Slaughter process: seabream in ice slurry container (foto A. Ramalho-Ribeiro)

A Joint European Certification System for Sustainable Non-Intensive Aquaculture: a proposal from the SEACASE project

PAULO VAZ-PIRES*[1,2], ANA RAMALHO[3], ANA JESUS[3], FLORBELA SOARES[3], LUÍS CONCEIÇÃO[3], MARIA TERESA DINIS[3], LAURA RIBEIRO[4], PEDRO POUSÃO-FERREIRA[4], MARIA EMÍLIA CUNHA[4], HUGO QUENTAL FERREIRA[4], MANUEL YÚFERA[5], GIOVANNA MARINO[6], CLARA BOGLIONE[7], STEFANO CATAUDELLA[7], JÉROME HUSSENOT[8], MARIE-LAURE BEGOUT[8], PAVLOS MAKRIDIS[9], ERIC BUARD[10], PHILIPPE BLACHIER[10].

1Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), Univ. Porto, Portugal

2 Instituto de Ciências Biomédicas Abel Salazar (ICBAS), Univ. Porto, Portugal

3 Centre of Marine Sciences (CCMAR), Univ. Algarve, Faro, Portugal

4 Instituto de Investigação das Pescas e do Mar (IPIMAR/INRB), Olhão, Portugal

5 Instituto de Ciencias Marinas de Andalucía (CSIC), Puerto Real, Cádiz, Spain

6 Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Rome, Italy

7 Università degli Studi di Roma "Tor Vergata", Rome, Italy

8 Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), Bouin, France

9 Hellenic Centre for Marine Research (HCMR), Crete, Greece

10 Centre Régional d'Expérimentation et d'Application Aquacole (CREAA), Le Château d'Oléron, France

Introduction

The European project *Sustainable extensive and semi-intensive coastal aquaculture in Southern Europe* (SEACASE) included the proposal of 6 Codes of Conduct for the aquaculture systems studied during the project work. These case studies are typical of the countries involved, namely semi-intensive polyculture (Portugal and Spain), extensive polyculture in *esteros* (Spain), integrated systems (France), valliculture (Italy), nursery ponds (Greece, Portugal, France and Italy) and eel ponds (France).

This article was written having as objective the providing of a concise summary of the characteristics that SEACASE collaborators found to be central to build a complete and trustable Certification system for products of sustainable non-intensive aquaculture (for "certification of sustainability", see Ojeda, 2008). The 6 Codes of Conduct are the basic information to build such a system in the future.

General considerations

The present article is a concise summary of the most important information taken from the six Codes of Conduct and a proposal for an integrated system of Certification of generalized implementation in EU countries. The following items, from implementation requirements to traceability and covering all farming steps and issues, are main guidelines to be observed in such a system.

Implementation requirements

Selecting the farming system

The farming system (species, water circuits, feeding regime, etc.) should be chosen taking into consideration not only the local specificities but also the local resources, in order to respect sustainability and environmental characteristics of the implementation region. Examples of possible interferences are: local populations, fishermen and fishing areas, other already established farmers, other types of industry or human activities, protected areas or special regimes that regulate activities, wild animals like other fish or aquatic species, birds and mammals.

Selection of location and farm layout

The selection of the final location should be a result of a careful study of all local possibilities and interferences, taking into account factors like pollution sources and competition with other existing activities. Farm layout should be planned considering the location, corresponding neighbourhood and technical requirements (*e.g.* wind direction) in order to take advantage of the area natural features.

Conflicts and legislation

Farming implementation and activity should follow all local, regional, national, European and international rules and legislation. If legal conflicts arise, the help of professionals in the area of legislation, preferably in the specific area of aquaculture, should be searched.

Facilities, equipment and labour

Buildings and solid structures

Many extensive farming activities are located in protected areas, where some human activities, for example the construction of additional or new buildings, are restricted or forbidden. As farming sites tend to grow and the need of new buildings can increase with time (slaughter rooms are a good example of a recent need that was not predictable some years ago), this must me taken into consideration from the implementation phase, as the rules of protected areas must be respected by farmers and professionals of other activities.

Technical requirements

The most adequate technical equipments and procedures should be preferentially used by farmers in order to assure the best possible conditions for the farmed animals, the workers and the surrounding environment. In alternative, the use of traditional techniques proven to be animal-, worker- and environmental friendly may also be promoted.

Personal and labour requirements

The number of workers and their corresponding qualifications must be in accordance with the predicted activities and taking into consideration that extensive farming is in many aspects a seasonal and variable activity, which increases management difficulties.

Ethical issues

Ethical issues like those related with child work, gender issues, fair trade and others that can become relevant with time should be considered and respected, in all possible aspects, by farmers.

Water and waste

Water sources, quality, use

Water sources must be correctly predicted and chosen, and the corresponding water quality must be adequate for the species farmed, in order to guarantee not only the conditions for farming and growth, but also their welfare and health status. Legislation about water use is normally very specific and restrictive and must be respected.

Water treatment and discard

Aquaculture, including all production systems, needs water and consequently provokes some sort of impact on the environment. The main source of pollution associated to aquaculture is feeding (with the exception of extensive aquaculture in which only natural food is used) which includes the particulate matter (faeces, uneaten feeds, and nitrogen/phosphorous compounds) and soluble material nitrogen and phosphorus from shellfish and fish metabolism and excretion. The choice of adequate feeding methods is a powerful tool to reduce feed wastes, but the decision on the use of those methods is largely based on a cost-benefit analysis (equipment vs. labour), as some feeding methods have clear advantage for given species / fish sizes and farming systems. Adequate treatments of the discarded water should be implemented, in order to reduce the effects of farming in the aquatic environment. Improved pond design and creation of buffer areas for effluents, taking into account the hydrodynamics of the receptor system in the vicinity of the farm, should be considered in the project lay-out. An appropriate hydraulic management is essential to assure a good water quality and minimal impacts on the benthic environment.

Farmed species

Species choice

Decision about species should also consider the native species allowed and/or recommended in the farming areas or countries of location, in order to avoid unnecessary biological impacts such as the interferences with natural stocks, as it is impossible to avoid completely escapees from farms to wild environments. In polyculture, species must be chosen taking into consideration the biological characteristics and advantages of each one and of the respective combinations, but also that they are necessarily different and with specific needs. Once only a small population of parents from each species is maintained in captivity, escapees may bring genetic drift and inbreeding problems. So, in the case of perceived important escapees, farmers should warn the local authorities and should give all possible collaboration in solutions and adopt new security measures to avoid escapes in the future.

Fry sources and suppliers

Fry suppliers must be identified companies with known experience in the farmed species market or new companies, ensuring, by adequate documentation, their origin and correct health status, as well as adequate transport conditions. In extensive aquaculture, juveniles from autochthonous breeders should be preferred.

Transportation and international requirements

Transport of live animals for farming must be planned and performed following international and national transportation rules. All forms of transfer or transport imply some increase in the stress level, which means the concern with welfare of the species is a key factor to be faced and respected. The welfare must be considered also during the preparation for transport and the phases of post-transport handling (quarantine, stabilization periods, etc.). The eventual transfer of diseases with the transported fish should be avoided by all possible available methods.

Stock density

Fish should be kept, during all growth phases, at an adequate density (nr. fish/volume of water) to guarantee the access to sufficient oxygen and to avoid accumulation of undesirable organic compounds in the farm and in the environment. Stressed fish are also more susceptible to diseases, so farming at lower densities,

Fig. 1 - Semi-intensive farming: seabream/seabass pond at Aqualvor farm, Portugal (foto P. Vaz-Pires)

improving water quality and avoid handling can improve the animals' natural resistance to diseases, and also contributes to adequate welfare of farmed species. It should be remembered that one of the most important characteristics of non-intensive systems is the relatively low charge (density) of individuals in the farming water spaces, so densities must be kept as defined by FAO for extensive and semi-intensive systems during all farming stages.

Food

Feed choice, supply and transport

Feed suppliers must be identified companies with known experience in the farmed species market, which can guarantee, by adequate documentation, the origin of the ingredients and the stability and quality of the feed composition, and their compliance to specifications and safety limits of undesirable substances (see also *ethical issues*). In addition, it is important that suppliers guarantee feed supply rapidly and timely, and provide effective and up-to-date technical assistance. Transport and storage should be performed in accordance with legal requirements and must guarantee the best possible nutritional quality The feeds must be nutritionally balanced, according to the latest scientific evidence, so that they guarantee maintenance of health status, normal growth and promote animal welfare.

Use of genetically modified organisms (GMO)

Considering the present moment, in which clear scientific evidence about positive and negative effects of the extended use of GMO it is not yet available for most ingredients, SEACASE suggests a strict conformity in the usage of GMO crops within those approved for use in animal feed in the EU market (Regulations EC No. 1829/2003 and 1830/2003). Avoiding the use of GMO ingredients and products should be promoted whenever possible. The feeds used should clearly state if the feed is or is not GMO free. Whenever a GMO-free claim is made by the feed suppliers, supporting documentation must be asked by farmers to suppliers.

Feeding

The quantity and frequency of feed supply to fish should be regularly checked and accurately recalculated, in order to ensure all fish have access to food. It should also avoid, as much as possible, excess of non-eaten feed in the water, which causes a rapid degradation of the water quality, with consequent negative effects in fish welfare and the environment.

Farming

Handling and other current operations

Extensive and semi-intensive farming are, by definition and when compared to intensive systems, activities with lower human interference. All typical farming technical operations and procedures (calibration, removal of dead or ill fish, tank or pond transfer, starving periods, net crowding, fishing, pre-slaughter, stunning and slaughter operations) must respect this characteristic. Procedures must be carefully planned and performed having in mind the animal welfare, avoiding unnecessary suffering or pain and delays due to inadequate work planning or inadequate training of the workers. The removal of dead or dying animals must be done frequently, to avoid interferences with health and welfare of the healthy remaining individuals.

Maintenance and control procedures

Maintenance is a very important component of any activity, including non-intensive farming. Farming equipments, instruments and machinery must be subjected to regular, planned maintenance operations (like cleaning, calibration, checking, etc.) in order to avoid unpredicted failures and/or shortening of the normal working lifetime. Farms, even extensive, tend nowadays to be complex and therefore systems to provide and register information about farm/water parameters should be used. This regular procedure will allow earlier problem detection and better perception of the appropriate solutions. In addition, registration of monitored data can also be used for other recent legal demands, such as HACCP and traceability.

Seabass weighing and packaging process at Aqualvor, Portugal (foto P. Vaz-Pires)

Slaughtering and welfare

Fish (and also some invertebrates, like crustaceans and cephalopods) are nowadays included in consumer-perceived welfare concerns. Animal welfare can be related with many different aspects, like disease, injury, starvation, beneficial stimulation, social interactions, housing conditions, deliberate or accidental ill treatment, human handling, transport, pre-slaughter and slaughter procedures, laboratory procedures, mutilations, presence of abnormalities (physical congenital defects), veterinary treatments or genetic changes. The most common concerns are about transport, pre-slaughter and slaughter, both in routine procedures and in special slaughter needs, as in emergency slaughter for disease management.

Transport of species

Transport is always stressful for animals. The conditions, phases, biological parameters and legal requirements during transport and corresponding duration times should be studied previously and rapid solutions should be predicted to solve delays and difficulties, in order to obtain the best possible welfare during transport.

Farming

Farming operations like handling, feeding, calibration, sampling, etc., must be performed having in mind the animal welfare, adopting the best procedures, minimizing handling times and avoiding unnecessary suffering.

Pre-slaughter phase

Pre-slaughter activities are nowadays considered as being as important (sometimes even more important) than slaughter procedures, in terms of potential for welfare improvement. They include environmental parameters (*e.g.* vulnerability to predation), water quality, social interactions between species, starvation (or feed withdrawal) periods, calibration and other handling operations, such as crowding in nets or tanks, fish transfer, stunning methods and all other procedures before fish slaughtering (death). In each of these components, welfare is nowadays of primordial importance and should be considered, mainly by choosing the best practices and by trying to minimize operation times and avoid suffering.

Slaughter phase

The slaughter method, normally combined with a previous stunning method, must be selected, among the technically available and possible field options, in order to allow a low stress and rapid processing, thereby minimizing animal suffering and pain. All farmers contacted by SEACASE project are using immersion in ice slurry as a stunning/killing method, which in terms of welfare is not consensual. Until scientific and precise information is available to clarify many of the arguments and ideas about the use of ice slurry, the method will continue to be used. In the present document, it is recommended that it should be improved at least in what refers to the time to obtain death of all harvested fish. This means the temperature of the ice slurry should be as low as possible (as close to zero degrees Celsius as possible, which is obtained by increasing the relation ice : water), so the temperature differential between crowding spaces in harvesting waters and slaughtering containers is high and ensures rapid death. Other possible improvement is to increase the amount of ice slurry in relation to fish volume added each time (increasing the relation ice slurry : fish quantity), so the increase in the temperature of the ice slurry induced by fish addition is minimal and fish dies quicker even after the first fish enters the ice slurry.

Emergency slaughter, killing or culling

If, for any reason, fish must be slaughtered urgently, for example due to the detection of a disease or other serious and unavoidable problem, the stress, suffering, welfare and environmental conditions must always be considered. Extra hygiene measures must be adopted to ensure the reduction of the disease spread; the period of time until the problem is considered solved must be respected. If not legally established, the final decision must be the based on a previous group decision, within the farm or shared with other farmers.

Disease management

General prophylaxis and therapeutic actions

Adequate prophylactic measures must be used as the first measure to increase welfare and to avoid diseases. When prophylaxis fails and therapeutic actions are needed, the more recent scientifically recommended pharmaceutical products and administration systems should be used, respecting local, national and international legislation. All products to be used must be approved by the authorities involved. The time period for the residuals elimination (withdrawal or elimination periods) must be observed before harvesting for commercial purposes. Measures of hygiene in fish production, the use of immunostimulants and fish vaccination may be also be used in order to prevent fish diseases. Drugs are used when fish diseases occur, but their application is often difficult in fish production.

Hygienic procedures

Priority should be given to good hygiene and other preventive efforts in containment of resistant infections in non-intensively farmed fish. The increasing of hygienic measures, with proper handling practices, will help to prevent infectious diseases, including parasites and virus, which cannot be treated with antibiotics. In non-intensive aquaculture, adequate hygienic measures must be planned, implemented, verified and continuously adjusted.

Immunostimulants

Chemicals that stimulate the immune system, have vast potential in aquaculture and can be used prior to situations that could result in increased stress to aquatic organisms (handling, changes in temperature, larvae adaptation to artificial feeding), or increased exposure to pathogenic microorganisms like seasonal variations in microbial composition of the marine environment or occasional higher fish densities.

However, in non-intensive farming, the use of this kind of compounds should be kept to a minimum, as it is expected to have less stress and lower incidence of diseases in non-intensive farming systems and also because the long-term effects are not yet well known. If their use is unavoidable, caution is needed about the dosages, because inadequate doses may cause unwanted effects, suppressing the fish defence mechanisms. The administration period of immunostimulants is also very important. It is important that immunostimulants are used before an outbreak of a disease, to reduce the losses and increase welfare.

As the oral route is the most practical method for administration of immunostimulants, in extensive or semi-intensive systems it is impossible or difficult to use the oral method, as artificial feed is only a part of the total food input.

Vaccination

Vaccination is a useful prophylaxis for bacterial infectious diseases of fish. Commercial vaccines are already available for vibriosis in seabass and pasteurelosis in seabass and seabream. Vaccines are not 100 % efficient; the degree of protection of a vaccine depends on a number of intrinsic (age, physiological status of fish, species) and extrinsic factors (vaccine, the concentration of vaccine, route of administration, presence of adjuvants, water temperature), that must be taken into account when vaccines are applied to non-intensively produced fish. Final decision on vaccination procedures and/or buying already vaccinated fish must be taken by the producers.

Disinfectants

The external disinfectants are used for the control of infections from organisms on the surface of fish and to eliminate or reduce potential pathogens of physical spaces. The disinfectants that exist for disease control should be miscible with water or capable of being suspended in water at a therapeutic concentration. The methods for external disinfection and treatment of fish disease include immersion and bath. The immersion is obtained by mixing the required quantity of disinfectant with a specific volume of water. As bath treatments are more appropriate for the treatment of fish in relatively small tanks, in many of non-intensive systems this procedure is difficult to apply. Treatment by immersion requires the fishing and transfer of the fish to smaller treatment tanks, which makes them also more difficult to apply on non-intensive systems.

Chemotherapeutic agents

Any chemotherapeutic agent should be used only after proper disease diagnosis and following a previously made antibiogram. The application of antibiotics in semi-intensive aquaculture is done through two different ways: orally, in the feed, or as a static bath treatment in earth ponds. The same difficulties previously mentioned for the use of disinfectants have to be considered also when antibiotic administration is needed. The use of antibiotics in EU aquaculture is regulated by the Council Regulation CE No. 2377/90 that establishes the maximum residue limits of veterinary medicinal products in foodstuffs of animal origin. This and all other kinds of legislation affecting the sector must be strictly followed.

Consumer safety and health

Fish diseases that can be dangerous for humans must be farmers' first concern, at all stages of production. Adequate prophylactic measures like immunizations, vaccinations and hygiene procedures are the most recent and adequate approach to prevent diseases in aquaculture, since normally when disease is detected it is too late to implement successful therapeutics.

Environmental issues and concerns

Predators and protected areas

Farmers usually complain about facilities invasion by predators, searching for the farmed species. Birds, mammals (and sometimes man) are the more frequently seen farm invaders. This is an environmental problem, because the fight against birds and mammals in protected areas is normally very restricted, and simultaneously it is a welfare problem, as farmed species are confined and are an easy prey if compared to the wild environment. Welfare is also compromised when fish appear with bird beak marks in the body, due to frustrated attempts to catch them. Measures should be taken to limit the access of predators to fish (*e.g.*, nets, physical barriers) or to keep predators far away from the farms (*e.g.*, scaring noises,

mechanical devices). Measures that are lethal (hunting) or cause serious disturbances in the biology of predators should only be used under legal licence and supervision.

Fish escapes to wild environment

All possible measures should be taken in order to avoid species escapes from the farms to the free wild environment. In the case of an involuntary important escape occurs, the farmers should collaborate with authorities in order to take the adequate possible measures.

Traceability

Traceability in aquaculture can be defined as *the ability to follow the movement of a product of aquaculture or inputs such as feed and seed, through specified stage(s) of production, processing and distribution.* Non-intensive farmers, like the ones from intensive farms and by legal impositions, must assure the traceability of their products, from the ingredients used in feeds until the final distribution, and at all stages of the farming process.

Conclusions

General attitude

Farmers should collaborate with local, national and international authorities, in all aspects related to their activity. Farmers should always search for the highest possible quality and freshness for their products, from production to consumer. As products from non-intensive farming have special characteristics which can be valuable for consumers, farmers should devote efforts to create and maintain a correct image and provide high quality products. Correct packaging and transport practices, along with complete and clear labelling information about product characteristics and its correct use should not be disregarded.

Difficulties and constraints

Codes of Conduct are normally made to be followed voluntarily by farmers and serve as a general guide to achieve the highest possible quality and value. This is also the case of the recommendations that are presented in this document. This basis for a Joint European Certification process is not intended to be applied only within a country, a region or a group of farmers/producers, but the objective is rather to achieve a system that can be implemented within all European aquaculture environment. Major difficulties in the process of building this proposal were the lack of scientific specific information in which to base clear quantified measurements, establishing limits that can these simple recommendations easily verifiable.

There is also a substantial lack of information in what concerns statistical data about aquaculture, even more evident when non-intensive systems are considered. The associative power of the companies (many of them family farms) is considerable low, so the information available through national or regional associations is often incomplete and outdated.

Final recommendations

Need of technical and scientific information

In the near future, technical and scientific developments are needed to allow a more specific group of rules, in order to design a complete up-to-date Certification system, based on more clear limits and quantifications of measurable parameters. The collection of updated statistical information should be a primary concern, both within countries and Europe, to provide a solid basis for more precise and clear recommendations or even compulsory rules or legislation.

System components and scope

A certification system has 2 main components: a set of clear rules (all previous lines are focused on this need) and an entity that must be able to control that the ones who claim to follow the rules (and benefit from the corresponding commercial advantages) are in fact within the established limits. SEACASE suggests that such an entity must have a European dimension and should be created by EC initiative, but it is recommendable that sub-entities are created in each country or region, in order to be more close to the farms and to address local specificities.

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