Aquaculture Common Issues Group

Key questions on aquaculture

GENERAL

Q. What is aquaculture?
A. Aquaculture is the farming of fish, shellfish and plants in the sea or in fresh water. Aquaculture, otherwise known as fish farming, provides consistently good quality, highly nutritious, good value for money seafood, whilst helping to maintain the long-term sustainability of wild caught fisheries.

Q. How are fish and shellfish farmed?
A. The method depends on the species and location, and a variety of techniques allow aquaculture to be carried out in almost every country in the world. As an example mussels and oysters, which feed on plankton and organic particles in the surrounding water, are grown on the bottom or on suspended ropes or racks. Warm water prawns are farmed in large ponds in coastal areas, predominantly in the Asia-Pacific region. Most marine fish are raised in net pens in coastal waters.

Q. Why do we need aquaculture?
A. Aquaculture allows us to grow the fish and shellfish we increasingly need, in a way that delivers quality and variety. With a growing demand for seafood it provides a means to supplement wild capture fisheries. The output of the world's wild fisheries is either steady or declining, yet the human population continues to grow. Aquaculture already supplies nearly half the world's seafood consumed by humans. The United Nations Food and Agriculture Organization forecasts a global seafood shortage of 50 – 80 million tonnes by 2030. Aquaculture can help to meet that growing demand and provide much needed protein and income in many of the poorer parts of the world.

Q. Where does aquaculture take place?
A. Salmon is farmed in the sea around Scotland, Norway, Canada, Chile and the Faroes. Pangasius is farmed in ponds near the Mekong river in Vietnam. Tilapia is mainly farmed in ponds and cages in warm countries in Asia, Africa and Central and South America but some is also produced in tanks inside buildings in temperate countries like the UK. In the UK the majority of finfish aquaculture is located in Scotland, although it is increasing in areas of Wales and England. Shellfish culture is spread more evenly throughout the UK. Regional aquaculture production by weight is split: Scotland (81%), England (6%), Wales (6%) and Northern Ireland (6%).

Q. If fish has been farmed, does it have to say so on the label?
A. The label on all pre-packed farmed fish (or the ticket if farmed fish is sold loose at a fish counter) must state that the product is farmed or cultivated, and must also state the country where it was farmed. The label must also state the name of the fish (according to rules about what species can be sold under certain names). All labeling and ticketing for fish farmed in the Britain must also include the term 'farmed in the UK' because Scotland and England are not designated countries of origin.

Q. How are fish farms regulated to minimise environmental impact?
A. All forms of aquaculture are subject to stringent environmental legislation. They are inspected both by local government agencies and by the auditors from their customers/or the certification companies to constantly maintain and improve assessment and management practices. There are environmental impacts, but these are minimised by undertaking impact studies when the farms are established, and ensuring that the farms do not create long-term damage to the environment. The effect of a fish farm will be monitored and controlled in a similar way to land animal farms. As well as being efficient users of feeds, fish and shellfish farming can demonstrate lower carbon and freshwater footprints than most other forms of animal production.

The production of bivalve molluscs (clams, oysters, and mussels) can provide positive environmental impacts. These farms do little to disturb the ecosystem and they can even improve water quality – because molluscs work as filters. Because of their three dimensional structure, they form habitats for other bottom dwelling organisms, adding to the biodiversity of the marine environment.

NUTRITIONAL BENEFITS FROM FARMED FISH AND SHELLFISH

Q. How do farmed finfish and shellfish contribute to a healthy diet?
A. Fish and shellfish provide high quality, easily digestible protein, a good source of important vitamins and minerals and they are low in calories, sodium and saturated fats. Fish and shellfish are excellent sources of long chain Omega-3 fatty acids and the simple fact is that scientific studies have shown that both farmed and wild fish carry the same nutritional health benefits.

The Food Standards Agency (FSA) recommends all consumers eat at least two portions of fish a week, including one which is oil rich. A recent FSA consultation has shown that on average UK per capita consumption is about 1.2 portions a week. If consumption levels are going to increase the sustainable development of aquaculture could help meet that demand. The FSA advice can be found at: http://www.eatwell.gov.uk/healthydiet/nutritionessential/fishandshellfish/#cat232547

To highlight the benefits:

- Farmed salmon (and wild) is an excellent source of long chain Omega-3 fatty acids [SSPO] and is high in vitamins A and D and carotenoids which, in addition to being essential for human nutrition, are thought to help prevent cancer. Salmon is low in saturated fat, and provides high quality, easily digestible protein - 20 percent more protein than hamburger, steak and pork loin. Salmon is low in calories, sodium and cholesterol.
- Shellfish are healthy sources of protein, rich in vitamins and minerals, and extremely low in fat. Shellfish such as crabs, mussels and oysters are also a good source of Omega-3 fatty acids. Cockles, mussels , oysters, scallops and clams are very low in cholesterol – about half that found in chicken. The Shellfish Association of Great Britain (SAGB) commissioned a comprehensive review of all the health benefits of eating shellfish in 2010. The report shows that shellfish are among the best possible dietary source of protein, containing as much protein per 100g as meat and the protein content is high in essential amino acids and is highly digestible because of the lack of connective tissue. The report shows that crabs, oysters, mussels and squid only come below herring and mackerel for their Omega-3 fatty acid content. See: http://tinyurl.com/shellfish-nutrition

AQUACULTURE IN THE UK

Q. Which species are farmed in the UK?
A. The main finfish species farmed in the UK is Atlantic salmon, which is mostly grown in Scotland. The other main species is trout, although there are some small companies growing halibut, sea bass, tilapia and Arctic charr. There have also been attempts in the UK to farm cod and turbot.

The main shellfish species farmed in the UK are mussels, Pacific oysters (a non-native species, imported from British Columbia under quarantine in the 1960's by Government for the sole purpose of cultivation), together with some native oysters. Small quantities of King and Queen scallops and clams are also cultivated.

Q. How much does aquaculture contribute to the UK economy?
A. The Scottish aquaculture industry farm gate value was in excess of £500 million in 2008. The Scottish Government Scottish Fish Farm and Shellfish Production Surveys 2009 show total production of Atlantic salmon was 144,247 tonnes (128,606 in 2008) and for rainbow trout 6,766 tonnes (7,670 in 2008). Total shellfish production was approximately 6,758 tonnes (6,200 in 2008).

According to Defra, the farm gate value of finfish farming in England and Wales was estimated at £23.5 million (2006), of which £13 million was salmonids (mostly freshwater grown rainbow trout), £0.5 million other food fish and £10 million coarse fish for re-stocking of fisheries and for ornamental purposes. In 2008 the total value of the shellfish produced in the UK was an estimated £33 million, from just over 39,000 tonnes.

Q. How is aquaculture regulated in the UK?
A. All fish and shellfish farms have to be registered under the Aquaculture Animal Health Regulations 2009. The Regulation requires businesses to be authorised prior to commencing farming and to operate to a written biosecurity measures plan that minimises the risk of introducing and spreading disease. As an example, key international commitments include adherence to the Aquatic Animal Health Directive which covers animal health requirements, the Water Framework Directive which aims to protect our waterways, and the Habitats and Birds Directive.

Q. Who represents the aquaculture sector in the UK?
A. In the UK, the shellfish industry's Trade Association is the Shellfish Association of Great Britain (SAGB). Scotland has its own trade body, the Association of Scottish Shellfish Growers (ASSG). In Wales, there is the Welsh Aquaculture Producers' Association (WAPA), representing both fish and shellfish farmers.

The marine finfish industry is represented by the British Marine Finfish Association (BMFA) and the British Trout Association represents the trout industry. In Scotland each species-sectoral group acts alone on behalf of its members. The Scottish Salmon Producers Organisation (SSPO) is the trade association for the salmon farming industry.

Q. How important are imports to the UK market?
A. Aquaculture imports are very important to the UK market. Capture fisheries have declined in the UK over recent years so the balance of supplies has had to come from aquaculture production and from increased imports. Imports represent more than 60% of European consumption. The main species the UK imports are salmon from Norway, shrimps (warm water prawns) from South East Asia and South America, cold water prawns from the North Atlantic and fresh water fish such as pangasius and tilapia, primarily from South East Asia.

Q. How important are exports to the UK market?
A. Although the UK market remains the main market for many species, exports are vital to the aquaculture industry. As an example, although the UK market remains the main market for Scottish farmed salmon, it is also Scotland's largest food export. Scottish salmon exports have increased by over 500% in the last 20 years. More than 13 million fresh salmon were exported to 55 countries in 2009.

LEGISLATION/CONTROLS/INPUTS

Q. Are there aquaculture standards?
A. Yes.

- International standards for aquaculture production have been agreed, or are in the process of being agreed, for most of the major species and production methods through a variety of organisations, including the Global Aquaculture Alliance (GAA) and GlobalGAP.
- In addition the development of aquaculture standards for the newly-formed Aquaculture Stewardship Council (ASC) is underway through the Aquaculture Dialogues, sponsored by the World Wildlife Fund for Nature (WWF). Whilst credible, robust, performance-based measures are already in place this development in standards aims to encompass everything from a pangasius farm in Vietnam, a shrimp farm in Ecuador, an oyster farm in England, a salmon farm in Scotland to rope-grown mussels from Wales.
- For feed, UK producers are members of the Agricultural Supply Industry Universal Feed Assurance Scheme (AIC UFAS) and source their raw material from suppliers who comply with the AIC Feed Materials Assurance Scheme (FEMAS). International standards for feed production have been developed by GlobalGAP and GAA.
- For producers of marine materials used in feed, there is the new Global Standard for Responsible Supply (IFFO RS) from the International Fishmeal and Fish Oil Organisation (IFFO).
- There are farming standards which are specific to UK producers such as the Code of Good Practice for Scottish FinFish Aquaculture (CoGP) and a similar one for shellfish aquaculture.
- There are EU wide rules for organic aquaculture which sets legal minimum criteria for the sector. In the UK, organic certification is awarded by the Soil Association (SA) and the Organic Food Federation (OFF). A number of producers in Scotland also farm salmon according to the prestigious French Label Rouge Standard.
- The RSPCA sponsored Freedom Food scheme has welfare standards for farmed salmon. In addition, individual farming companies and most retailers have Codes of Practice and/or standards which mostly add specific criteria to those prescribed by the organisations above.

Q. Do farmed fish spread disease to wild fish stocks?
A. Concerns have been raised about disease outbreaks in farms increasing levels of pathogens in the surrounding environment.

Juvenile farmed salmon are transferred from freshwater – in which sea lice cannot survive – and enter the ocean lice free. There are significant factors influencing the dynamics of sea lice populations other than fish farming activity. Wild salmon numbers were in long-term decline for many years before the advent of salmon farming. Indeed, catches seem to have stabilised as farming production has grown. On the east coast of

Scotland – where no salmon farms are present – wild salmon's decline has followed a similar declining pattern.

The management of sea lice and the development and implementation of environmentally sustainable, integrated control strategies is employed by the Scottish industry.

Q. What kind of feed is given to farmed finfish and shellfish?
A. Farmed aquaculture species are either omnivores (eat fish and plants), herbivores (eat plants and algae) or carnivores (eat other fish). The UK's most popular farmed fish – salmon – is carnivorous and relies on fish to form at least part of its diet. Different types of pelleted feeds, mainly distinguished by variations in pellet size, fat and protein content, are used according to the life stage of the fish and the species of the fish being farmed. Many of the ingredients are the same as those used in the production of feed for domestic animals, and are all natural products, including, in addition to fish protein and oil - oilseed meals, grain products, fish and plant oils. Fish use these feeds much more efficiently than other forms of domestic livestock. Farmed shellfish rely on natural food in the water for their growth, and are not given additional food, except abalone which does use feeds including fresh and dried seaweed.

Q. What are pigments and why are they given to finfish?
A. In nature, fish such as salmon, trout and Arctic charr get their pink colour from eating crustaceans (mainly small shrimps), which contain natural carotenoid pigments. These provide vitamin A and function as antioxidants, enhancing the animal's immune system, helping to prevent disease. Farmed salmon and trout are fed carotenoid pigments to create the same flesh colour as found in wild fish. Organic salmon are fed only naturally derived pigments (extracted from a type of yeast). Other farmed salmon maybe fed on a synthetically produced, but identical, pigment, or the natural extract, depending on the requirements of the particular retailer or brand that is selling the farmed fish.

Q. Are antibiotics used in fish farming?
A. Yes sometimes to maintain fish health and welfare. Antibiotics can only be used when prescribed by a veterinarian. Their use in finfish aquaculture is much lower than in land-based animal farming, and a strictly regulated withdrawal period ensures that the active compounds are gone before the fish are sold to consumers. Antibiotic usage has dropped considerably in aquaculture production due to better husbandry techniques and the development and use of effective vaccines.

For all shellfish cultivated in the UK antibiotics are never used. Occasionally, for some species, particularly warm water shrimp production, it may be necessary to use antibiotics under veterinary supervision. Again, strictly enforced withdrawal periods and testing ensure that no residues reach the consumer.

Q. Do farmed fish contain harmful chemical residues?
A. No. Aquaculture is one of the most tightly controlled industries in the UK. A range of chemicals are used in marine aquaculture operations and these can be

categorised as disinfectants, antifoulants and medicines (including vaccines). Strict withdrawal times are followed so that drug residues do not remain when fish and shellfish reach the market.

This use is under strict control. The Scottish Environment Protection Agency (SEPA) issue discharge consents for the use of chemicals on fish farms under The Water Environment (Control of Activities) (Scotland) Regulations 2005. The use and disposal of disinfectants on marine fish farms is carried out in accordance with COSHH regulations.

There are very low levels of industrial chemicals in the environment as a carry over from less well controlled industrial use in the last century. All types of food are monitored and scientists are seeing a steady decrease in the environment each year. The levels found in farmed fish are highest in the fish fed on a wild fish diet but these are still very much lower than the most precautionary safe limits, even if you were to choose to eat the fish every day.

The advice from the Food Standards Agency is unequivocal – the health benefits outweigh any potential risk.

SALMON FARMING

UK salmon industry

Q. How much of the UK's aquaculture industry comprises salmon farming?
A. In Scotland, which is most of UK salmon production, the total output of the aquaculture sector is estimated to be around £367 million per year at farm gate, including around £336 million for farmed Atlantic salmon, £15 million for rainbow trout and £8 million for shellfish. Brown trout, sea trout, halibut and Arctic charr are also farmed in Scotland. Production in England and Wales is just under £50 million.

Q. How is the UK salmon farming industry regulated?
A. The Scottish salmon farming industry is the most tightly regulated aquaculture industry in the world - scrutinised by 10 different statutory bodies and subject to more than 60 pieces of legislation, 43 European directives, three European regulations and 12 European Commission decisions.

Q. Are farmed salmon different from the wild salmon?
A. Farmed and wild salmon have the same ancestors, and are genetically almost identical. Salmon farmers select fish that have demonstrated good performance in terms of health, flesh quality and growth, and use these fish as broodstock.

Nutritional benefits and risks

Q. Are there any nutritional concerns with farmed salmon compared to wild salmon?
A. No. All salmon – wild and farmed – is considered a healthy food choice with proven health benefits. According to the US Department of Agriculture, farmed Atlantic salmon has higher levels of Omega-3 fatty acids than any of the five species of wild Pacific salmon. Farmed Atlantic salmon is readily available in the UK whilst wild Pacific salmon mainly comes from Canada and Alaska.

Q. Is farmed salmon a safe and healthy choice?
A. Yes. The known benefits of eating fish and fish products hugely outweigh any possible risks. An EFSA (European Food Safety Authority) opinion delivered in July 2005 stated that: "Overall the panel concluded that with respect to their safety for the consumer there is no difference between wild and farmed fish." In its decision the EFSA panel focused on possible contamination risks with methylmercury and dioxin-like compounds in salmon, herring, anchovies, tuna, mackerel, pilchards, rainbow trout and carp.

Minute traces of dioxins and PCBs are found in both wild and farmed salmon and, for that matter, also in beef, chicken and dairy products. Dioxins and polychlorinated biphenyls (dl-PCBs) are chemically related compounds identified as persistent organic pollutants (POPs). Dioxins are the unwanted by-products of various combustion and incineration processes, whereas dl-PCBs were specifically manufactured for use in electrical equipment. They are ubiquitous in the environment.

For the majority of people, dietary intake is the main pathway of human exposure to dioxins and dl-PCBs. The contaminants are present in most fat and oil rich products such as milk, meat, fish and eggs. Due to these background levels the FSA advice tells women and children to limit their consumption of oily fish, including salmon, to 2 portions a week. Both feed fish materials and salmon are monitored carefully and levels are well within legal limits and dropping steadily each year.

The levels of dioxins and dl-PCBs in farmed and wild fish derive predominantly from the marine ingredients in their feed. However, through a combination of smarter raw material use, careful sourcing and some removal of contaminants from feed materials, modern feeds all comply with very strict legal limits.

The advice from the Food Standards Agency is unequivocal – the health benefits outweigh any potential risk.

Feed for carnivorous fish

Q. What feed is given to farmed salmon?
A. Much of the protein and oil used in salmon feed comes from small, bony fish that are not in high demand for human consumption, or from fishery by-products such as heads, offal and trimmings. Other sources of nutrients include products derived from grains (wheat and maize); pulses (peas and beans); and oil seeds and oil seed products (soya, rapeseed, sunflower). Essential vitamins, minerals and carotenoids are added to the diet to secure optimal fish health and quality.

Q. Is there an adequate supply of fishmeal for making fish feed?
A. Yes. According to the Food and Agriculture Organisation (FAO) of the United Nations, about 90% of global fishmeal production from whole fish is from oily fish species such as anchovies, mackerel, pilchard, capelin and menhaden. Fishmeal and fish oil is produced from these mostly small bony fish, or from the by-products of seafood processing. Whilst aquaculture production has expanded in recent decades total fishmeal production has remained relatively constant. All the fish stocks used in the product of fishmeal are subject to management controls.

Q. Will the rapid expansion of aquaculture and its demand for fishmeal and fish oil threaten wild fish stocks?
A. No. Fishmeal is used as a feed ingredient in almost all forms of finfish aquaculture requiring feed, even if only at the beginning of the lifecycle. The need to provide fish as feed for other fish is seen as a challenge to the growth of the aquaculture sector. However fishmeal and fish oil are being used more selectively and more efficiently in aquaculture. The overall picture for the future is of more strategic use of fish based feed throughout the growth cycle of the fish and gradual substitution of fishmeal and fish oil, which need not result in undue pressure on feed fish stocks despite continuing fast growth. As alternatives to supplement the supply of fishmeal and fish oil, the aquaculture industry is using vegetable proteins and oils. The development of the IFFO

RS standard will help ensure that fishmeal and fish oil is produced responsibly from managed fisheries.

Q. What is a fish in-fish out (FIFO) feed conversion ratio?
A. A fish in-fish out ratio compares the amount of whole wild fish used in fish feed with the amount of whole fish produced by the fish farm. The International Fishmeal and Fish Oil Organisation (IFFO) estimates that on average producing a tonne of farmed fish (excluding filter feeding species) takes 0.5 tonnes of whole wild fish. For salmon the FIFO ratio is below 2. The use of whole-fish is kept down as nearly 25% of the raw material for fishmeal comes from recycled fisheries by-products, much of which used to be dumped.

Environment and safety

Q. Do salmon farms affect the sea floor beneath farm sites?
A. Yes, there are transient impacts but aquaculture has the lightest environmental effects of any form of large-scale food production. These effects are limited largely to the ocean floor in the immediate vicinity of salmon farms, and are short-term and fully reversible if the site was left fallow. Salmon waste and uneaten food on the ocean floor can cause temporary oxygen reduction and other chemical changes as they decompose.

Q. Do salmon escape from farms?
A. Yes sometimes. Salmon are accidentally released from farms, in the same way that livestock sometimes stray from land farms. Escapes have been dramatically reduced in recent years due to improved cage and mooring designs that can withstand predators and survive severe storms. Advances in fish handling methods help prevent accidental escapes. The industry has developed new codes to share best practices and trained staff to eliminate human mistakes. These advances have been complimented by stringent regulations that require annual inspections.

The industry is actively engaged in research and initiatives to eliminate escapes due to equipment failure and to deter predators such as seals. The industry works very hard to prevent such losses, as each fish lost represents a real loss of money for the farmer. A farmed salmon that is lost into the wild is poorly adapted for survival, and only small proportions of escaped salmon survive.

Q. Why are sea lice mentioned in relation to farmed salmon?
A. Sea lice are naturally occurring marine crustacean (related to shrimp and crab) parasites that can affect all types of wild and farmed fish. Sea lice management is an important issue for both salmon farmers, as well as the wild fishery. Although no direct cause and effect relationship between sea lice, salmon farms and wild salmon has been identified, salmon farms are monitored for sea lice to ensure early detection as a precautionary measure to protect both wild fish and farmed fish health and welfare, and better management practices are being developed.

A common natural method of controlling sea lice is to put wrasse in the cages with the salmon. The wrasse act as cleaner fish by nibbling the sea lice from the salmon without harming the salmon.

Other sea lice treatments involve the use of approved therapeutants, such as SLICE, and a mandatory withdrawal period ensures no residue is present in the final product sold to consumers. Fish farmers follow the 'National Strategy for the Control of Sea Lice on Scottish Salmon Farms' as set out in Annex 8 of the Code of Good Practice and the advice given in the leaflet 'Avoiding Resistance on Sea Lice" referred to in Annex 7 of the same document.

SHELLFISH FARMING

UK shellfish industry

Q. What species of shellfish are farmed?
A. The main shellfish species farmed in the UK are mussels, Pacific oysters (a non-native species, imported from British Columbia under quarantine in the 1960's by Government for the sole purpose of cultivation), together with some native oysters. Small quantities of King and Queen scallops and clams are also cultivated.

Q. How is the UK shellfish industry regulated?
A. All shellfish farms are subject to a statutory process prior to consent and must be registered with the requisite devolved government agency. All commercially harvested shellfish are subject to strict hygiene regulations. The growing waters must be tested on a regular basis for contamination and shellfish flesh monitored and categorised before the shellfish can be harvested or marketed. Most farms operate at the two highest levels, A or B. Under the European Commission's Shellfish Hygiene Directive, Member States must also have algal toxin monitoring programs, which cover all the commercial shellfish production areas. Target maximum levels of toxins are set by the EC and fisheries can be closed to protect the public health if concentrations of toxins exceed these limits.

Q. What are the stages of shellfish farming?
A. There are five stages:

- Seed. The farming process begins with the collection of seed stock from natural spawning, existing wild stocks or from hatchery sources.
- Nursery. Nursery rearing of shellfish begins once the seeds have set and lasts until the juvenile shellfish are ready to be transferred to the grow-out site. Nursery rearing systems are intertidal, suspended in deep water, or built on land or floating rafts with seawater flow-through.
- Grow-out. Once seeds are at the right size, they are removed from the nursery sites, and put into socks, tubes, trays, lantern nets, or set on long lines, in bags, on tables, on the sea floor or the beach.
- Grading and Sorting. To ensure the highest survival and growth rates, it is essential to periodically sort and grade the stock into appropriate sizes. This must be done for oysters, clams or scallops especially during the juvenile stages.
- Harvest. It takes anywhere from 1½ to four years for shellfish to reach harvest size. Harvesting techniques range from hand harvesting to crew-operated harvest machines, and each species of shellfish requires different farming techniques.

Q. What are the different ways to grow shellfish?
Just as there are many species of shellfish, there are many types of shellfish culture: Tray, pole, tube, bag and cage, raft, longline, seabed and intertidal.

Q. Where are the shellfish farms located?
Shellfish farms are mostly located in the South West, the Thames Estuary, North Wales and Scotland.

Nutritional benefits and risks

Q. How are farmed and wild shellfish different?
A. Farmed and wild shellfish have the same ancestors. There is very little difference between wild and cultured shellfish. Both wild and farmed shellfish are filter feeders that consume phytoplankton already in the ocean.

Q. How does the shellfish industry ensure the safety of its product?
A. The shellfish industry together with Regulators applies rigorous water quality and end product standards to ensure the best possible safety standards for all shellfish placed on the market. There are strict rules and monitoring in place to ensure consumer safety. Each batch dispatched has to be accompanied by a health certificate that means all shellfish in the UK should be safe to eat, cooked or raw, when you buy it.

However, these shellfish are filter feeders. This means the water they live in passes through them and they filter their food from the water. So any pollution in the water will build up in the shellfish. Consequently controls are in place to mitigate against such potential contamination. As a result, there is the possibility that live shellfish, such as mussels, clams and oysters can contain viruses and bacteria that may be harmful, so caution should be exercised unless you are certain of their origin, or have an accompanying health certificate, particularly if you intend to eat them raw, or do not cook them thoroughly. They are one of the only foods normally delivered to the consumer alive. Once purchased, it is important that they should be stored correctly and used quickly to avoid any spoilage.

Environment and safety

Q. How important is water quality?
A. Water quality is very important for the production of shellfish and is regulated by two directives. The EC Shellfish Waters Directive (2006/113/EC codified version) seeks to protect or improve shellfish waters in order to support shellfish life and growth and thus contribute to the high quality of shellfish products directly edible by man.

The EU Food Hygiene Regulations lay down specific rules for official controls on products of animal origin intended for human consumption. These controls include a requirement for monitoring and classification of commercial bivalve shellfish production areas. Harvesting sites are monitored and classified A to C according to levels of *E. coli* (faecal indicator bacteria) in the shellfish. Classification then determines the post-harvesting treatment required before bivalve molluscs can be sold for human consumption.

For further information:
http://www.shellfish.org.uk
http://www.iffo.net
http://www.globalgap.org
http://www.ascworldwide.org/
http://www.gaalliance.org
http://ec.europa.eu/agriculture/organic/eu-policy/legislation_en
http://www.scottishsalmon.co.uk
http://www.shetlandaquaculture.com
http://www.britishtrout.co.uk
http://www.bmfa.uk.com
http://www.assg.org.uk
http://www.defra.gov.uk/foodfarm/fisheries/farm-health/aquaculture.htm
http://www.dardni.gov.uk
http://www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish/

See also the Seafish website:
http://www.seafish.org/sea/aquaculture.asp?p=ec339

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