Quality in the production processes in the aquaculture industry: Bases, procedures and economic implications

Puebla M., Gutiérrez F., Alvarez-Guerra S.

Global quality assessment in Mediterranean aquaculture

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 51

2000
pages 31-35

Quality in the production processes in the aquaculture industry: Bases, procedures and economic implications

M. Puebla, F. Gutiérrez and S. Alvarez-Guerra
Tinamenor, S.A., 39.594-Pesués, Cantabria, Spain

SUMMARY – Marine aquaculture has experienced great development during the last decade. This growth is encouraging private companies to become more and more competitive by improving their productivity. As in other industries, the establishment of a quality policy as the first step to develop a Quality Guarantee System contributes to improving the productivity of the farms, by guaranteeing the quality of their products and of everything related to their manufacture. Regarding the quality of the products, the main consequences of not applying a Quality Guarantee System to the production processes (aimed to the hatchery products) is discussed.

Key words: Aquaculture, hatchery, quality, production.

RESUME – *"La qualité dans les processus de production de l'industrie aquacole : Bases, procédures et enjeux économiques". L'aquaculture marine a connu un grand développement lors de la dernière décennie. Cette croissance encourage les sociétés privées à devenir de plus en plus compétitives en améliorant leur productivité. Comme dans d'autres industries, l'établissement d'une politique de qualité comme premier pas pour mettre au point un Système de Garantie de Qualité contribue à améliorer la productivité des fermes, en garantissant la qualité de leurs produits et de tout ce qui est lié à leur fabrication. En ce qui concerne la qualité des produits, les principales conséquences de la non application d'un Système de Garantie de Qualité aux processus de production (visant les produits des écloseries) sont discutées.*

Mots-clés : *Aquaculture, écloseries, qualité, production.*

Introduction

The generation of a Quality Guarantee System (QGS) is defined in Fig.1.

It must be guaranteed that the three objectives: quality securing, elimination of obstacles for commercialisation and harmonisation of the decisions of acceptance and authorisation- without exclusion, are carried out inexorably as permanent characteristics. To obtain this aim, a *Quality Policy* has to be established, in order to create a series of programmed activities which together will determine the Quality Guarantee System (QGS).

These objectives are justified because a Quality Guarantee System (QGS), commonly accepted by the aquaculture industry *must* provide a uniform decision base to maintain a quality system in the whole aquaculture industry and obviously because the products are manufactured by Authorised Companies*, whose activities must be inspected periodically* by the appropriate authorities.

In practice, this means that the *approval of a product that fulfils the specifications* of a member country of the EU, must be valid within the EU, and those specifications *have to be obligatorily observed by all countries that commercialise aquaculture products within the EU.*

Therefore a good QGS, has to achieve two missions: (i) to manufacture Quality Products; and (ii) to provide the aquaculture industry of the EU with a common language.

And to achieve these objectives, a QGS works in five different aspects:

(i) *Good Manufacturing Practices* (GMP), applied to the suppliers, personnel, facilities, proceedings, machinery, buildings and raw materials. They are aimed to assure the quality of the product, to avoid barriers for its commercialisation and to harmonise criteria for authorisation of a product.

(ii) *Quality Management*, including all the activities which may affect the quality and the way to control them.

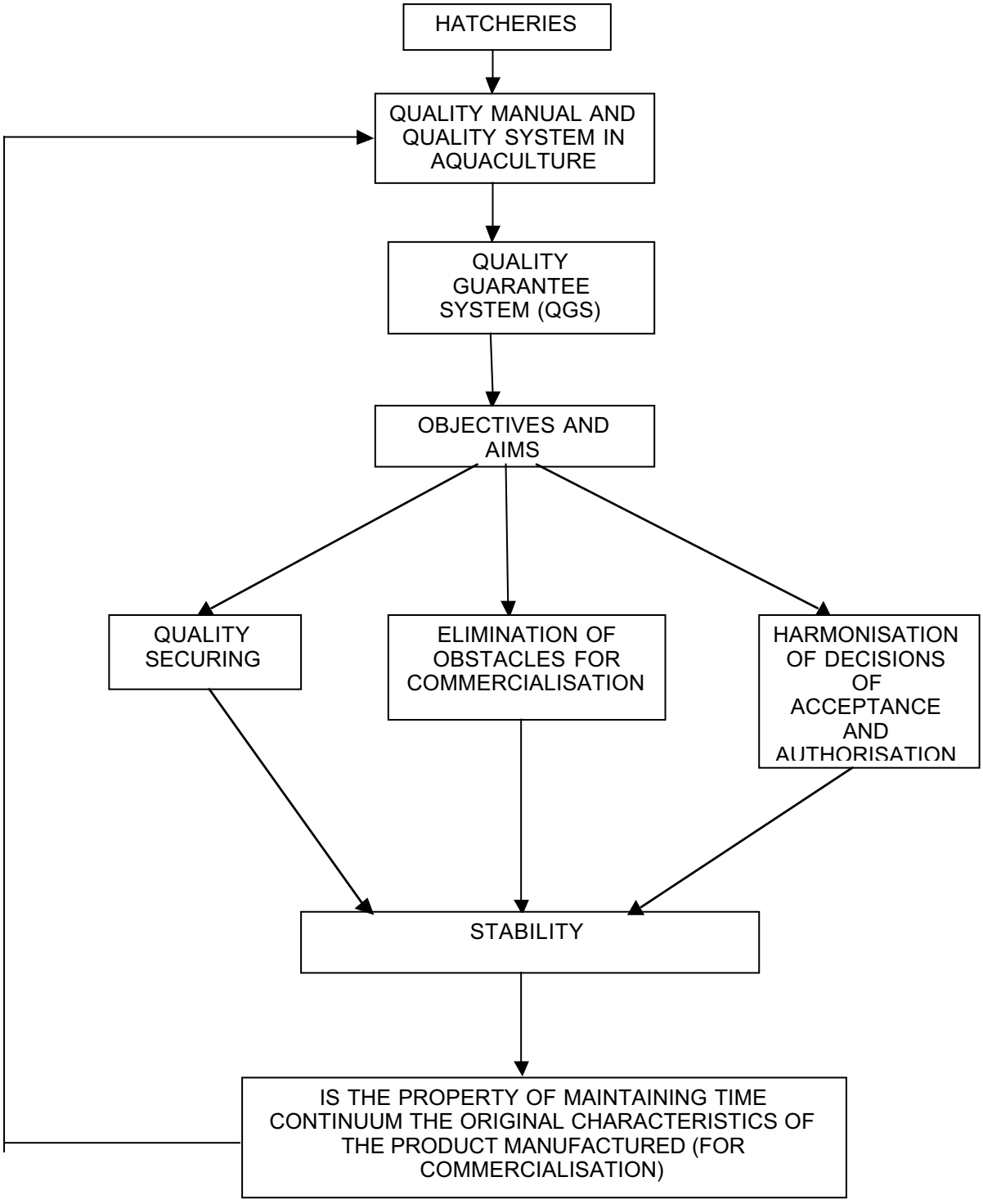

Fig. 1. Generation of a Quality Guarantee System (QGS).

(iii) *Documentation*, it must contain every single aspect involved in the manufacture of a batch, without exclusions. The aims of the documentation are:

- To define the manufacturing and control system.

- To reduce the mistakes of oral communication.
- To give durable registers.
- To instruct the personnel.
- To guarantee a secure and reliable manufacturing.
- To permit the follow-through of complaints.

(iv) *Internal authorities*, which is the way to measure how the Quality System is functioning and the effectiveness of the Quality Guarantee System.

(v) *Training of personnel*, to determine responsibilities in each area, to improve their knowledge and to get the potential of each individual person, towards the quality of the product.

Quality of the products. Consequences of not applying a quality guarantee system in the production processes

Morphology

Malformations are one of the most representative factors of the quality of fingerlings, although only some of the malformed fish are either poor growers or difficult to sell. There are many kinds of deformities, (some, genetically transmitted, can be valuable markers for selection), but just a few are quite common in most hatcheries: (i) bad pigmentation; (ii) lack of swimbladder; (iii) deformed vertebral column; (iv) shortened operculum; (v) snub nose; and (vi) shortened or twisted jaw.

Lack of skin pigmentation is common in turbot, normally in patches in the fore part of the body. This pseudoalbinism has been related to nutritional imbalance during larval stages, particularly to the highly polyunsaturated fatty acid profile in the live food. Affected fry batches, in percentages between 1 and 20%, need to be hand sorted before delivery. As some patches are difficult to see for the naked eye, hatcheries have to wait until they reach few grams, thus incurring a high cost.

The *lack of swimbladder* in sea bream and sea bass was a hard problem in the 80s. Affected fish have to swim continuously, which causes lordosis in the fore part of their column and reduce their growth rate.

Other kinds of *column deformities* are quite common, affecting bass and bream. Vertebral fusion produce shortened fish. Acute lordosis occurring near the tail causes a lot of trouble in sea bream. Affecting sometimes up to 30% of the batch, this problem is one of the main objectives in most hatchery research.

Shortened operculum is, perhaps, the most common problem affecting the fish's shape in bass and bream. It does not reduce its performance, but sometimes reduces its final commercial value. With prevalence up to 30%, malformed fry need to be hand-graded. Although many reasons have been cited trying to explain this problem: gas supersaturation, incubation factors, pollution, etc., it is likely that there is a set of particular circumstances affecting every hatchery, which, then, need to be individually studied.

Almost the same can be said about *maxillary malformations*, snub nose and twisted/shortened jaw. In all these cases, genetics, although unlikely, cannot be discarded.

All these skeletal malformations (except shortened operculum) can be checked visually or, better, by X-rays. For fry smaller than 5 g, breast X-ray machines give a very good resolution. X ray plates are easy to study, to measure the deformities and to keep good record of this information.

Growth rate and food conversion rate

Both factors are very important for the ongrowing since they are critical to improve productivity and reduce cost of production. A long production cycle means less biomass generated per cage and, therefore, more investment in live stock, more food and labour invested during slow growing periods (winter) and more risk.

Three main factors affect the duration of the production cycle at about the same rate: fingerlings, food and husbandry. From the hatchery point of view, a lot of research is needed in genetics; meanwhile, care should be taken to supply juveniles according to a growth pattern and in uniform batches. Batch uniformity in terms of size is important not only for choosing the cage's net size, preventing the small ones from escaping, but for choosing food pellet size. Uniformity is normally measured as relative dispersal of the individual weight (standard deviation in terms of percentage over the average). Figures close to 20% are the standard in the industry. Obtaining less than 15% is hardly difficult for most hatcheries, and of doubtful value for the ongrowers.

When properly handled during the growing cycle, it has been demonstrated for sea bream that standard deviation remains about the same as the initial value. In sea bass, due to sex differentiation and different growth rates, deviation in sizes increases during the growing cycle.

Looking to the future, some companies are now conducting selection programmes for growth rate, but it will take several years before their first results are obtained.

Initial number

The number of individuals in every delivery has many times been a cause of complaint. Fish farmers keep record of everyday losses and sales, but when fish weigh a few grams, and are in a high temperature, the dead bodies can disappear without notice, either by cannibalism or by decay. Animal or human depredation can also contribute to the total number of unrecorded losses found at the end of every batch. The average percentage of these unrecorded losses in the industry is difficult to know, but it could range between 2 and 5%.

Understandably, inaccurate numbers from the hatchery have been quoted many times as the main cause of this shortage. But, although this could have been the case years ago, the actual available methods and machinery make this difficult to accept today. Fry number is usually counted by automatic counting machines, giving an error of about 1%.

Hatcheries must have a reliable protocol for this operation, including periodic calibration of the machines, as part of a good supervision scheme. All this process needs to be completely transparent for the customers' eyes, keeping hatchery records always available for their scrutiny.

Disease free quality

Infectious diseases are the nightmare of fish farmers, sometimes causing losses of more than half of the stock, and, more often, between 5 to 15%, they are surely the main single factor of economic damage to the industry.

Once again, two main factors involved when an infectious disease appears in a farm: the hatchery, during the early days of the ongrowing and the husbandry, during the rest of the growing cycle. Unfortunately, there is no farm, either hatchery or ongrowing, which has no risk of infection. The interaction with the environment is a risk itself and the key for keeping a "disease-free status" is to control exhaustively all these interactions. It is necessary to have a very strict protocol to control every single input from outside the farm: the water, the food, the broodstock and/or eggs, transfer of personnel and materials inside the farm, disinfection of lorries, etc.

The best tool to fight against diseases is prevention. Every single farm needs to establish its own protocol according to its particular case and its particular circumstances.

Great importance is attributed to vaccination in disease control. Vaccines have been currently used in the Mediterranean hatcheries because of the high cost of vaccinating small fish once stocked in cages. There are effective vaccines for *Enterococcus* in turbot and for vibriosis in bass. The vaccine for pasteurelosis in bream and bass is not yet 100% effective, nevertheless, suppliers and researchers and working very hard on improving them and on developing new ones. Future for vaccines is very promising.

Quality on delivery

As most of hatcheries are normally far from their customers, fry need to be transported long distances in special tanks, in lorries specially adapted to this purpose. Commonly, fish are loaded in fibreglass tanks, stocked at densities ranging 5 to 25 kg/m^3 depending on species, individual weight, temperature and distance. As an example, 200,000 sea bream of 1 or 2 g can be carried in one of these lorries for up to 4 or 5 days.

The whole procedure to deliver one batch begins 7 to 10 days before departure, when the fish are finally counted and divided in as many tanks as it is planned to be loaded in the lorry. This period is very important for a successful transport and it is necessary to look after the juveniles carefully, providing the best conditions in terms of water quality, food (sometimes adding some supplement of vitamins or immunostimulants) and handling, to reduce stress to the minimum.

During the trip, there is a continuous supervision of basic factors, dissolved oxygen, temperature, pH and ammonia.

Once in the destination, the water in the tanks is changed slowly, allowing the fry to acclimatise to the new environment. Landing must be done quickly and safely (many times, the conditions in the customer's site makes it the most risky part of the whole process). Feeding should be restarted as soon as possible, by hand and carefully, with food normally supplied by the hatchery, for the first one or two days. In normal conditions, juveniles should be perfectly adapted to their new habitat in 24-48 hours.

Conclusion

Quality is not just fulfilling customer's expectations but a constant attitude or policy to apply throughout the process of producing and selling goods or services. This "label" has to be used in every part, with suppliers, and with/between staff, in the daily use of raw materials, and in the proper recording of every day's data, and, of course, with the customer. Supervision and analysis of the whole process is the only way to improve it.