INCREASING INCIDENCE OF ZOONOTIC *Mycobacterium spp.* INFECTIONS IN MEDITERRANEAN AQUACULTURE INDUSTRY

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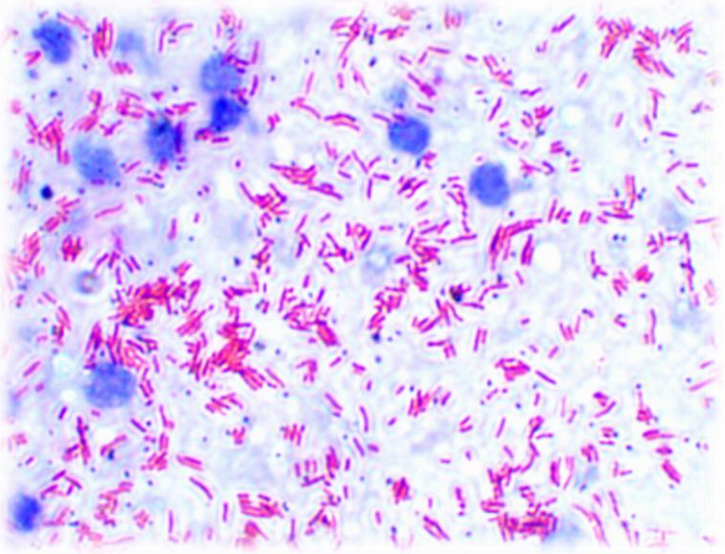
Mycobacterium marinum infection in Fin – Fish

- *Mycobacteria spp.* include a large group of aerobic bacteria which cause serious and well known diseases in mammals, including tuberculosis and leprosy .
- *Mycobacteria* are classified as an acid-fast Gram-positive bacteria because of their lipid-rich cell walls,
- Mycobacteria are slightly curved or straight rods between 0.2-0.6 µm wide by 1.0-10 µm long .
- Optimum growth temperatures vary widely according to the species and range from 25 °C to over 50 °C .



Mycobacterium marinum infection in Fin – Fish

- *Mycobacterium marinum* has traditionally caused a chronic and very slow developing disease in freshwater, saltwater, and brackish environments .

- Mycobacterium affects a very wide range of species. (all fish species should be considered susceptable)

- In the Mediterranean region, Sea Bass, Sea Bream, Barramundi, H. Stripped Bass and numerous ornamental fish species are frequently involved.

Mycobacterium marinum infection in Fin – Fish

- Initial disease expresion in intensive culture facilities is very slow. (“quiet”)

- Clinical signs in fish may include decreased growth performance, increased FCR values, increasing presence of external parasites ,non-healing superficial ulcers, distended abdomen, loss of appetite ,external hemmorages, fin erosion, unusual coloration and possibly exopthalmia.

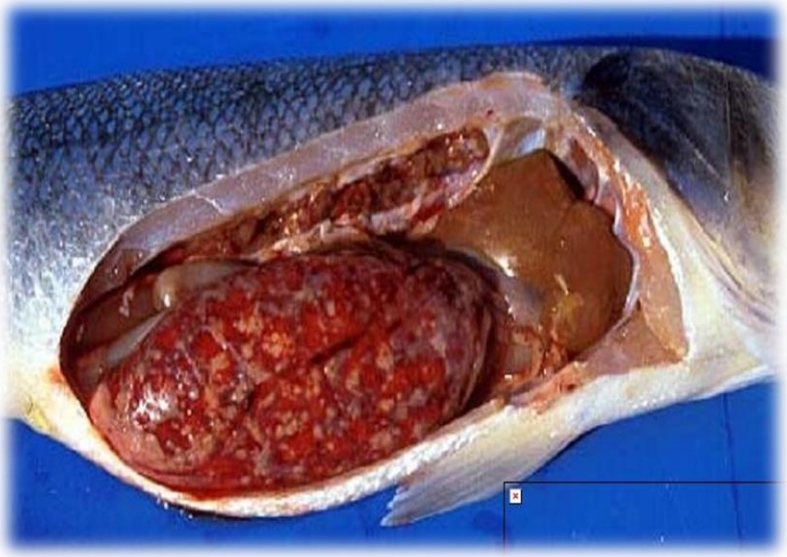
- Infected fish may die without external symptoms.

Mycobacterium marinum infection in Fin – Fish

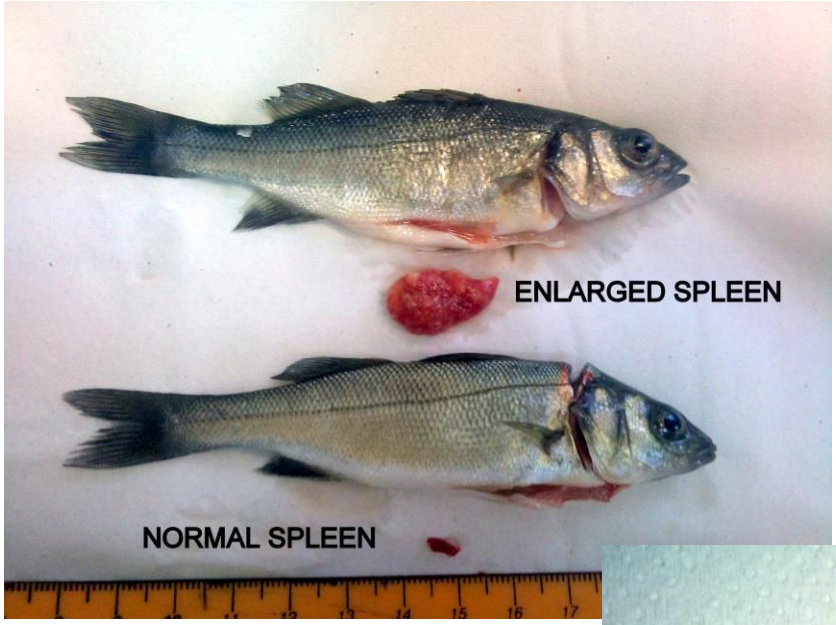
- One of the earliest signs of Mycobacterium involvement is lack of response to common protocols of antibiotic therapy .
- Other signs may include recurrent infection with external parasites, several days after treatment.
- In ornamentals, continues reports from importers on "sensitivity" of imported fish and "unexplained mortalities".

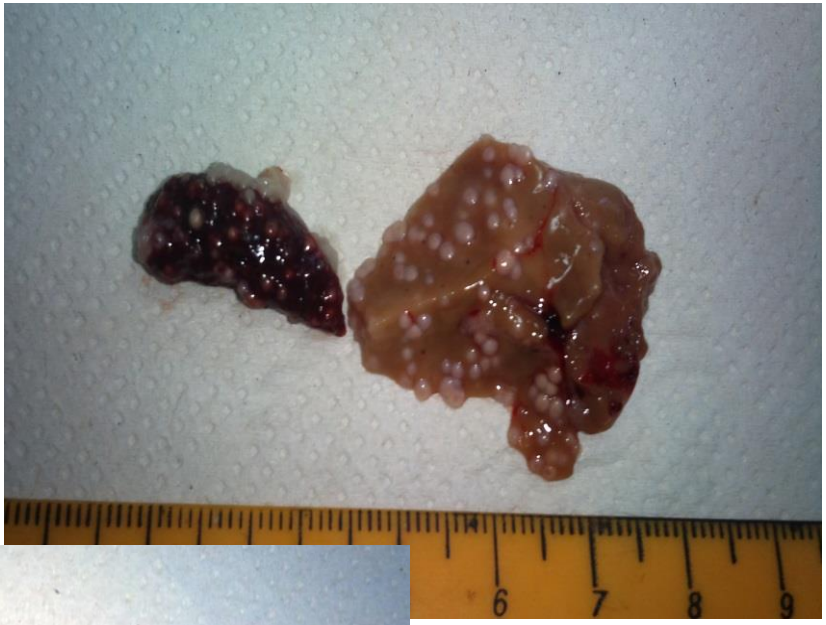
Mycobacterium infection in Fin – Fish

- As the pathogen establishes it's presence in the aquatic environment, mortalities due to Mycobacterium infection are characterized by changes in internal organs:
  - Splenomegaly and hepatomegaly:
  - Presence of granulomas on/in Spleen, Kidney and Liver:



Mycobacterium infection in Fin – Fish





Mycobacterium marinum infection in Fin – Fish

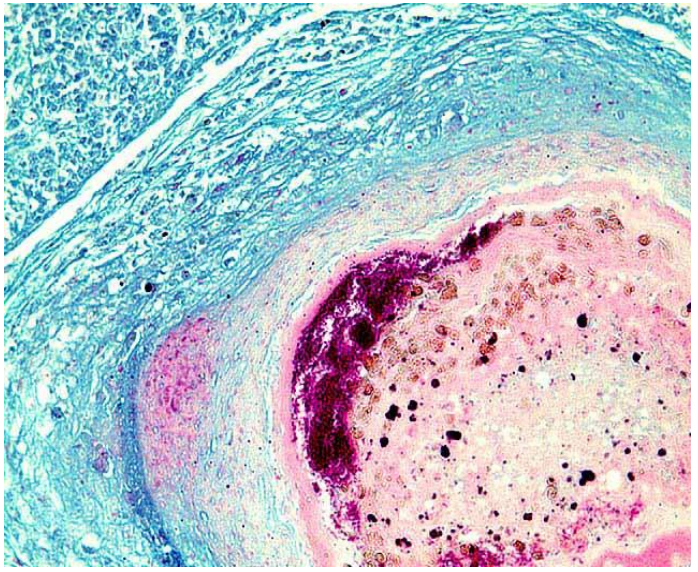
- Recirculated culture systems systems create favorable conditions for expression of this infectious agent

- In recirculated culture systems, we observe a rapid transition from the “traditional” chronic nature of this disease to an acute outbreak characterized by wide morbidity and mortality.

Mycobacterium marinum infection in Fin – Fish

- Sub – optimal water quality parameters, continues stress and various nutritional deficiencies are direct contributing factors to the clinical onset of this pathogen in RAS.

- Prevention of introduction of Mycobacterium to RAS systems include detailed pre – purchase exam, long quarentine period, aggressive culling procedures, aggressive sanitation procedures, optimization of environmental conditions and continues health monitoring programs.



Mycobacterium infection in Ornamental Fish

- During the last 3 – 5 years there is a dramatic increase in presence of Mycobacterium infections in ornamental fish farms and imports.

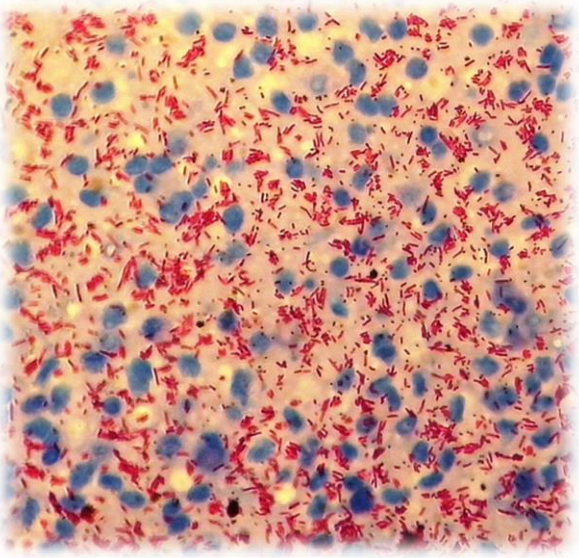
- This process may have a direct effect on presence of the disease in edible fish culture facilities.
- There is a clear increase of incidence rate among:
  - Ornamental fish producers:
  - Ornamental fish hobbyists:
  - Ornamental fish Importers:

- Due to increased awareness among European ornamental fish importers and the zoonotic effect of this agent, “suspected farms” will frequently need to stop their sales into the EU until proven “free” from *Mycobacterium* infection.

Mycobacterium infection in Fin – Fish

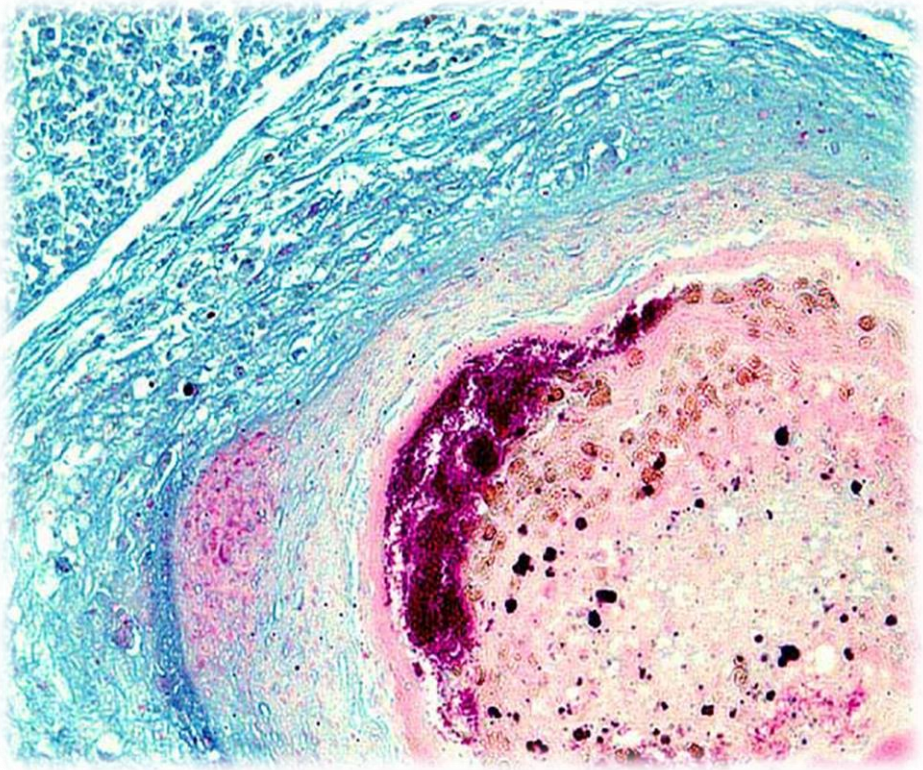
DIAGNOSES:

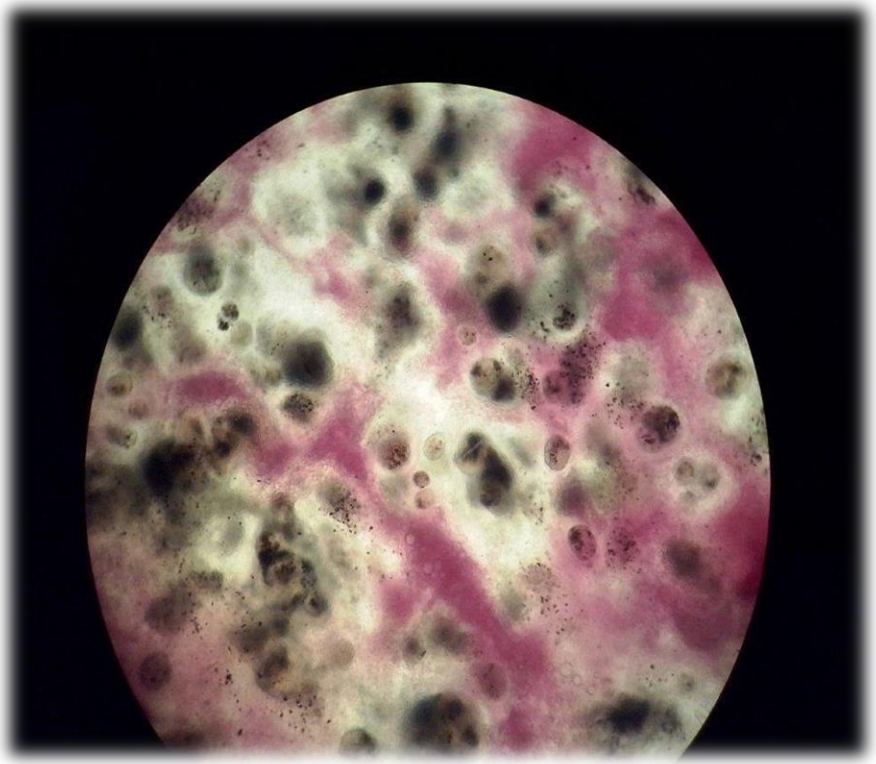
- History of progressive disease, decreased growth performance, increased FCR and lack of response to antibiotic therapy.
- In most suspected cases there is no attempt to culture the organism.
- Definitive diagnosis - Acid fast stain.
- A post-mortem examination will reveal nodules in the internal organs; in particular, the kidney, spleen, and liver .



Mycobacterium infection in Fin – Fish

- Visceral Granulomas are composed of a thick capsule of conective tissue surrounding necrotic centers which contain large numbers of acid fast positive organisms.





Mycobacterium marinum infection in Fin – Fish

PREVENTION and TREATMENT:

- No vaccines:
- Aggressive "pre – purchase exam":
  - Detailed history of the fish.
  - Detailed history of previous shipments from hatchery.
  - In depth understanding of disease outbreaks in the Hatchery. (Background information)
  - In depth clinical evaluation:
    - Parasitology/Bacteriology/Virology. Histopathology:
    - Stress testing . (Challenges)
- Quarantine:
  - Completely separate quarantine facility:
  - Long: (Determine the minimum required period)
  - "Stress Testing" and Biological Assays.
  - Prevent inward and outward movement of biological materials, equipment and both passive and active disease carrying vectors
- Aggressive bio – security procedures: ("Disinfection, disinfection, disinfection…")
- "Test and slaughter"…. (Inc. full disinfection of culture facility)
- Culling of suspected carriers and rapid disposal of dead and/or dying fish.
- Rapid response to secondary infections and presence of external parasites:
- Antibiotic treatment with drug of choice*:
  - Doxycycline:
  - Clarithromycin:
- Improved water quality:
- Improved nutrition:
- Prevent mishandeling:
- BMP – Best Management Practices.

Mycobacterium marinum
"*The Fish Disease you can Catch…*"

ZOONOTIC DISEASE

- “A zoonotic disease is a disease of animals which can be passed from animal species to humans”.
- Well known examples of zoonotic infections include Plague, Rabies, Lyme Disease, Ebola Virus, Bird Flu, Toxoplasmosis, and a long list of intestinal parasites.

- Mycobacterium infects human skin through cuts or scrapes.
- The most frequent symptom is a slowly developing nodule (raised “bump”) at the site the bacteria entered the body.
- Swelling and edema are common findings when infection is present on the hands.

- Frequently, the nodule is noticed on the hand or upper arm.
- Later the nodule may become an enlarging ulcer.
- Swelling of nearby lymph nodes may occur.
- The infection may also involve the joints and bones.
- This deep infection is usually associated with a puncture wound like that from the spiny ray of a catfish, dorsal fin of Sea bass or from a deep, open wound that becomes infected.

Mycobacterium in Humans

Mycobacterium in Israel

•During the last few years, numerous cases of cutaneous Mycobacterium infections are reported by the Ministry of Health in Israel.

•This increase may be due to increased public awareness, improved diagnostic capabilities and the dissemination of the disease causing agent to new species such as ornamental fish.

•The primary risk factor that links the majority of the patients with positive skin infections in Israel (over 67%) is ornamental fish culture, either as hobbyists or as professional ornamental fish farmer.

• Other patients with positive skin infections were linked to edible fish, mostly due to occupations associated with grading and packaging of fresh/live infected fish.

Mycobacterium in Israel

- Most recorded cases in Israel involve immune-competent patients.

- Most recorded cases require long term systemic antibiotic therapy. (one year and longer…)

- Most cases required more than one antibiotic medication.

- Several cases required surgical intervention.

Mycobacterium in Israel

- Most lesions are identified in the upper extremities and especially the fingers.

- Several cases present a wide-spread infection of the extremity which involved joints and tendons.

- In Israel, there is a significant delay between the initial clinical presentation and the final diagnosis of Mycobacterium Infection. (mean 7.1 months, range 1-27 Months.

- Mean time between taking skin biopsy and receiving final results of bacterial identification and antibiotic sensitivity pattern was 2.3 Months. (Median 1.9, Range 1.3 – 4.6)

SUMMARY

- There is clear indication as to the increase in frequency of this disease in the Eastern – Mediterranean aquaculture industry.

- This phenomena is probably also developing in S. E. Asia with wide spread presence of Mycobacterium in ornamental fish.

- This increased incidence rate is observed in both ornamental and edible fish culture systems in various environments.

- The delay observed in Israel between the onset of disease and definitive diagnosis is much longer among other Mediterranean farm and processing plant workers who do not have regular access to specialty dermatological diagnostic services.

- There are probably numerous un-reported cases of cutaneous Mycobacterium Infections among workers of the aquaculture industry in the Mediterranean region.

Questions?