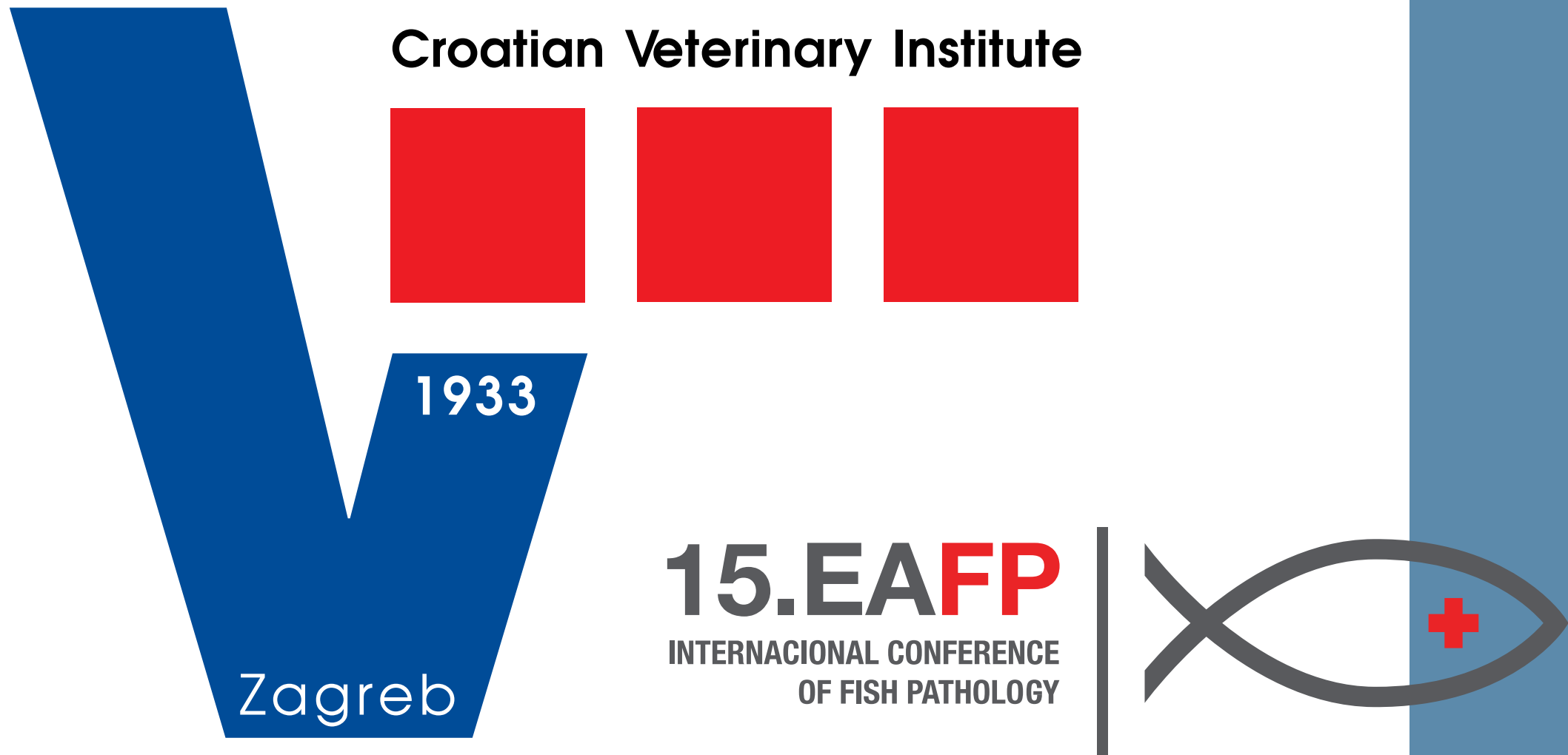


OVERVIEW OF MOST IMPORTANT DISEASES AFFECTING RAINBOW TROUT CULTURE IN CROATIA FROM 2005. TO 2010.

D. Oraić^{1*}, S. Zrnčić¹, I. Lojkić¹, I. Mladineo²

¹Croatian Veterinary Institute, Zagreb, Croatia

²Institute of Oceanography and Fisheries, Split, Croatia



Rainbow trout (*Oncorhynchus mykiss*) is a main salmonid fish species cultivated in Croatia. There are twenty seven freshwater rainbow trout (*Oncorhynchus mykiss*) farms and two rainbow trout marine cages. Systematic health surveyance in Croatia was performed on the majority of those in the period between 2005 and 2010 and this paper derives its results. Diseases caused by bacteria like rainbow trout fry syndrome (RTFS), yersiniosis, furunculosis, vibriosis, motile *Aeromonas septicemia*, *Pseudomonas* infection and bacterial kidney disease were recorded. Infections caused by *Flavobacterium psychrophilum*, *Yersinia ruckeri*, *A. hydrophila*, and *A. salmonicida* occurred most frequently, but a few outbreaks of *Renibacterium salmoninarum* were also recorded. Clinical appearance of red mark syndrome associated with *Flavobacterium* sp. was recorded on two farms recently. Enteric redmouth disease (yersiniosis) was recognized in both growing and adult fish with different clinical appearance. Mainly juvenile rainbow trouts were affected by RTFS and acute form of furunculosis cased by *Aeromonas salmonicida* subsp. *salmonicida*. Fifty seven bacterial isolates were phenotypically identified in 249 fish. Most of the bacteria were isolated in spring and summer fewer in fall and winter. Occurrence of parasites was recorded occasionally without serious impact on fish health. Moreover, infection with infectious pancreatic necrosis virus (IPNV) became enzootic in several farms.

Introduction

Rainbow trout (*Oncorhynchus mykiss*) is a main salmonid fish species cultivated in Croatia (Table 1.). There are twenty seven freshwater rainbow trout (*Oncorhynchus mykiss*) farms and two rainbow trout marine cages farms (MPRRR, freshwater fish; <http://www.mps.hr/default.aspx?id=6522>, 2011.).

FRESHWATER FISHING, 2005. / 2010.*				
PRODUCTION OF MARKET SIZE FISH, 2005. / 2010.		Indices		
		2005.	2010.	2005. / 2010.
Total in tons	Part in trout production in tons			
2005.	4 303	1 301	30	
2010.	5 048	2 492	49	192
2005. / 2010.				117

*Croatian Bureau of Statistics, First Release, 3rd of June 2011.

A variety of diseases and parasites were observed during the period from 2005 to 2010 and they are summarised in the tables (Table 2, 3 and 4.). The samples subjected to diagnostic procedures were collected at the fish farms either because farmers noticed mortalities in different production units or as samples submitted through official programme of notifiable diseases control.

Material and methods

Samples

Samples submitted to the laboratory were usually accompanied by notes describing the situation on the farm and observed changes of behaviour. Some of analysed samples were submitted for control of viral diseases namely VHS and IHN.

Diagnostic procedure

Anamnesis-provided by owner or officials usually targets the course of diagnostic procedures but macroscopical examination of external and internal organs as well as microscopical examination of gill and skin scrapings are regular procedures. According to those findings the procedures are followed by bacteriological examination on non specific or specific bacteriological media like TSA, Marine agar, BA etc. Bacterial isolates are identified using BBL (Becton&Dickinson, USA) or API systems (bioMerieux, inc., France). Tissues intended for histological examination are subjected the routine histological procedures. Diagnosis of viral diseases is performed by isolation of virus on the different cell cultures (EPC, BF2, FHM, CHSE etc.) and identification using ELISA, IFAT or PCR.

Discussion

Bacterial diseases are the most often causing problems in rainbow trout farming. Usually medicated feed stop the mortalities but the step forward should be done and attention should be directed toward prevention. This is the most important approach which includes good hatchery sanitation by restricting access, installing disinfectant footbaths and disinfecting equipment reduces the exposure of vulnerable fish to disease-causing agents, immunoprophylaxis by non-specific immunomodulators and specific vaccines.

References

- Anderson B.G.: *Atlas of Trout Histology*, Wyoming Department of Fish and Game, 1974.
- Austin B., D.A. Austin: *Bacterial Fish Pathogens Diseases of Farmed and Wild Fish*. Springer-Praxis Books, Chichester, Fourth Edition, 2007.
- Cone D.K.: *Monogenea (Phylum Platyhelminthes)*. (Ed.), P.T.K. Woo Fish Diseases and Disorders. Volume. 1. Protozoan and Metazoan Infections. CABI, London 1995.
- Dickerson H.W. and D.L. Dawe: *Ichthyophthirius multifiliis* and *Cryptocaryon irritans*. (Ed.), P.T.K. Woo Fish Diseases and Disorders. Volume. 1. Protozoan and Metazoan Infections. CABI, London 1995.
- Fijan N.: *Zaštita zdravlja riba III*, Poljoprivredni fakultet u Osijeku, Osijek 2006.
- Lom J.: *Trichodinidae and Other Ciliates (Phylum Ciliophora)*. (Ed.), P.T.K. Woo Fish Diseases and Disorders. Volume. 1. Protozoan and Metazoan Infections. CABI, London 1995.
- Paperna I.: *Digenaea (Phylum Platyhelminthes)*. (Ed.), P.T.K. Woo Fish Diseases and Disorders. Volume. 1. Protozoan and Metazoan Infections. CABI, London 1995.
- Roberts R.J.: *Fish Pathology*, Bailliere Tindall, London, Second edition, 1989.
- Wales J.H.: *Microscopic Anatomy of Salmonids*. An Atlas, United States Department of the Interior, Resource Publication 150, 1983.

Results

All diagnosed diseases and their characteristic are summarized in Tables 2., 3. and 4. and shown on Figures.

Table 2. Diagnosed parasitic diseases during period from 2005 to 2010.

PARASITIC DISEASE/ AGENT Order by impact	OCCURRENCE	OBSERVED SYMPTOMS	INTENSITY/ MORTALITY
White Spot Disease <i>Ichthyophthirius multifiliis</i>	Early at spring; Most often at temp. below 15° C	During routine sampling and associated to mortalities; white patches on body; lethargic; trying to eliminate parasites by rubbing on side of tank	Sometimes very intensive; mortalities 30%-50% on fry
Ichthyodoodosis (formerly Costiasis- <i>Costia</i> sp.) <i>Ichthyobodo necator</i>	Occasionally; In case of high density of fish and puddle water (stom)	One of the most frequently found parasites in routine examinations and with mortalities in hatcheries, slime on skin and gills which contains parasite	No mortalities
Trichodinosis <i>Trichodina</i> sp.	Occasionally; high density of fish and puddle-water (stom)	The most frequently found parasitosis in the survey	Rarely low mortalities on fry
Dactylogiriosis <i>Puik Dactylogira</i> sp.	Very often finding	Parasites attached to gills; leaving lesions that are attacked by bacteria and <i>Saprolegnia</i>	No mortalities; solitary parasite or low prevalence
Gyrodactylidiosis <i>Puik Gyrodactylus</i> sp.	Very often finding	Parasites attached to caudal and anal fins body and fins erode, leaving lesions that are attacked by <i>Saprolegnia</i>	No mortalities; solitary parasite or low prevalence

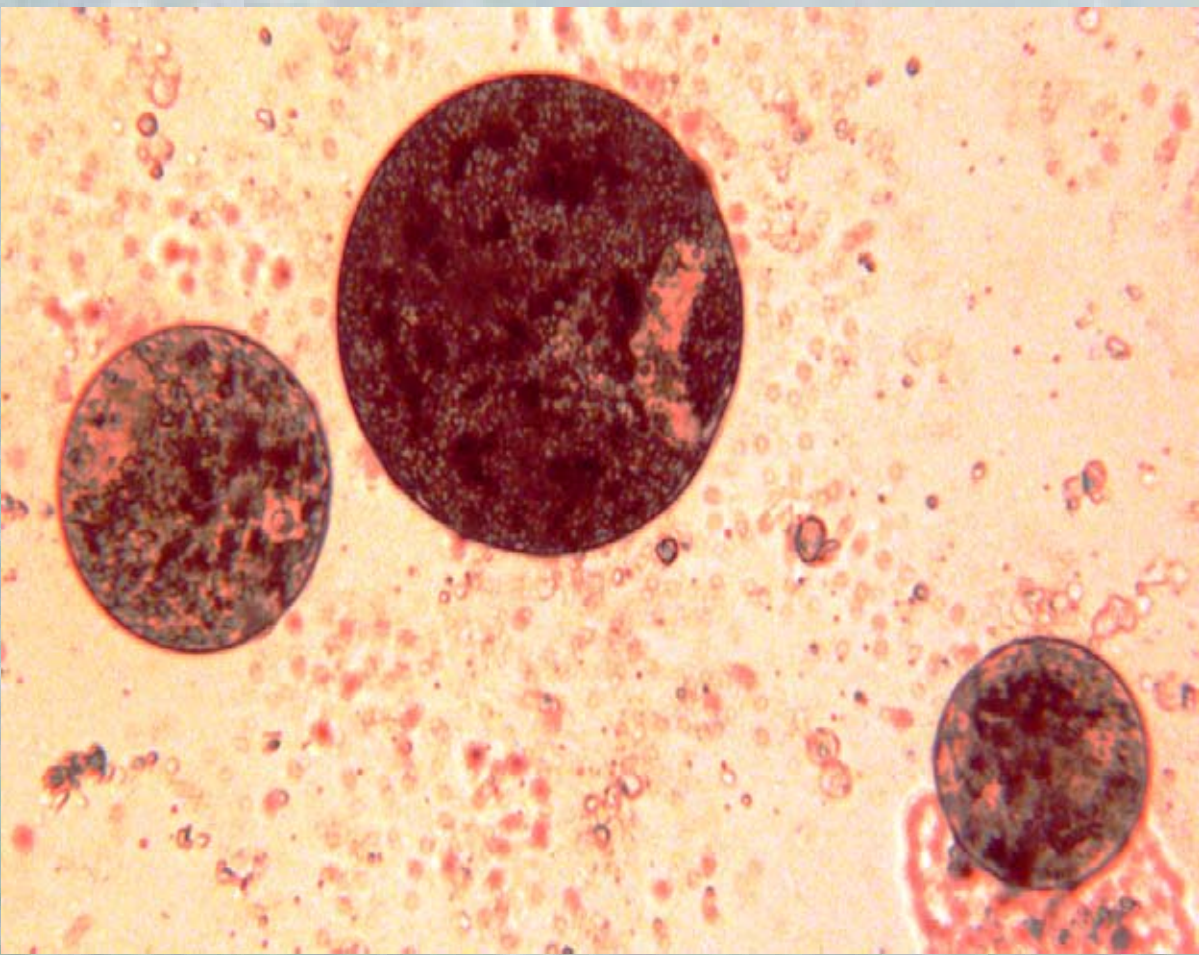


Fig. 1 *Ichthyophthirius multifiliis* from the skin of rainbow trout.



Fig. 2 *Ichthyobodo necator* from gills.

Table 3. Control and findings of viral diseases during period from 2005 to 2010.

VIRAL DISEASE/ AGENT Order by impact	OCCURRENCE	The clinical signs and lesions	MEASURES
Infective Pancreatic Necrosis IPNVirus Biviratus	Every year on same fish farms after movement by from hatchery to farm	Affected fish dark pigmented, rotte bodies while swimming, without mortality; distended abdomens and exophthalmus, the presence of a gelatinous material in the stomach and anterior intestine; mucoid fecal casts, hemorrhages in gut, primarily in pyloric ceca. Histologically, necrosis of the pancreatic acini, gut mucosa, and renal hematopoietic elements. Inflammatory infiltrate is usually observed around the pancreatic acini.	No mortalities associate with virus; assessment; no treatment available; eradicate disease by removal of infected stock
Infective Haematopoietic Necrosis IHN Virus Rhabdovirus	Single outbreak in 2005, in quarantine, import fry	The disease is observed in the fry. Fry were lethargic or apyretic, dark pigmentation, anemia and pale gills, exophthalmus, abdominal distension, and fecal cast were seen. Hemorrhage on skin and above the lateral line.	Partial stamping out follow OIE standards and program
Viral Haemorrhage Septicemia VHS Virus Rhabdovirus			program

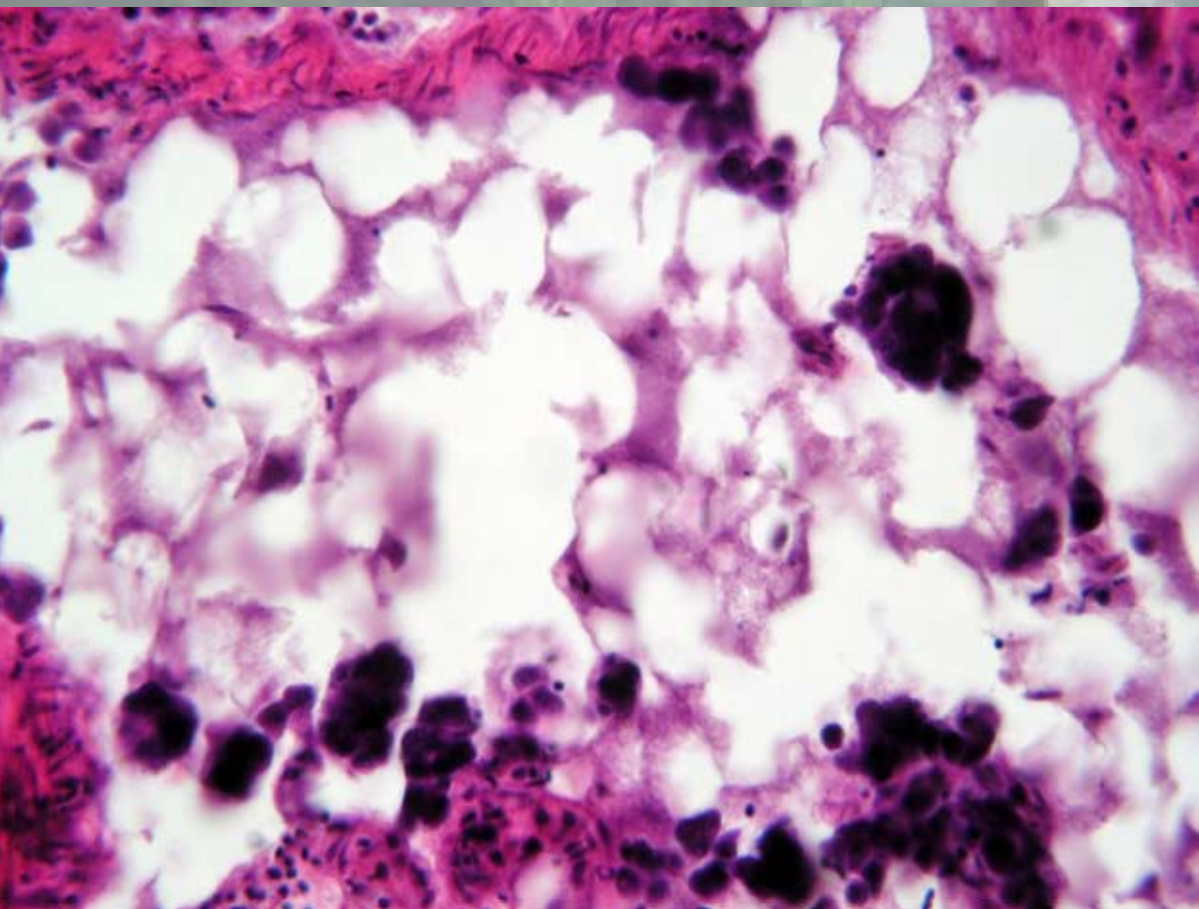


Fig. 3 Extensive necrosis of pancreatic acinar tissue (arrow) with accompanying necrotic changes of adipocytes in rainbow trout larva showing clinical signs of IPN.

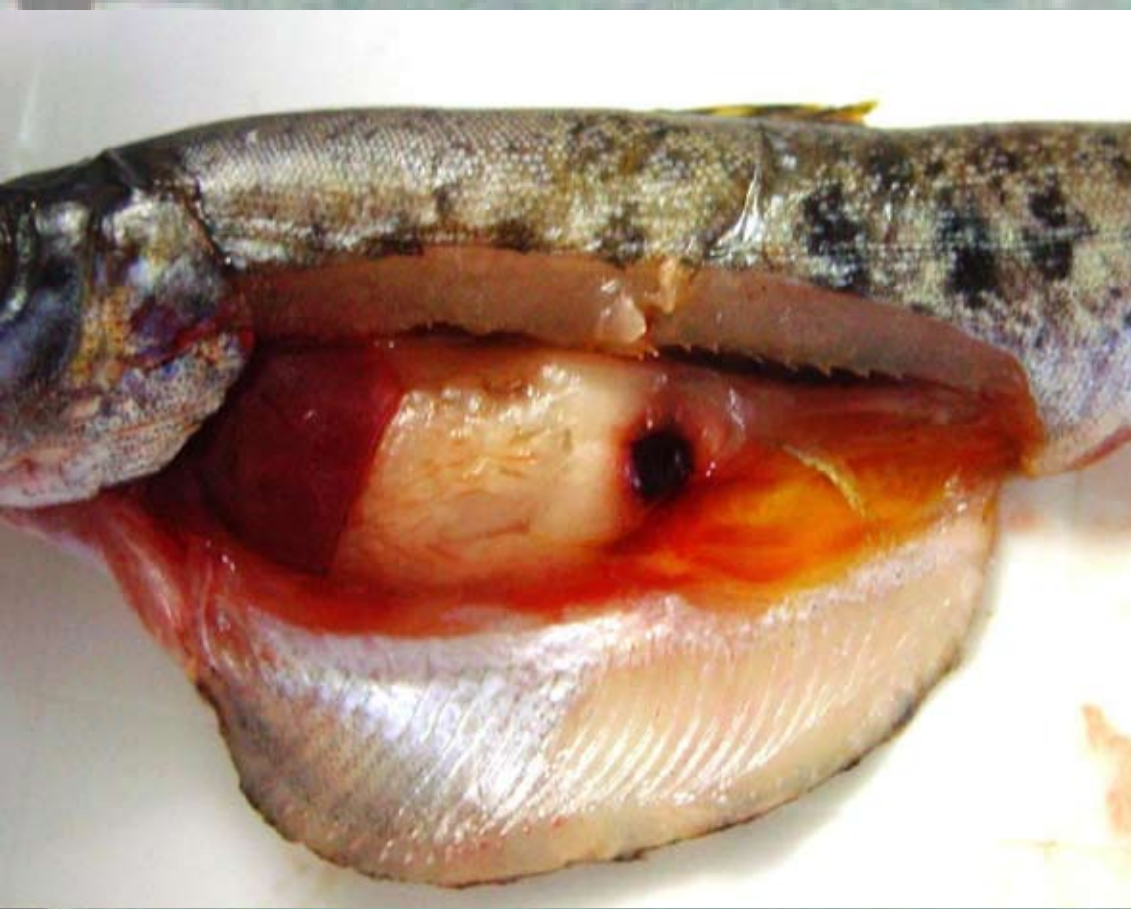


Fig. 4 Rainbow trout fry syndrome in 3 months old specimen.

Table 4. Bacterial diseases recognized on Croatian farms from 2005 to 2010.

BACTERIAL DISEASE/ AGENT Order by impact	OCCURRENCE	The clinical signs and lesions	INTENSITY/ MORTALITY/ MEASURES
RTFS (Rainbow Trout Fry Syndrome)		Abdominal distention, exophthalmus, dark pigmentation, lethargic, loss of balance, pale gills, occasionally cutaneous ulcers and necrosis of tail fins, epidermal hyperemia and increase mucus secretion; splenomegaly and hepatomegaly are common with multifocal necrosis of the liver spleen and kidney.	Low to high; 10% to 50%; Antibiotic mixed in feed
<i>Cyphopharyngodon</i>	Every year; Most often in spring very small fish after movement		
Gram negative filamentous bacteria			
<i>Columnaris</i> disease Saddleback disease	Usually on 1+ year old fish and older	Small white spots on the caudal fin progresses towards the head; the caudal fin and fins may become severely eroded. Sometimes numerous grey white ulcers on the skin. Gill lesions are characterized by necrosis of the dorsal end of the gill filament that progresses to involve the entire filament.	Low intensity; no mortalities; sometimes necessary to use antibiotic mixed with feed
<i>Flavobacterium columnaris</i>			
Gram negative filamentous bacteria			
Bacterial gill disease		Fish are anorectic; collecting at the water inflow; prominent hyperplasia (mucus and epithelial) of the gills; Microscopically proliferation of the epithelium resulting in clubbing and fusion of the lamella. Necrosis of the gill lamella in serious cases.	Bathing in bactericide
<i>Flavobacterium columnaris</i> , <i>E. ictyophthirius</i> , <i>C. psychrophila</i>	In case of incident; high density of fish and puddle water (stom)		
Gram negative filamentous bacteria			
Furunculosis		Septicemia with general hemorrhaging; reddening of fins; subcutaneous swelling causing an ulcerative dermatitis, splenomegaly, ascites, and swelling of the kidneys; Inflammation of intestine. Chronic case lesions may cavitate into the adjacent musculature.	Medium to high; up to 30%; Obligatory treatment with antibiotic mixed with feed
<i>Aeromonas salmonicida</i>	Acute form on fry to chronic on bigger fish and broodstock		
Gram negative bacteria			
Similar to furunculosis <i>Aeromonas hydrophila</i> Gram negative bacteria	Very rare finding on bigger fish	Dark pigmented skin, smaller lesions on body that become open sores; reddened of fins and tissues break down	Low; no mortalities; because of skin lesions treatment as furunculosis
RMS Strawberry Disease (SD UK; SD USA) etiological agent/s unknown	First outbreak in 2010.	The single and multiple, superficial, slightly raised lesions well demarcated, haemorrhagic and generally appear below the lateral line	Recover without the need for treatment or in some cases antibiotic mixed with feed
Enteric red mouth			
<i>Yersinia ruckeri</i>	Regularly as a result of being exposed to stress like overcrowding or puddle water (stom)	Septicemia with hemorrhages and ulceration of the jaw and palate, gills and operculum, musculature, serosal surfaces of the intestines, exophthalmus, ascites, splenomegaly, kidney swelling	Antibiotic mixed with feed. Experimental vaccination gave good results
Gram negative motile rod			
Vibriosis <i>Vibrio anguillarum</i> Gram negative motile bacteria	Only few outbreaks on marine farms mixed with <i>Flavobacterium</i> sp. infection	Loss of appetite; reddening of the fins and areas around vent and mouth; hemorrhage in the skin of the tail and fins, ulceration of the skin, hemorrhage in the muscles and serosal surfaces; sometimes bleeding around mouth and gills; potential high mortality	Antibiotic mixed with feed, e.g. potentiated sulphonamide. Vaccination should be applied
Bacterial kidney disease (BKD) <i>Renibacterium salmoninarum</i> Gram positive bacteria	Outbreaks on few fish farms in same year but rarely	Loss of appetite, swimming close to surface, dark coloration; whitish lesions in the kidney; hemorrhages in kidney and liver	Low to high; cumulative mortality up to 35%; obligatory treatment; antibiotic mixed with feed, e.g. erythromycin



Fig. 5 Lesions caused by *Aeromonas salmonicida*.



Fig. 6 Red mark syndrome in marked sized rainbow trout.



Fig. 7 Hemorrhages in the jaws caused by *Yersinia ruckeri*.



Fig. 8 Whitish nodules in the kidney of the fish affected by BKD.