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Towards Quality Criteria for Aquaculture and its Products

M.K. MUKUNDAN

Central Institute of Fisheries Technology
P.O. Matsyapuri, Cochin - 682 029, India.

In the past few years India has registered phenomenal growth in aquaculture. The fisheries GDP has registered a growth rate of around 13%. In fact the share of aquaculture products exported has exceeded the quantity of marine catch exported with respect to prawns. The advantages of aquaculture production have gained widespread popularity, leading to a shift from agriculture to aquaculture utilizing the inland water bodies. Unlike marine waters the quality problems of freshwater bodies are many. There are also increased chances of contamination of freshwater bodies and culture ponds with domestic waste, sewage and industrial wastes. These wastes can enter into the tissue of fish/shellfish grown in these water bodies and cause health problems to the consumers. So far, no attention has been given to this hidden danger and there is no surveillance system in operation. Quality criteria are proposed for the water used for aquaculture as well as the fish/shellfish produced by aquaculture.

Key words : Quality criteria, aquaculture, aquaculture products.

The growth of freshwater fish production in India in the recent years was phenomenal. The achievement of 13% increase in GDP in fish production in recent years is enviable (Ayyappan & Biradar, 2001). The present freshwater resources in the country are estimated to support an annual production potential of 4.5 million $t.yr^{-1}$. But our actual freshwater fish production is only around 2.5 million $t.yr^{-1}$.

Asia contributes about 90% of the world aquaculture production and China leads the world with a production of 24 million t of freshwater fish/shellfish per annum (Gopakumar, 2001). India ranks second in inland production, but the total freshwater fish/shellfish produced is comparatively less and is contributed by aquaculture (1.8 million t) and capture fisheries (0.5 million t). The present production is only half of the existing potential.

On the marine front, it is estimated that the production potential is about 4 million $t.yr^{-1}$ (Nair & Juneja 2001). The latest statistics shows that India is producing nearly 3 million t from marine sector. The trend of marine fish production in the recent years is somewhat alarming. There is no significant increase in marine fish production commensurate

with the increase in catching effort. In fact, certain marine species are showing a decreasing trend in production. On the other hand, deep sea and oceanic waters hold some potential. However, it is technology and capital intensive method of fish production.

In inland sector, obviously, there is plenty of scope for significant increase in fish/shellfish production. India has large areas of freshwater resources in the form of dams, lakes, rivers, canals, streams, etc. Inland water spread of India works out to 8 million ha (Table 1) (Nair & Juneja 2001). Average production from these inland water bodies is around 300 $kg.ha^{-1}$, against the national average of aquaculture production in India (2.2 $t.ha^{-1}$) (Singh & Misra, 2001). Achieving this average production for the entire inland water area may be a difficult proposal. However, doubling the present rate of production seems to be a practical proposition. Establishing seed production facilities, ranching, cage culture, pen culture and conventional aquaculture can be easily adopted in the inland water areas. If the aspirations of scientific and farming community are translated into reality, freshwater fish production can be significantly increased. This realization has made China to make rapid strides in aquaculture production.

Table 1 : Inland water area available in India for aquaculture

Category of water body	Area, $x10^6$ ha
Ponds, tanks & dams	2.25
Water logged paddy fields	2.30
Rivers	2.09
Small reservoirs and water bodies	1.30
Canals and channels	0.10
Total area	8.04

Punjab, the largest producer of wheat and rice, achieved commendable increase in fish production of 4.77 t, against the national average of 2.2 $t.ha^{-1}$, by utilizing agricultural lands for aquaculture (Singh & Misra, 2001). This has set a trend leading to conversion of some of the agricultural farms into fish farms. At Nellore, Bhimavaram and other places in Andhra Pradesh such changes have already taken place. Fish processing establishments are also established in these inland areas. With this trend India's target of 5 million t of freshwater fish per year is going to be an easy task. Chances of excess production over demand also cannot be ruled out.

Among many problems like handling and distribution, quality and safety of the freshwater fish will also be major concerns. Compared to marine waters, the inland water is subjected to various kinds of contamination and pollution. The quality of freshwater available within a geographic region varies from place to place, unlike marine environment where such changes are expected to be minimal. Consequently, the fish raised in inland water bodies are prone to contamination with bacteria of public health significance, toxic chemical residues, etc., posing health problems to the consumer. This issue of contamination of aquaculture products should be given due consideration as the chances of rejection of aquaculture products, based

Table 2 : Proposed quality criteria for freshwater fish (farm fresh)

Criteria	Limits*
Total plate count	$<5x10^6.g^{-1}$ ($<5x10^5.g^{-1}$)
Faecal coliforms	$<50.g^{-1}$ ($<20.g^{-1}$)
E. coli	$<50.g^{-1}$ ($<20.g^{-1}$)
Coagulase +ive staph.	$<100.g^{-1}$ ($<100.g^{-1}$)
Salmonella spp.	Absent in 10 g (Absent in 25 g)
Vibrio spp.	$<1000.\ g^{-1}$ (Nil)
Vibrio cholerae	Absent in 10 g (Absent in 25 g)
Listeria sp.	Absent in 10 g (Absent in 25 g)
Chlorinated pesticides	<10 ppm (<5 ppm.)
Mercury	<1 ppm (<0.5 ppm)
Lead	<2 ppm (<1 ppm)
Cadmium	<6 ppm (<3 ppm)
Antibiotic residues	Absent (0.1 ppm in case of Japan)

* Calculated based on per capita fish consumption of $27g.day^{-1}$ in developed countries. The values in brackets indicate the limits prescribed for marine fish.

Table 3 : Proposed quality criteria for water used for aquaculture

Criteria	Limits
Total plate count	$<5x10^4.ml^{-1}$
Faecal coliforms	$<2.ml^{-1}$
E. coli	$<2.ml^{-1}$
Coagulase +ive staph.	$<10.ml^{-1}$
Salmonella spp.	Absent in 25 ml
Vibrio spp.	$10.ml^{-1}$
Vibrio cholerae	Absent in 25 ml
Listeria sp.	Absent in 25 ml
Chlorinated pesticides	0.1 ppm.
Mercury	0.01 ppm
Lead	0.02 ppm
Cadmium	0.06 ppm
Antibiotic residues	Absent

on microbial, pesticide, heavy metal and antibiotic residues are quite significant. Therefore, along with the effort to increase inland fish production there shall also be parallel efforts to produce safe and good quality inland fish in order to avoid unexpected quality problems.

Over the years, well-developed quality criteria were evolved for ensuring safety of seafood. However, such information in the freshwater fish resources is relatively scanty and there is need to evolve suitable quality criteria so that the water for aquaculture and the fish produced from it shall be safe for human consumption. Typical quality criteria drawn up similar to USFDA/Codex/BIS standards to ensure safety of the consumer, is given in Table 2 (Mukundan *et al.*, 2000). The limits are fixed after giving due consideration to the situation prevailing in tropical countries and also the per capita fish consumption prevalent in developing countries (Mukundan *et al.*, 2000). Considering a higher incidence of bacteria of public health significance in inland water bodies, a higher safety limit is prescribed for microbiological parameters in comparison to that for marine fish. Since no consumer will be consuming the fish in raw condition, the levels prescribed are safe and practical. However, it is to be ensured that typical pathogens like *Salmonella* spp., *V. cholerae* and *Listeria* sp. are absent. It will be important to note that a relaxed standard is prescribed for pathogens, by reducing the sample size. Similarly, a higher limit is prescribed for the pesticide and heavy metal residues. This is based on the fact that per capita consumption

of fish is much less (one-third) compared to that in developed countries and the chances of their accumulation to dangerous levels do not occur, even on long-term consumption.

The criteria (Table 2) are useful to ascertain the safety and quality of freshwater fish that is harvested and put up for sale and consumption. There is need for quality criteria of the water meant for aquaculture, as the safety and quality of fish is directly related to quality of water. Quality standards are available for the water meant for aquaculture (US EPA, 1976; Roberts, 1978; Nitingale, 1976; Anon, 1979; BIS, 1982; Boyd, 1984) But all these are intended to provide a safe environment for the aquaculture organisms. Among these standards, except USEPA no other agency gives any criteria for bacteria of public health significance, which is an essential criterion to prevent spreading of waterborne infectious diseases. In the light of the above, quality criteria are proposed for water bodies meant for aquaculture, for ensuring safety of the products of aquaculture (Table 3). There shall be additional requirements like dissolved oxygen, pH, nutrients, etc., to ensure health of the aquaculture organisms, as described elsewhere.

Ensuring these criteria for the water bodies for aquaculture will make sure that the fish cultured in such a water body conform to the limits prescribed (Table 2) making it safe for human consumption. There will also be no cause for discarding or destroying the aquaculture products for want of specific quality. However, export of the products of aquaculture may require still stringent quality criteria as laid down in BIS/USFDA/EU norms or other buyer requirements.

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