Feature

VET FUTURES

Vets and aquaculture: an evolving relationship

Aquaculture is one of the largest farming sectors in the UK, particularly in Scotland. Although veterinary involvement remains small, vets have proved their worth in the industry. As part of *Veterinary Record*'s continuing series of articles discussing the state of different sectors of the veterinary profession, Ronnie Soutar describes the growth of aquaculture and the evolving relationship between the industry and profession

AQUACULTURE in the UK is dominated, in financial terms, by the Scottish salmon farming industry. Indeed, the size of this industry makes the UK's aquaculture production the largest in the EU. With over 40 million young fish moved into on-growing sea sites every year, annual salmon production in Scotland now exceeds 160,000 tonnes, giving an estimated farm gate value of £677 million in 2013.

Globally, aquaculture is believed to have overtaken wild fisheries in volume terms in 2014. Norway leads the world in salmon production, with an industry approaching 10 times the size of the UK's. However, this is dwarfed by the tonnages of warmwater species produced from extensive freshwater ponds, particularly in Asia. While Vietnam produces about four times as many 'river cobbler' catfish as Norway does salmon, China is by far the largest global aquaculture producer. In 2012, China produced an estimated 23 million tonnes of farmed freshwater fish, with a further million tonnes from marine fish farming.

Across the UK, it is estimated that aquaculture contributes well over £1 billion turnover to the national economy and has generated around 8800 jobs. While those jobs include a wide variety of roles in the farming, processing and service sectors, they do not include many vets.

Veterinary involvement

Fish are not specifically mentioned in the current Veterinary Surgeons Act and this has been interpreted as meaning that the Act does not apply to fish; anyone may diagnose and treat fish diseases. However, fish are covered by medicines legislation so only vets with the animals under their care can prescribe medicines (in the appropriate categories) for farmed fish. Given the relative paucity of medicines with appropriate marketing authorisations, it is also important to remember that only vets can prescribe under the cascade.

The Scottish salmon farming industry produces more than 160,000 tonnes of fish annually

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The above factors meant that in the early development of aquaculture in the UK (and still, to an extent, outwith the salmon sector) veterinary involvement might be described as arm's-length. Farms would be visited in order to establish appropriate contact but most on-farm testing and diagnosis was carried out by non-vets, who would deliver sufficient information for prescriptions to be provided. Back-up support and specialist diagnostics were available through interested academics, most notably in the University of Stirling's Institute of Aquaculture, which also had a major role in postgraduate veterinary education.

Intensification and consolidation within salmon farming, along with the clear realisation that fish health and welfare was firmly linked to company profitability, led to the three big aquaculture companies in Scotland each employing a company vet in the early 1990s. Later that decade, Scotland's first fish-only practice was established by the Fish Vet Group in Inverness. Despite not having a statutory remit, other than in relation to medicines, vets were proving their worth in the front line of the fight against the major disease threats to farmed fish, and that trend has continued.

Salmon production cycle

Fish farms provide an interesting combination of intensive production with extensive exposure. The initial stage of the salmon farming cycle is generally a very controlled phase of production, with the young fish held in freshwater land-based

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Virtually all Scottish farmed salmon are vaccinated against a range of pathogens before leaving freshwater

tanks. Biosecurity is usually good; the most modern of these units employ water recirculation technology which significantly restricts pathogen access. Such units compare well to high-end pig and poultry production systems.

The controlled farm environment, with modern feeds and the ability to manipulate water temperature and perceived day length, allows smolts (the sea-ready stage of the life cycle) to be produced much more quickly than in the wild. Farmed smolts are now put to sea in two annual batches; some will go to sea in the autumn after hatching, while the majority go in the spring, 14 to 15 months after hatching. Farmed smolts will generally be much larger than the wild equivalent, at an average of around 100 g; the trend is ever upward, and smolts of 300 g and above are not uncommon.

Sea farms present a very different and much more challenging environment. The growing fish are contained in pens which now typically consist of a circular plastic collar from which a tubular net hangs. In Scotland, pens of 80 metres in circumference are common and the nets may reach a depth of around 15 metres, although many pens have an even larger volume. A standard farm is made up of groups of such cages and might hold in excess of half a million salmon. The tides and currents will pass through and between the pens, exposing the farmed fish to everything the sea contains.

Pathogens and fish health

Although reared under relatively controlled conditions, fish in their early life stages are threatened by viral, bacterial, fungal and parasitic pathogens. Traditional remedies for these problems may not have greatly involved vets in the past but the possibility of the loss of formalin from an already sparse armoury has recently focused attention on the need to ensure good prescribing practice and effective use of the cascade in order to protect young stock.

It will be appreciated, however, that the principal health challenges to farmed salmon come during the seawater phase. Of course, this is also the stage where individual fish are becoming increasingly valuable, as they approach an average slaughter weight of around 5 kg. To meet some of these marine challenges, virtually all Scottish farmed salmon are vaccinated

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before leaving freshwater. The vaccines have been extremely successful in combating the principal bacterial pathogen, *Aeromonas salmonicida*, to the point that clinical furunculosis is now very rare and the use of antibiotics is minimal.

Protection against viruses has been more variable but there is no doubt that both morbidity and mortality due to infectious pancreatic necrosis and pancreas disease have been greatly reduced through immunisation. Emerging viral pathogens are, however, an ongoing problem, through exposure to wild fish and other aquatic organisms, and the industry has been periodically hit by notifiable viral diseases and the associated controls. While this has increased the involvement of vets in the industry (for example, through the Scottish Chief Veterinary Officer's office and the APHA), thankfully there are no zoonotic diseases which affect farmed salmonids, so the profession's role in public health is focused primarily on issues such as ensuring an absence of residues or contaminants in aquaculture products.

Gill disease has been an emerging and significant issue in the current decade. As fish gills have both an oxygen exchange and waste excretion function, this might be considered the equivalent of a combined pneumonia and nephrosis in mammalian livestock. Fish with diseased gills fail to thrive and may die when undergoing routine husbandry procedures. The cause of this problem is unclear – amoebae are certainly involved in one particular syndrome – and a great deal of investigative work and veterinary thought is currently being exerted. Treatment options are limited, although hydrogen peroxide has proven useful, and the issue is currently largely being managed through good husbandry and stress avoidance.

The aquaculture pathogen which most people have heard of and many have an opinion on is the sea louse. Lice have a complex life cycle, and can multiply rapidly in farmed populations, and treatment is complicated by a number of practical and regulatory issues. The limited number of available chemotherapeutants are administered either in-feed or as a bath. The former method carries the risk of not delivering an accurate dose to each fish, particularly as sick (including heavily parasitised) fish lose appetite. Bath treatments involve the enclosure of the net pens in an impervious sheet, followed by the addition of the diluted therapy. Calculating treatment volumes is tricky even under good conditions, while treatment at the appropriate time may be impossible if tidal or weather conditions are wrong. In addition, discharge consents for medicines usage can be so restrictive that the ideal of treating a whole farm in the shortest possible time (to avoid parasites moving from treated to untreated pens) may be impossible. Indeed, discharge consents may in some cases even prevent the use of a fully licensed sea lice treatment. Small wonder, then, that the industry and its vets struggle against the development of drug resistance in these ectoparasites.

Lumpsuckers are being used as 'cleaner fish' to help control sea lice in salmon production

Taking samples for analysis: bacteriology and histopathology, together with observation, history taking and data analysis, are key diagnostic tools for the salmon vet

Finding novel, husbandry-based approaches to sea lice control is therefore an ongoing and significant aspect of fish health management. Having been first trialed in the late 1980s, 'cleaner fish' are now making a significant impact in this area. A number of companies are gearing up to produce the fish species that have shown most promise in removing lice from salmon. These are mainly wrasse (particularly *Labrus* species) and, more recently, lumpsuckers (*Cyclopterus lumpus*). Improved methods for the production of juvenile cleaner fish and for providing effective microhabitats for them within sea pens have greatly improved their effective deployment and the sustainability of this means of ectoparasite control.

However, the health and welfare of the cleaner fish themselves have to be managed. We are at an early stage of discovering which pathogens affect them, both in nature and when farmed. As wrasse and lumpsuckers may be deployed together within a salmon pen, the interaction of three different hosts and their pathogens in this polyculture also has to be understood and managed by the vets under whose care they come.

Quality produce and fish welfare

The retail sector appears often to be presented as the villain in the story of livestock production. Certainly the influence of supermarket chains on farm-gate prices is similar in salmon farming as in other sectors. However, there is a much more positive side to the involvement of big retailers in the development of intensive aquaculture.

The supermarkets' drive for a year-round supply of fish of consistent quality can be seen as highly significant in the massive rise in the sale and consumption of farmed, as opposed to wild, salmon over the past three decades. Recognition of the importance of fish health and welfare to the consistency and quality of the end product is central to this story and the role of vets has been enhanced by it.

The industry now operates under a number of quality assurance schemes, most of which give prominence to fish welfare. The vast majority of farms are operated by members of the Scottish Salmon Producers Organisation and therefore comply with that organisation's code of good practice. This code, available online, emphasises the key importance of veterinary involvement and requires all participant farms to have a veterinary health plan and biosecurity plan in place. Similarly, while the RSPCA is not operationally active in Scotland, the major producers of Scottish salmon have signed up to the RSPCA assured welfare scheme (formerly Freedom Foods), placing fish welfare and vets centrally in the development of the industry.

Technological developments

Bacteriology and histopathology, in support of the basic veterinary skills of observation, history taking and data analysis, have been the main tools in the salmon vet's box. 'Histo' remains crucial and is now enhanced by the ability to digitally share and compare slides. With a relatively low number of vets active in the field and the risks which isolation can bring to diagnostic rigour, the means to create virtual diagnostic communities is a significant step forward.

A range of other diagnostic technologies are now also routinely employed. As viruses have increased in significance, so PCR has become an everyday part of the armoury. Diagnostic imaging, mainly radiography, is used in the investigation of suspected non-infectious diseases as well as in screening skeletal health at key times in the production cycle.

Specialist knowledge continues to develop within academic institutions and is available to support the field diagnostician, in areas including parasitology and epidemiology. The Scottish fish vet is blessed with a wealth of bioscientific expertise on the doorstep; the Moredun Institute, Scotland's Rural College (formerly SAC) and both Scottish vet schools all have an ongoing interest in aquaculture, as do the universities of Stirling, Aberdeen and St Andrews, as well as the University of the Highlands and Islands, among others.

As in other sectors, genomics (and a variety of other '-omics') are becoming important in fish health. The Roslin Institute, for example, has worked with a leading supplier of salmon eggs and juveniles on a project aimed at enhancing the genetic resistance of farmed fish to specific diseases. While genetic modification is not on the agenda, we are entering an era where the salmon we farm are becoming genetically adapted to the farmed environment, rather than being wild fish in pens; this can only be positive in terms of their welfare.

Other sectors and the global picture

Apart from ornamental fish production, the only other finfish farming of significance

The freshwater phase of salmon farming generally provides a controlled high-tech environment

in the UK is of rainbow trout. Some 16,000 tonnes are produced annually from around 350 farms (British Trout Association figures), the vast majority being in freshwater. In this smaller, less well funded and more fragmented industry, veterinary participation is not at the level it is in salmon aquaculture. However, local practitioners are involved in supporting trout farms and the Fish Veterinary Society counts a number of prominent and active trout vets among its members.

Globally, veterinary involvement in aquaculture varies with sector. The more intensive the production, the more likely it is that the support of vets is requested and that the costs of intervention can be justified. Again, the impact of retailers (and, indeed, consumers) is significant; producers anywhere in the world wishing to sell farmed fish into lucrative Western and developing Oriental markets realise the importance of quality compliance and this can drive a focus on fish health and welfare.

Continuing evolution

Finfish aquaculture is growing globally, but that growth is currently stalled in the UK. In the past, the industry's development here has stuttered from time to time, usually due to one of two constraining factors – technological or biological. Advances in technology have seen a move to larger, more robust pens, allowing farming to take place in exposed sites which may carry the advantage of consistently better water quality. Biological advances have included improved nutrition and advances in breeding but have very largely centred on meeting the variety of fish health challenges.

Now, however, the constraint is mainly on physical expansion, either in finding new farm sites or in significantly growing existing sites. Fish health does play a part here; objections to applications for expansion often centre on the perceived risk of fish disease (and particularly sea lice) spreading from farmed to wild fish. Vets have a significant role in demonstrating that high standards of fish health can be effectively maintained, in an environmentally friendly manner, to overcome such fears and allow the industry to grow sustainably to meet the ever-increasing demand for farmed fish.

Aquaculture, in the UK and worldwide, does not provide a high percentage of veterinary jobs but the vets who are involved generally have interesting, innovative and relatively well-paid careers. As in all livestock sectors, it is the vet's ability to make a demonstrable difference to productivity and profitability which is the key to the profession's involvement. There are frustrations, particularly when it comes to the range of available treatments, but there are few fish vets who regret dipping a toe in the water.

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Further reading

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