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CLINICAL DISEASE IN SEAFARMED ATLANTIC SALMON (*SALMO SALAR*) ASSOCIATED WITH A MEMBER OF THE FAMILY PASTEURELLACEAE - A CASE HISTORY

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Abstract

Pasteurellosis causes clinical disease in a number of fish species, although Pasteurellaceae have not yet been described in Atlantic salmon. This paper presents a clinical case history from an Atlantic salmon farm in the West of Scotland, involving mortality associated with the presence of members of the family Pasteurellaceae.

Introduction

Pasteurellosis, a disease caused by bacteria of the genus Pasteurella, has been described from a variety of cultured and wild marine fish species from around the world, particularly in Japan and the USA (Southgate, 1993). Cultured marine fish in which pasteurellosis has been described include yellowtail, sea-bream, striped bass and white perch. The species isolated from cases of clinical disease documented in the literature is Pasteurella piscicida, first observed by Snieszco et al (1964) in white perch and sea bass in the USA, and subsequently classified by Janssen & Surgalla (1968). The clinical disease normally presents as a haemorrhagic septicaemia with the formation of granulomata in the tissues, prompting Japanese writers to describe it as "bacterial tuberculoidosis" (Kubota *et al.,* 1970). Clinical disease caused by members of the Pasteurellaceae has not been described in Atlantic salmon in the literature.

Clinical history

A salmon cage seasite consisting of two groups of steel cages in the West of Scotland was stocked with approx. 260,000 Atlantic salmon smolts in March 1998 from one of the company's own freshwater sites. The seasite had previously been fallowed and the incoming fish had no significant history of disease. The site is subject to periodic freshwater influence, but is otherwise unremarkable. Early post transfer losses were not considered unusually high.

Mortalities began to rise in July 1998 in some cages. Levels of losses fluctuated from cage to cage, remaining at a significant over-

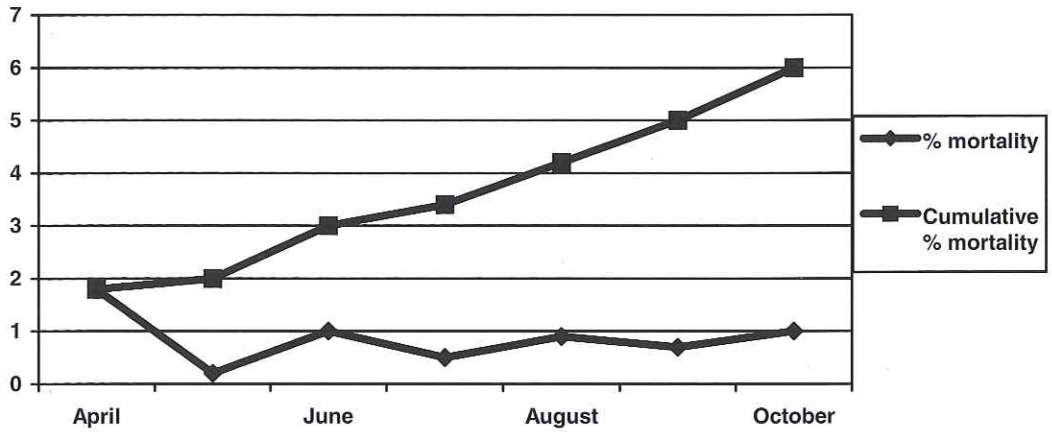

Figure 1 Mortalities by month in 1998

all level throughout the summer (see Fig 1). Other investigators who visited the site at the end of July isolated a Vibrio species, and bacteria described as members of the Enterobacteriaceae, from moribund fish removed from the site. Oral treatment with Sarafloxacin ("Sarafin", Vetrepharm) was instigated by these investigators to treat the Vibrio species in the worst affected cage, and various cages were treated orally using Amoxycillin preparations, with little impact on the level of mortality.

Visits to the site by the authors through September & October 1998 revealed variable but significant cataracts typical of those described by Wall (1998) and believed to have a nutritional aetiology, an increasing Caligus elongatus lice burden, and a continuing low grade but significant morbidity/mortality. Poor mean weight and significant size variation indicated erratic performance.

Examination of moribund/fresh dead fish revealed no feed in the stomach, and variable gross pathology. This initially consisted of internal petechiation on caecal fat and peritoneal surfaces, and discrete white focal lesions through the kidney, spleen, and heart. Later samples presented a more chronic picture with generalised peritonitis and false membrane formation giving a diptheritic appearance to peritoneal organs and swimbladder. This was accompanied by pericarditis and straw coloured peritoneal fluid exudate. (Fig 2.) It should be noted that these fish had been injected with an oilbased furunculosis vaccine into the peritoneal cavity prior to transfer to sea, and the resultant peritoneal adhesions complicated the interpretation of gross and histological pathology.

Histopathology

Histological examination of tissues from moribund fish revealed variable pathology which appeared to progress over time. Findings included striking multifocal areas of coagulative necrosis in kidney, liver and spleen. These consisted of eosinophilic evenly stained centres with volcanic "rims", developing into granulomata with variable giant cell and polymorphonuclear cell involvement (fig 3). In later samples, pericarditis and generalised peritonitis became predominant, with similar necrotising granulomata within the inflamed serosae (fig 4). Bacteria were difficult to locate but were seen in chronically affected fish within phagocytic cells amongst the serosal membranes associated with the swimbladder.

Bacteriology

Kidney swabs taken from moribund/fresh dead fish were plated onto tryptone soy agar supplemented with 2% salt and 5% horseblood, and incubated at 20oC. These consistently yielded large numbers of slow growing small grey, round, convex colonies of gram negative, non-haemolytic, oxidase negative bacilli. Cultures were sent to Glasgow University Division of Infection and Immunity for identification, where the organism has been placed in the Family Pasteurellaceae. Further taxonomic tests are ongoing and will be the subject of a future publication.

In vitro plate diffusion sensitivity tests indicated the organism to be sensitive to antibiotics licensed for use in Atlantic salmon. An oral treatment using Trimethoprim + Sulphadiazine ("Sulfatrim", C-vet) top dressed onto feed to give a dose of 40 mg/kg fish per day for 7 days, was instigated, although little evidence of clinical response to treatment was seen. Mortality finally began to diminish in November 1998 with reducing temperatures, and following the use of feed supplemented with non-specific immune stimulants and elevated vitamin C levels ("Response" diet, Trouw).

Discussion

The clinical case study described here appears to be a low-grade, chronic granulomatous bacterial disease, associated with the presence of a member of the Pasteurellaceae which may have been that observed within phagocytes in inflamed tissues. Pasteurella piscicida has been shown experimentally to be phagocytosed by macrophages in vivo in gilthead bream (Noya *et al.*, 1995), with

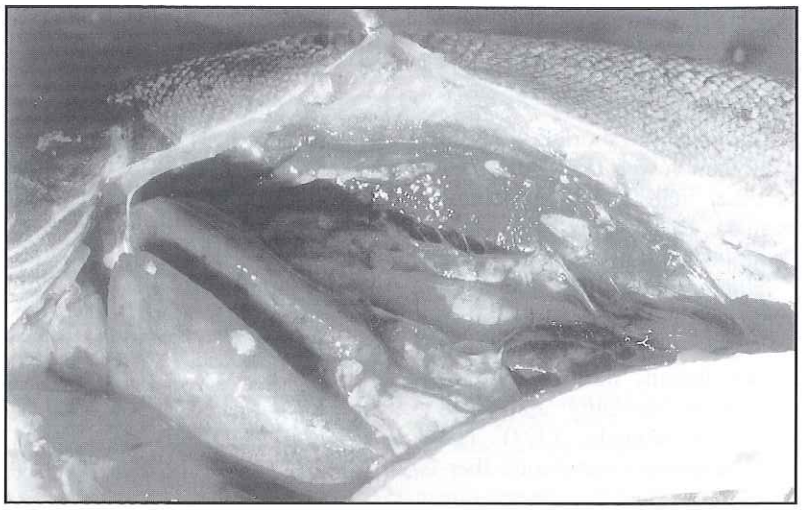

Figure 2: Gross pathology showing severe peritonitis

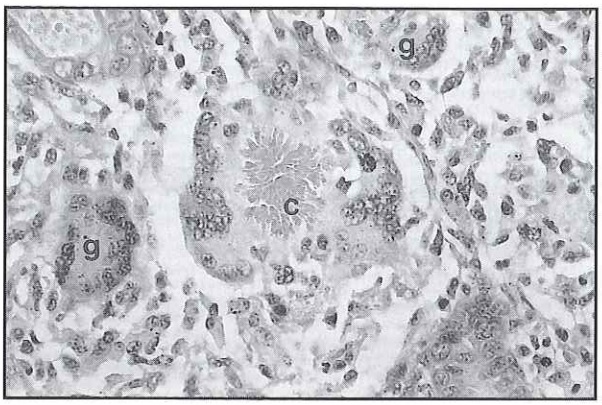

Figure 3: Kidney showing area of coagulative necrosis (c) with surrounding giant cells (g). H&E x 400

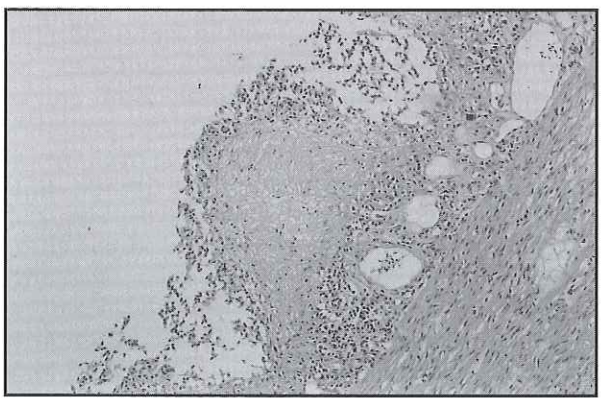

Figure 4: Area of pericarditis with granulomata formation. H&E x 100

bacteria-laden macrophages appearing in a variety of tissues. The bacteria within the macrophages are thought to resist intracellular killing.

The levels of morbidity and mortality in this case may have been lower than described elsewhere for other marine fish. Concomitant problems make objective assessment of the impact of the bacterial problem difficult, although the pathology seen here is consistent with pasteurellosis described in other fish species.

Suitable antibiotic therapy normally proves effective in reducing mortality associated with pasteurellosis (Southgate, 1993). The apparent lack of response to antibiotic therapy in this case may reflect the observation that the organism appears to spend at least some of its time within host phagocytes, a negative effect of the cataracts on medicated feed uptake, or the fact that this condition had been ongoing for some considerable time and a percentage of affected fish were non-feeders.

This may represent the first described case of clinical disease associated with Pasteurellaceae in farmed Atlantic salmon. Further studies are required to confirm the organism isolated as the causative agent of the pathology described.

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