Molluscs: the public health issue

By **NJ Dagoon**

Bivalves are filter feeders which strain detritus, microalgae, and microorganisms from the water. In contaminated waters, bivalves can concentrate pathogenic microorganisms and bioaccumulate substances such as heavy metals and chlorinated hydrocarbons which can prove harmful and toxic when ingested by humans.

Human sewage is considered the major source of human pathogenic bacteria, parasites and viruses contaminating the shellfish environment. Ailing persons pass on live pathogens through their feces which may contain as much as one million viruses per gram (Jaykus et al. 1994). These organisms thrive in thick sewage reaching waterways and the open sea with the aid of some enhancing factors as inorganic and organic nutrient loading, high suspended solids, elevated temperatures, presence of fine-grained organic rich sediments and poor tidal flush (Jaykus et al. 1994). There, molluscs feed on them. When the infected bivalves are brought to a diner's table, the cycle recurs.

Picorna viruses, poliovirus, rotaviruses, adenoviruses and Hepatitis A, B and E viral strains are some of the human enteric viruses known to inhabit shellfish waters and bivalve hosts (Jaykus et al. 1994).

Human-associated bacterial pathogens that have travelled the fecal-oral route with shellfish as their vehicle include *Salmonella typhi* (causative agent of typhoid fever), *Shigella*, *Escherichia coli*, and *Staphylococcus aureus* (Hackney and Potter 1994a). *Campylobacter*, *Clostridium perfringens*, *Yersinia enterocolitica* and *Listeria monocytogenes* are some animal-associated and terrestrial bacterial pathogens that have been isolated from molluscs and also affect man (Hackney and Potter 1994b). Bacteria common to aquatic environments such as *Vibrionaceae*, *Vibrio*, *Plesiomonas* and *Aeromonas* have been implicated in mollusc-borne human diseases (Liston 1994). Diseases that the above may cause range from diarrhea, dysentery, gastroenteritis and cholera to primary septicaemia and meningitis. *Entamoeba histolytica*, the causative agent of amoebiasis, is mollusc-borne.

"Public health officials and local governments need to protect mollusc harvest areas from sewage contamination and other pollutants."

Molluscs also become toxic to humans as a result of feeding on toxigenic microalgae whose toxins are not destroyed by cooking and processing (Liston 1994). There are three types of poisoning: paralytic shellfish poisoning (PSP), neurotoxic shellfish poisoning (NSP) and amnesic shellfish poisoning (ASP). Both PSP and NSP are caused by certain species of dinoflagellates, while ASP is produced by diatoms. The dinoflagellates account for a certain discoloration of seawater known as red tide. All three forms are dangerous and deadly for which there is yet no discovered antidote (Liston 1994).

The sanitary survey

Public health officials need to protect mollusc harvest areas from sewage contamination and from other pollutants.

According to Garreis (1994), the sanitary survey is a powerful public health weapon which pays dividends way beyond protecting mollusc for human consumption.

The sanitary survey has three major components (Garreis, 1994):

- The ***shoreline survey*** aims to identify and, if possible, eliminate inland sources of pollutants to the water body by means of map delineations and field visits.
- To confirm the tentative conclusions derived from the shoreline survey that a harvest area is contaminated or not, ***bacteriological examination of water samples*** are undertaken. The coliform count has been used to characterize the potential risk for disease transmission by measuring the amount of fecal material present in the water column. This is based on the assumption that the more fecal material in the water, the greater the risk of persons contracting disease while using the water or shellfish (Garreis 1994).

  Currently, 70 MPN (most probable number of bacteria) total coliforms or 14 MPN fecal coliforms per 100 ml of water is the allowable US Food and Drug Administration standard for shellfish sanitary quality (Jaykus et al. 1994).

  As for the red tide organisms (*Pyrodinium bahamense* and others), the Bureau of Fisheries and Aquatic Resources (BFAR) notes that 5 cells per liter of the water sample indicate the tolerable limit in the Philippines.
- ***Shellfish examination*** covers microbial and chemical analyses. Some countries (including the Philippines) have set microbiological criteria and standards (table next page). There are no estimates of acceptable concentrations for toxic substances.

  As for red tide, BFAR notes that 40

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Microbiological criteria and standards for oysters (from SRDC's **The Science and Business of Growing Oysters,** 1991)

Country	Product form	*E. coli* per gram	Total bacterial plate count per g	Remarks
France	Raw	less than 1		*Salmonella* must be nil in 25ml sample; Standard for raw consumption
Japan	Raw	≤ 2.3	≤ 50,000	Standard for raw consumption
Australia	Raw	2.3	100,000	Standard for raw consumption
USA	Raw	≤2.3	≤ 500,000	Standard for raw consumption
Philippines	Raw	4.0	1,000,000	*Staphylococcus* 1,000 per g; *Vibrio parahaemolyticus* 100 per g; *Salmonella* 0 per g
	Frozen	Negative	≤ 500,000	*Salmonella* – negative; *Staphylococcus* – negative; *V. parahaemolyticus* – negative; Yeasts and molds – negative
Italy		≤ 6.0		
Singapore	Frozen	≤ 20	≤ 500,000	*V. parahaemolyticus* 100 per g; *Salmonella* nil in 25 g; *Shigella* nil in 25 g; *V. cholera* nil in 25 g

micrograms of organisms per 100 g of mollusc meat is the tolerable limit in the Philippines.

Garreis (1994) noted that shellfish waters may be classified into approved, restricted and prohibited areas based on the sanitary survey. Restricted waters can be further divided into conditionally approved, restricted and conditionally restricted.

Generally, people accept that there are risks, though small and finite, associated with all food and water consumption. Underestimation of risk can have serious consequences, while overestimation of risk can have important social and economic consequences. The latter unnecessarily deprives the public of the use of an important food resource, may cause economic hardship, and causes the public to perceive tracts of water where no contamination may exist as "polluted."

Garreis (1994) maintained that the "sanitary survey is a powerful tool for recovering valuable shellfish resources and improving water quality. It can be used to get citizen support for correcting contaminant sources and government priority funding for failing septic systems and wastewater treatment plants.

"Maintenance of high quality necessary for shellfish harvesting assures the public of clean, safe recreational waters.

"The sanitary survey is a powerful tool for recovering valuable shellfish resources and improving water quality.

It can be used to get citizen support for correcting contaminant sources and government priority funding for failing septic systems and wastewater treatment plants."

Removal of contaminants and impacts associated with poor sewage treatment can have marked influence on aesthetics, property values, fish and shellfish spawning and habitat, algal bloom control, and general environmental quality.

"Reduction and elimination of heavy metals and organic chemical discharges can increase fish and shellfish spawning success, protect fish and shellfish from accumulating undesirable substances in their tissues, protect wildlife and assure general water quality."

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