species (*Pelagia noctiluca*, *Lobonemoides robustus*, *Rhopilema hispidum*, *Chrysaora chinensis*, *Chrysaora* sp., *Porpita porpita*, *Lychnorhiza sp.*, *Crambionella annandalei*, *Carybdea* sp. and *Physalia physalis*) are occurring along the coast, but only one rhizostomatids jellyfish, *C. annadalei* forms a seasonal and targeted gillnet fishery (Fig.1). The species were caught in traditional gillnets during day time operated both from motorised (8.5-9 m OAL, 9 hp engine capacity) and non-motorised fishing boats (6.5-8 m) at a water depth of 5-12 m. Gillnets (mesh size 52-58 mm) were set in water for 1-2 hours (soaking time) and usually 2-3 hauls per boat were performed based on the availability of jellyfish. Nearly 70- 100 boats were engaged in jellyfish fishing along the coast. Fishermen usually do some pre-processing on-board and only the oral arms are transported to the shore. However, if the catches are poor, they bring the whole specimen to shore for processing. The survey revealed that each boat caught nearly 20-500 kg of oral arms per fishing trip which were sold to the local traders and processors @ ₹15-22 ($0.21-$0.30) per kg at landing centres.

301 whole fresh specimens of *Crambionella annandalei* collected from the landing centres were brought to the laboratory for detailed studies. Individual jellyfish was dissected and determined the sexes and maturity stages of gonad both by macroscopic and microscopic methods. By comparing the shape, texture and color of the gonad, it was possible to differentiate the sex and maturity stages of the individuals. Bell diameter (BD)

Pelagia noctiluca



Porpita porpita

Crambionella annandalei

Lobonemoides robustus

Rhopilema hispidum

Lychnorhiza sp.

Chrysaora chinensis

Carybdea sp.

Physalia physalis

Fig. 1. Jellyfish species diversity along Odisha coast

Fig. 2. Processing of oral arms of *C. annandalei.*

a. Outboard fibreglass boat with crates of oral arm, b. Transportation of oral arm to processing unit, c. Cleaning with rotors (2 hours), d. Salt Mixing (50kg/t oral arm), e. Grading and cleaning, f. Second soaking tank (12-18 days), g. Transferring from first soaking tank to second (after 12 hours), h. Alum treatment (2kg/oral arm), i. Packing of 16 kg salted semi dried oral arms in 20 L plastic bucket, j. Adding 3 L sea water, k. Adding 1 kg common salt, l. Closing lead tightly, m. Final Product for export

Table 1. Biological aspects of *Crambionella annandalei* sampled

Months	N	Bell Diameter (cm)	Mean BD ± SE	Total weight (g)	Mean weight ± SE	Sex ratio (M:F)	Mature (%)
January	17	16-23	19.5 ± 0.59	208-720	495 ± 43	1.1:1	65
February	112	11-26	22 ± 0.24	100-1209	784 ± 21.1	1.2:1	84
March	120	17-26.5	22.4 ± 0.19	334-1459	897.9 ± 20.9	1.4:1	84
April	52	20.3-27	24.3 ± 0.21	520-1548	1169.3 ± 29.5	0.86:1	98
Total	301	11-27	22.4 ± 0.14	100-1548	879.7 ± 15.8	1.2:1	85

recorded as the standard measurement for the jellyfish ranged from 11 to 27 cm with mean weight (g) in the range of 879.7 ± 15.8g. The overall sex ratio was 1.2: 1 (Male: Female). The BD for female jellyfish ranged between 18–27 cm and between 11 and 26.5 cm in males. The mean total length of female jelly fish (23 ± 0.16 cm) was not significantly different from the males (22 ± 0.21 cm) as given in Table 1.

Three temporary jellyfish processing units were in operation, each at Pentakota, Chandrabhaga and Arakhakuda in Puri district of Odisha (Fig.2). Only the oral arms of jellyfish are processed which is transported to the processing units located in the vicinity of the fish landing centres, immediately after harvest to avoid spoilage.

Oral-arms are first cleaned and washed in a circular polythene tank containing sea water with a rotor for churning the water for 2 hours, to remove the dirt, sand, mucus, membranes, and remnants of gonads. The oral arms are then removed from the cleaning tank, rinsed with the clean sea water and transferred to the soaking tank. In soaking tank, common salt @ 50 kg/t and alum 2 kg/t of oral arms is added in to the 300 l of sea water (25 ppt) and kept for 12 hours. This process helps in penetration of the salt into the tissues, allowing osmosis, dehydration and thus minimizing any spoilage. This is followed by a second soaking (in salt and alum water) for 12-18 days, prior to packing. The semi-dried oral arms are graded into different export categories depending on the size of oral arms and cleaned to remove the remaining dirt particles and membranes before packing. The final processed oral arms are packed in 20 litre buckets, each containing 16 kg oral arms, 3 litres salt water and 1 kg common salt. Processed oral arms of jellyfish are exported to China via Chennai @ ₹500-550 ($6.88-$7.57) per kg as it has a very good demand in Southeast Asian countries.

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