

Sources of Contamination with *Salmonella* during Processing of Frozen Shrimps

T. S. GOPALAKRISHNA IYER and P.R.G. VARMA

Central Institute of Fisheries Technology, Cochin - 682 029

This paper deals with the sources of contamination with *Salmonella* during processing of shrimps. Water from culture ponds, coastal sea water, sea beach sand, process water, ice, shrimp-contact surfaces, floor and rodent and lizard droppings were traced out to be the major sources of contamination.

The importance of *Salmonella* as a cause of food borne illness has been well recognized. *Salmonella* is usually absent in fish caught from unpolluted waters and its incidence in seafoods is due to external contamination. Eventhough the incidence of *Salmonella* in fish and fishery products has been reported by many investigators (Shewan, 1962; Appleman *et al.*, 1964; Anderson *et al.*, 1971; Bryan 1973; Cann 1977; Rajagopalan 1978; Shrivastava 1978; Beckers *et al.*, 1981; Varma *et al.*, 1985; Iyer, 1986), very little attempt has been made to locate the sources of contamination. Badiali *et al.* (1957) found that poor sanitary conditions in and around the processing unit are responsible for contamination of tuna with *Salmonella*. One benchmark survey of the menhaden industry has shown that raw fish is generally contaminated with *Salmonella* from fishing boats and 'pump' water used on-board (Morris *et al.*, 1970). Anderson *et al.* (1971) reported that seafood handlers, utensils and droppings from sea gulls are the major sources of contamination of processed fishery products with *Salmonella*. In Karachi, the practice of washing fish with coastal sea water has resulted in contamination of the landed material with *Salmonella* (Zuberi & Qadri, 1981). Obviously, there is a lack of published information on the sources of *Salmonella* in fish processing

in this country. Studies carried out by the authors in this direction are summarised in this paper.

Materials and Methods

In the routine monitoring of the sanitary conditions of the shrimp processing units to locate the sources of contamination, a few samples have shown incidence of *Salmonella*. These positive samples were included in this paper to pin-point the sources of contamination.

Samples from the contact surfaces were collected by the swabbing technique from 25 sq. cm area of the surface. The swabs were transferred to lactose broth and transported to the laboratory under aseptic conditions.

Water and ice were collected aseptically in 500 g quantities in sterile bottles. Analysis started within 3 hours of collecting the samples.

Lactose broth was used for pre-enrichment. For selective enrichment, selenite cystine broth and tetrathionate broths were used. Brilliant green agar and bismuth sulphite agar were used for presumptive isolation of the suspected colonies. Only oxid

brand media were used in the study. The isolated colonies were confirmed by the usual biochemical and serological tests (Iyer *et al.*, 1985).

Table 1. Sources of contamination with *Salmonella* during shrimp processing

Source	Serotype isolated
Water from culture pond	<i>S. farmsen</i> <i>S. weltevreden</i>
Mud from culture pond	<i>S. newport</i>
Coastal sea water	<i>S. havana</i>
Sea beach sand	<i>S. weltevreden</i> <i>S. bareilly</i>
Process water	<i>S. typhimurium</i>
Ice	<i>S. bareilly</i>
Floor, pre-processing unit	<i>S. bareilly</i> <i>S. weltevreden</i>
Utensils	<i>S. weltevreden</i>
Droppings of wall lizards seen over the processing table	<i>S. weltevreden</i>
Table top known to have contaminated with the droppings of wall lizards	<i>S. weltevreden</i>
Droppings of rodents seen over the processing table	<i>S. weltevreden</i> <i>S. typhimurium</i>
Table top known to have contaminated with the dropping of rodents	<i>S. weltevreden</i> <i>S. typhimurium</i>

Results and Discussion

Table 1 shows the different sources from where shrimps are contaminated with *Salmonella*.

Results presented in the Table indicate that shrimp can get contaminated with *Salmonella* from many sources during handling and processing. The organism has been isolated from the water collected from culture ponds. The serotypes isolated from this source were *S. farmsen* and *S. weltevreden*. This is the first report of isolation of *S. farmsen* in India. Contamination of water in the culture ponds

may be from the animal manure generally used to fertilize culture ponds. The observation has great significance in the present context when there are augmented efforts to increase shrimp production in the country by adopting culture techniques.

S. newport has been isolated from mud samples collected from culture ponds. The source of *Salmonella* in the mud is, again, apparently from the manure used in the culture ponds.

Coastal sea water has been identified as the next important source of contamination. Washing the unloaded catch or the boat deck and other fish contact surfaces with coastal sea water can lead to contamination with *Salmonella*. Results of the present study agree with that of Zuberi & Qadri (1981) who have reported contamination of fish with *Salmonella* from coastal sea water. The serotype of *Salmonella* isolated in the present study from coastal sea water was *S. havana*.

Two serotypes of *Salmonella* (*S. weltevreden* and *S. bareilly*) have been isolated from five important sea beaches in Kerala. The results indicate that sorting the catch on sea beaches is dangerous and may contribute substantially to contamination with *Salmonella*.

Out of several water samples tested, *Salmonella* could be isolated from only one sample. The isolation is (of course), significant (particularly) in view of the fact that the serotype isolated from this source (*S. typhimurium*) is the dominating serotype in the clinical cases in India (Saxena *et al.*, 1983). Detailed investigation of this particular case has revealed that, although the water sample was from the municipal line the overhead tank of the factory was not closed and the water inside the tank had been contaminated with *Salmonella* due to the

dropping of birds. Results of the present study point out the necessity for proper chlorination of the process water prior to use in the processing hall. The overhead tanks have to be adequately closed in order to avoid contamination from external sources.

Ice used for processing, is another source of contamination. Only one sample out of over 400 samples tested has shown incidence of *Salmonella*.

A few samples collected from the floor of primary process units have shown incidence of *Salmonella*. *S. bareilly* and *S. weltevreden* were the serotypes isolated. Results have indicated that peeling of shrimps on floor is risky and is against principles of Good Manufacturing Practices.

The droppings of wall lizards and rodents seen lying on table tops were found to carry *Salmonella*. While *S. weltevreden* was isolated from the droppings of wall lizards, *S. weltevreden* and *S. typhimurium* were isolated from the droppings of rodents. The same serotypes of *Salmonella* were isolated from the table tops over which these droppings were seen. This clearly indicates that contamination of table tops with *Salmonella* is from the droppings of rodents and wall lizards. In India, there are also previous reports on the isolation of *Salmonella* from the droppings of rodents and wall lizards (Kaura & Singh, 1968; Gupta *et al.*, 1980).

Based upon the study, it is recommended that fishing from polluted waters and washing the catch with coastal sea water are to be avoided. Sorting the catch on sea beaches is to be discontinued. Extra care is needed in chlorination of process water (10 ppm level), disinfection of contact surfaces and in rodent control measures. Peeling shrimps on floor must also to be avoided.

The authors are grateful to Shri M. R. Nair, Director, Central Institute of Fisheries Technology, Cochin for his kind permission to publish this paper.

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