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in

Rogers C. (ed.), Basurco B. (ed.).

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Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 86

2009

pages 29-34

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=801059>

To cite this article / Pour citer cet article

Çagirgan H. **The use of veterinary drugs and vaccines in Turkey.** In : Rogers C. (ed.), Basurco B. (ed.). *The use of veterinary drugs and vaccines in Mediterranean aquaculture.* Zaragoza : CIHEAM, 2009. p. 29-34 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 86)



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The use of veterinary drugs and vaccines in Turkey

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Abstract. Aquaculture is a relatively new industry for Turkey in comparison with terrestrial animals that started with rainbow trout culture in the 1970s. Turkey is the fifth biggest aquaculture producer in the Mediterranean, after Spain, France, Italy and Greece. Main cultured fish species are rainbow trout, sea bass and sea bream. *Lactococcus garvieae* infection, ERM, listonellosis and RTFS are the major diseases of rainbow trout, and IPNV and VHS have also been diagnosed. Vibriosis, pasteurellosis and tenacibaculosis are serious threatening bacterial infections of sea bass and sea bream. The most important parasites for cultured sea bass and/or sea bream are *Cryptobia* sp., *Trichodina* sp., *Cryptocaryon irritans*, *Amyloodinium ocellatum*, *Myxidium* spp., *Diplectanum aequans*, *Meinertia oestroides*, *Lernanthropus kroyeri*, *Caligus minimus*, and *Furnestinia echeneis*. Fish vaccines are imported but vibriosis, lactococcosis and ERM vaccines are also produced by a private company. Medicines containing oxytetracycline, potentiated sulphonamide, and florphenicol are produced for fish species. Turkey follows EC regulations, including 2377/90 and those related to chemotherapeutant residues. VHS, IHN, SVC and BKD are notifiable fish diseases.

Keywords. Aquaculture – Fish disease – Treatment – Regulation.

Utilisation de médicaments vétérinaires et de vaccins en Turquie

Résumé. L'aquaculture est une industrie relativement nouvelle en Turquie en comparaison avec les animaux terrestres, et qui a commencé par l'élevage de la truite arc-en-ciel dans les années 1970. La Turquie est le cinquième producteur aquacole en Méditerranée, après l'Espagne, la France, l'Italie et la Grèce. Les principales espèces aquacoles sont la truite arc-en-ciel, le bar et la daurade. L'infection par *Lactococcus garvieae*, ERM, listonellose et RTFS sont les principales maladies de la truite arc-en-ciel, et on a également diagnostiqué IPNV et VHS. Les vibrions, pasteurelloses et ténacibaculoses sont des infections bactériennes qui constituent des menaces sérieuses pour le bar et la daurade. Les parasites les plus importants pour le bar ou la daurade d'élevage sont *Cryptobia* sp., *Trichodina* sp., *Cryptocaryon irritans*, *Amyloodinium ocellatum*, *Myxidium* spp., *Diplectanum aequans*, *Meinertia oestroides*, *Lernanthropus kroyeri*, *Caligus minimus*, et *Furnestinia echeneis*. Des vaccins pour poissons sont importés mais les vaccins contre la vibriose, la lactococcose et l'ERM sont également produits par une compagnie privée. Des médicaments contenant de l'oxytétracycline, sulphonamide potentialisée, et florphenicol sont produits pour les espèces piscicoles. La Turquie observe les réglementations de la CE, y compris le règlement 2377/90 et ceux liés aux résidus chimiothérapeutiques. VHS, IHN, SVC et BKD sont des maladies des poissons à déclaration obligatoire.

Mots-clés. Aquaculture – Maladies des poissons – Traitement – Réglementation.

I – Introduction

Turkey is situated between a latitude of 42° 06' - 35° 51'N and a longitude of 25° 40' - 44° 48'E. Three sides of Turkey are bordered by sea and it has a large potential for aquaculture, since the total length of the Turkish coastline is 8,333 km. The total area of natural lakes with a surface area of 5 km² and over is 8,903 km². The area of dammed lakes with a surface area of 5 km² and over is 3,368.8 km² (Anon., 2009).

Aquaculture is a relatively new industry for Turkey in comparison with other farmed animals but it is the fifth largest aquaculture producer country in the Mediterranean after Spain, France, Italy

and Greece. Aquaculture in Turkey was started with rainbow trout (*Oncorhynchus mykiss*) in the 1970s. Approximately ten years later, sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*) began being produced in the 1980s by catching larvae and fry from natural resources. Hatcheries were then established and they began to grow out sea bass and sea bream larvae. Eleven hatcheries are currently producing sea bass and sea bream larvae. Sea bass and sea bream fry production in 2007 was approximately 245 million. Total production by culture was 45,450 tonnes in 1997, and it reached 139,873 tonnes in 2007 (Anon., 2009).

II – Production

According to the State Institute of Statistics data, total fish production was 772,323 tonnes in 2007, which included cultured fish. A total of 47,214 tonnes are exported. Cultured fish and shellfish production was 139,873 tonnes, which was 18.11% of the total production. The main cultured fresh water species is currently rainbow trout (*Oncorhynchus mykiss*) with 58,433 tonnes (approximately 99% of total cultured fresh water fish). Total cultured marine fish and shellfish was 80,840 tonnes in 2007 and 41,900 tonnes of this production was sea bass (*Dicentrarchus labrax*) (51.83%), 33,500 tonnes was sea bream (*Sparus aurata*) (41.44%), and 2,740 tonnes was trout (3.39%) (Anon., 2009). Recently, *Acipenser* sp., *Salmo trutta labrax*, *Anguilla anguilla*, *Pagrus* sp., *Epinephelus aeneus*, and *Diplodus puntazzo* have been grown mostly for research based production.

The total number of fresh water and marine fish farms is 1,312 and 339, respectively, and 100 marine farms have been producing in earthen ponds. Fresh water and marine aquaculture productions are given in Tables 1 and 2 for the period 2002-2007.

Table 1. Fresh water fish production (Anon, 2009)

Species/tonnes	2002	2003	2004	2005	2006	2007
Rainbow trout	33,707	39,674	43,432	48,033	56,026	58,433
Carp	590	543	683	571	668	600
Total production	34,297	40,217	44,115	48,604	56,694	59,033

Table 2. Marine fish production (Anon, 2009)

Species/tonnes	2002	2003	2004	2005	2006	2007
Sea bream	11,681	16,735	20,435	27,634	28,463	33,500
Sea bass	14,339	20,982	26,297	37,290	38,408	41,900
Trout	846	1,194	1,650	1,249	1,633	2,740
Mussels	2	815	1,513	1,500	1,545	1,100
Others	-	-	-	2,000	2,200	1,600
Total	26,868	39,726	49,895	69,673	72,249	80,840

1. Production techniques for sea bass and sea bream

Intensive, ultraviolet-disinfected clear water and closed circuit rearing techniques are used for the production of sea bass and sea bream larvae. The capacity of sea bass and sea bream larval production has been increasing. The total number of sea bass and sea bream larvae produced was 185 million, 190 million, and 240 million in 2005, 2006 and 2007, respectively. The number of sea bass and sea bream larvae produced in 2007 was 150 million and 90 million, respectively.

Larvae are weaned onto formulated feeds by 30-35 days post hatch. Larvae tanks are 4-20 m³ with stocking densities of 50-300/l at the pre-larval stage. *Brachionus plicatilis* and *Artemia* are used as exogenous prey, whereas endogenous prey is not used for feeding. Commonly cultured species of microalgae include *Nannochloris* spp., *Nannochloropsis oculata*, *Chlorella minutissima*, *Isochrysis* sp., and *Tetraselmis* sp. Larvae are grown in inland tanks until they reach 2 g at a stocking density of 3,000-5,000 fry/m³ and they are then moved to marine cages. HDP and off-shore type cages are used to grow-on sea bass and sea bream juveniles. Wooden material cage production is rare. The stocking density of fish is approximately 20 kg/m³ when they reach 300-400 g.

2. Production techniques for rainbow trout

The farming cycle of rainbow trout can be subdivided into three stages: incubation in the hatchery, fry rearing and on-growing. Some farmers prefer to buy eggs from Turkish hatcheries but others prefer to buy eyed eggs from overseas (e.g. South Africa, United Kingdom, USA). Rainbow trout eggs are hatched in trays containing 5,000-10,000 eggs in the hatcheries, and the fry are then moved to concrete ponds at a stocking density of 25 kg/m³ for grow-on. Trout are sold when they reach 250-300 g. Depending on consumer demand, astaxantine may be added to the feed to obtain a pink flesh colour. Some trout farms prefer to buy 15-20 g juveniles and grow out in hexagonal wooden or HDP cages in dammed lakes. However, most lake water temperatures are above 20 °C by the end of April-May.

III – Common diseases

1. Main marine fish diseases

The main bacterial diseases of sea bass are vibriosis, caused by *Listonella anguillarum* serotype O1, and pasteurellosis. However, a few cases have been caused by *V. ordalii* (Çağırğan and Yürekliürk, 1996), and *Photobacterium damsela* var. *piscicida* has been isolated from sea bream and sea bass (Çağırğan, 1993; Candan *et al.*, 1996; Tanrikul and Çağırğan, 1997). *Pseudomonas anguilliseptica* infection is rarely observed in sea bream but *Tenacibaculum maritimum* infection is serious in most hatcheries. Suspected cases of novavirus infection were observed in 1998-1999, however, the symptoms disappeared.

Amyloodinium ocellatum (Çağırğan and Tokşen, 1996), *Cryptobia* sp., *Trichodina* sp., *Cryptocaryon irritans*, *Diplectanum aequans*, *Meinertia oestroides*, *Lernanthropus kroyeri*, and *Caligus minimus* are observed in sea bass. *Furnestinia echenenis*, *Microcotyle chrysoptarii* and *Meinertia oestroides* are problems in sea bream (Tokşen, 1999). Lymphocystis is common to all juvenile sea bream and causes very low level mortality. *L. anguillarum*, *V. alginolyticus* and *T. maritimum* have also been isolated (Çağırğan and Yürekliürk, 1996).

2. Main fresh water fish diseases

The main disease for rainbow trout until 2000 was ERM caused by *Yersinia ruckeri* (Çağırğan and Yürekliürk, 1991; Timur and Timur, 1991; Çağırğan, 1996). Serotyping of *Yersinia ruckeri* isolated from rainbow trout farms in Western Anatolia has shown that strains were serotype O1a (Çağırğan, 1998). However, *Lactococcus garvieae* infection has been seriously threatening trout farms since 2000. The disease was observed firstly in 1993 in Turkey and was named *Enterococcus*-like bacteria (Çağırğan and Tanrikul, 1995). The disease was limited to two farms at Karacasu and Denizli until 1997 and then it was observed in Çameli (Çağırğan and Tanrikul, 1997). Lactococcosis was sporadic until the disease spread to a hatchery in 1999. Subsequently, the disease was observed with a high level mortality in mid-2000 following increasing water temperatures (Diler *et al.*, 2002).

There have been some reports of bacterial kidney disease (BKD) in Turkey. However, there have been no observed symptoms or isolates of *Renibacterium salmoninarum* from thousands of diseased rainbow trout sent to our laboratory from all over Turkey since 1990. The first questionable report of BKD was in 1977 (Halıcı *et al.*, 1977) Researchers were able to grow the bacterium on Ordal-Earp medium incubated at 25 °C for 72-96 hours but this seems a short time for isolating *Renibacterium salmoninarum*. The second suspected BKD outbreak was reported from Eastern Anatolia, and the researcher used 10% sheep blood containing standard agar for isolation (Sarıeyüboğlu *et al.*, 1985). However, it is known that *Renibacterium salmoninarum* can only grow in the presence of L-cysteine on bovine serum enriched media (Austin and Austin, 1989). Recently, *Renibacterium salmoninarum* was isolated from diseased Black Sea salmon (*Salmo trutta labrax*) (Savas *et al.*, 2006). However, no repeat outbreak or confirmation report has been produced to date.

Furunculosis is a serious disease of rainbow trout in most countries. However, even though there are some reports of the isolation of *A. salmonicida* (Kirkan *et al.*, 2003) from rainbow trout from the Aydın district, there is no confirmatory data. Recently, *L. anguillarum* serotype O1 was isolated from two rainbow trout farms (Çağırğan, unpublished data) and it has spread to most of the other rainbow trout farms. RTFS has also caused serious losses in rainbow trout (Çağırğan, 1997).

As in other countries, *Ichthyophthirius multifiliis* and *Ichthyobodo* sp. are major parasitic problems in trout fry. However, good health management techniques and treatment with formaldehyde has been shown to be quite effective. There is no report of *Myxosoma cerebralis* from the western part of Turkey.

The IPN virus genome was determined by RT-PCR (Candan, 2002). IPN virus (IPNV) was isolated first from diseased trout fry (Degirmenci *et al.*, 2007) and all hatcheries are now contaminated with IPNV. VHS virus was first isolated from diseased rainbow trout farms located in the Bolu district in March 2006 (Çağırğan, unpublished data). However, there is no reported isolation for IHN virus and SVC virus.

IV – Vaccines and vaccination

Recently, a private company has begun producing licensed fish vaccines against vibriosis, lactococcosis and ERM in Turkey.

Most of the fish vaccine producing companies are represented in Turkey. Imported vaccine from these companies in 1999, 2000, 2001 and 2002 was 29,860,000, 56,077,000, 49,595,000 and 32,905,000 doses, respectively (H. Tanrıverdi, pers. comm.).

V – Diagnostic services and treatment of fish diseases

All Fisheries Faculties and some of the Veterinary Medicine Faculties have a fish disease laboratory and most of them accept diseased fish for routine diagnostic purposes. The Veterinary Control and Research Institute laboratories at Bornova-Izmir, Pendik-Istanbul and Etilik-Ankara have diagnostic facilities for fish diseases. Laboratories at the Veterinary Control and Research Institute Laboratories in Bornova and Pendik, as well as the Ege University Fisheries Faculty, are capable of routinely examining fish for virus diseases.

There are some raw data published by several researchers but no epidemiological surveys for bacterial parasitic and viral fish diseases. Consequently, there is no disease map for establishing epizootiological zones. However IHN, VHS, SVC and BKD are notifiable fish diseases in Turkey (Anon, 1989; Anon, 2004; Anon, 2007).

Oxytetracycline, potentiated sulphonamides, and florphenicol are registered by the Ministry of Agriculture and Rural affairs for fish disease treatment.

The Bornova Veterinary Control and Research Institute regularly checks prohibited drug and antibiotic residues by screening with ELISA and chromatographic techniques. Turkey is classified as a Third Country by the EC and is included in List 1 for aquaculture purposes. Turkey has been following all the EC regulations. According to the regulations, using stilbenes, anabolic steroids, *Aristolochia* spp. and its derivatives, chloramphenicol, chloroform, chlorpromazine, colchicine, dapsone, dimetridazole, metronidazole, nitrofurans, and ronidazole are prohibited. In addition, malachite green should not be present in flesh.

VII – Constraints and needs for fish farmers

There are serious problems for marketing fish. While the cost of feed, labour and energy are increasing, market prices are decreasing or are static. The market price of a portion-sized (300-400 g) sea bass and sea bream is about 3.5-4 US \$/kg. However, the cost of feed for sea bass and sea bream is about 0.84-1 US\$/kg. Portion-sized (250-300 g) rainbow trout prices are about 1.5-2 US\$. The cost of fish feed is 0.7-1 US \$/kg for rainbow trout, depending on quality.

The current development of a residue monitoring program with withdrawal periods has put serious restrictions on the ability of the farmer to carry out his business. On the other hand, the financial problems and the global economical crisis affecting most farmers have been causing recession for farmers.

1. Constraints on drug prescription - a veterinary view point

Veterinary control of fish diseases in rainbow trout applies particularly to treatment of bacterial diseases (e.g. yersiniosis, lactococcosis, RTFS, motile aeromonads, pseudomonads), as well as the parasitic diseases white spot and ichthyobodiasis. In sea bass and sea bream, vibriosis, pasteurellosis, myxobacteriosis and parasitic diseases (e.g. *Cryptobia* sp., *Trichodina* sp., *Cryptocaryon irritans*, *Amyloodinium ocellatum*, *Diplectanum aequans*, *Meinertia oestroides*, *Lernanthropus kroyeri*, *Caligus minimus*, *Furnestinia echenenis*, and *Microcotyle chrysophrii*) all require treatments. Most of the bacterial diseases can be treated by antibiotics and there are some licensed medicines for sea bass, sea bream and trout. Development of resistance is a serious problem. Most of the recent isolates of *L. anguillarum* are resistant to oxytetracycline, potentiated sulphonamides and flumequine, and all of the *Lactococcus garvieae* strains are resistant to the antibiotics previously used (e.g. oxytetracycline, potentiated sulphonamides, flumequine, ampicillin, amoxicillin, enrofloxacin and erythromycin).

Some parasitic diseases can be treated with fresh water/salt water or formaldehyde baths, whereas other parasites require the use of insecticides. Availability of only a few licensed fish medicines has resulted in extralabel use of licensed veterinary medicines and the veterinarian takes responsibility for prescribing such medicines, although this causes a lot of paper work.

Mixing pelleted feed with a medicine can cause palatability problems, although this may be corrected by mixing with fish oil.

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