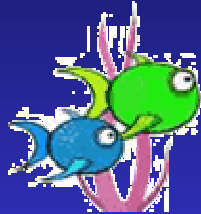


VMD 412: FUNDAMENTALS IN ZOOSES

ZOOSES IN PET REPTILES AND AQUARIUM FISH



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PET REPTILE POPULATION, U.S.A., 2001

<u>Animal Group</u>	<u>Total Popul.</u>	<u>Mean No. per household</u>
Turtles	1.07 million	1.7
Snakes	661,000	2.1
Lizards	545,000	1.3
Other reptiles	598,000	1.9

(source: AVMA, 2002)

Bacterial Zoonoses of Reptiles

Salmonella

Mycobacterium

(*Coxiella*)

Campylobacter

Yersinia

Aeromonas

Plesiomonas

Edwardsiella



Zoonotic Bacteria of Reptiles

Salmonella

Gram-negative, rod, usually with flagella

Facultative anaerobe

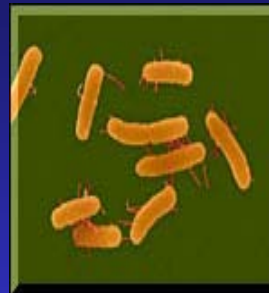
Over 2000 serotypes

Most recognized zoonoses of reptiles

Harbored by 83.-93.7% of reptiles

First described in 1946, First proven in 1963.

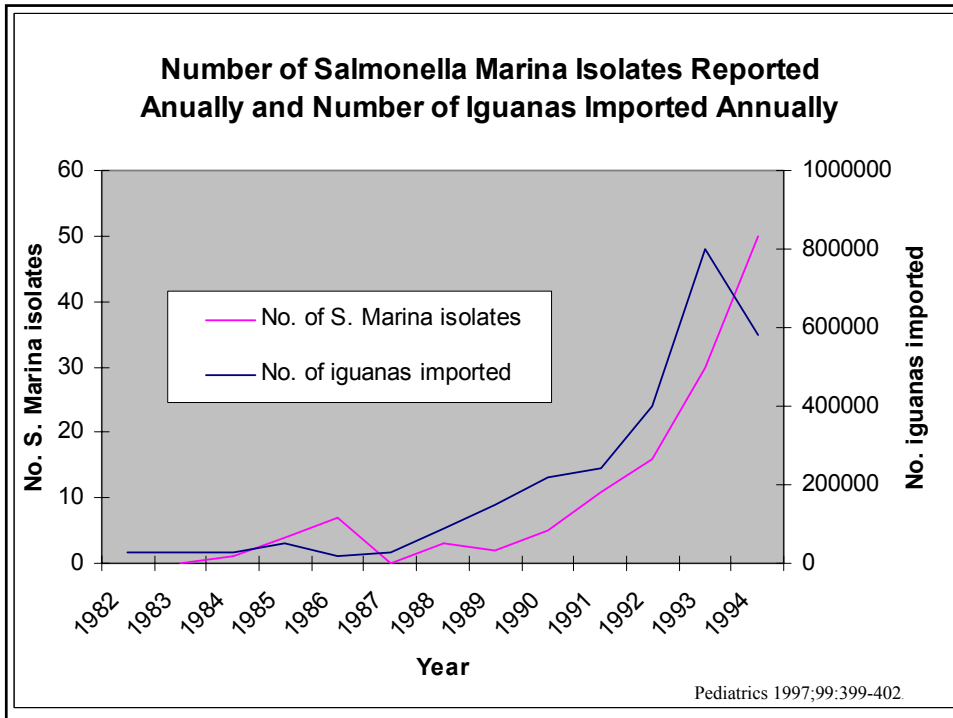
Approximately 93,000 cases are attributable to pet reptiles





Reptile-associated Human *Salmonella* History

- 1944** First *Salmonella* sp. isolate from snakes.
- 1946** First *Salmonella* sp. isolate from turtles and lizards.
- 1963** Turtle-associated salmonellosis first described.
- 1972** FDA regulation requiring certification of turtles for sale as "Salmonella-free."
- 1974** Study shows 300,000 turtle-associated human salmonellosis cases per year in U.S.
- 1975** FDA bans sale of viable turtle eggs or live turtles with carapace length < 10.2 cm.
- 1977** CA State regulations ban sale, as above.



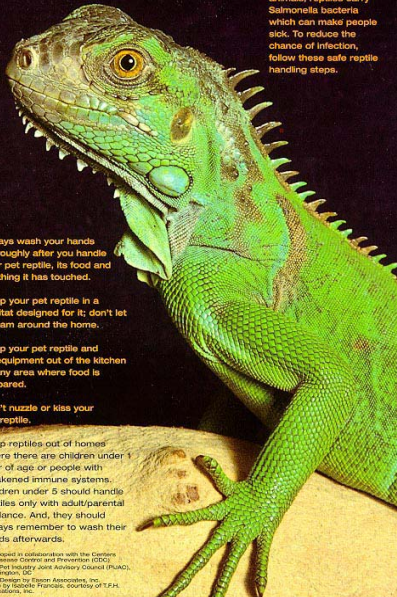
- **Diagnosis**
 - Culture (humans and reptiles)
 - Difficult in reptiles
 - Not always passed in feces
 - More common if stressed
 - Persistent in breeding ponds and nests
- **Treatment**
 - **Humans**
 - Self-limiting (5-7d)
 - Supportive care for dehydration
 - Antibiotics if disseminated
 - **Reptiles**
 - Problematic
 - Antibiotics can suppress shed, but not eliminate

IMPORTANT!

Reptile Handling Steps

Follow these safe reptile handling steps... and enjoy your pets!

As with many other animals, reptiles carry Salmonella bacteria which can make people sick. To reduce the chance of infection, follow these safe reptile handling steps.



- Always wash your hands thoroughly after you handle your pet reptile, its food and anything it has touched.
- Keep your pet reptile in a habitat designed for it; don't let it roam around the home.
- Keep your pet reptile and its equipment out of the kitchen or any area where food is prepared.
- Don't nuzzle or kiss your pet reptile.
- Keep reptiles out of homes where there are children under 1 year of age or people with weakened immune systems. Children under 5 should handle reptiles only with adult/parental guidance. And, they should always remember to wash their hands afterwards.

Developed in collaboration with the Centers for Disease Control and Prevention (CDC) © 1997 The Iggy and Anselmo Council (I&A), Washington, DC
© 1998 The Reptile Association, Inc. Photo by Rebecca Francine, courtesy of T.F.H. Publications, Inc.

Mycobacterium Disease in Reptiles

- Chronic granulomatous and non-granulomatous lesions
 - Lungs
 - Liver
 - Subcutaneous tissue
 - Oral mucosa gonads
 - Bone
 - CNS

Edwardsiella tarda

- Gram negative
- Enterobacteria similar to E.coli
- **Reptile Disease**
 - Not well documented
- **Human Disease**
 - Gastroenteritis in a 2 yr old child and a wound infection in an Australian young man.
 - 1 documented case from a turtle

Plesiomonas shigelloides

- Gram negative rod
- **Disease in reptiles**
 - Progressive, ulcerative stomatitis
- **Disease in humans**
 - gastroenteritis
 - Diagnosis via fecal culture
 - Exposure to Boa constrictor
- Treatment
 - Sulfamethoxazole-Trimethoprim

- ***Yersinia spp.***
found in reptiles, serotypes involved usually not found in humans
- ***Campylobacter fetus***
Isolated from a pet turtle during a case of Salmonellosis
- ***Serratia marcescens***
One case in a child (8 yr old) after a bite by an iguana

Parasitic Zoonoses of Reptiles

Pentostomiasis

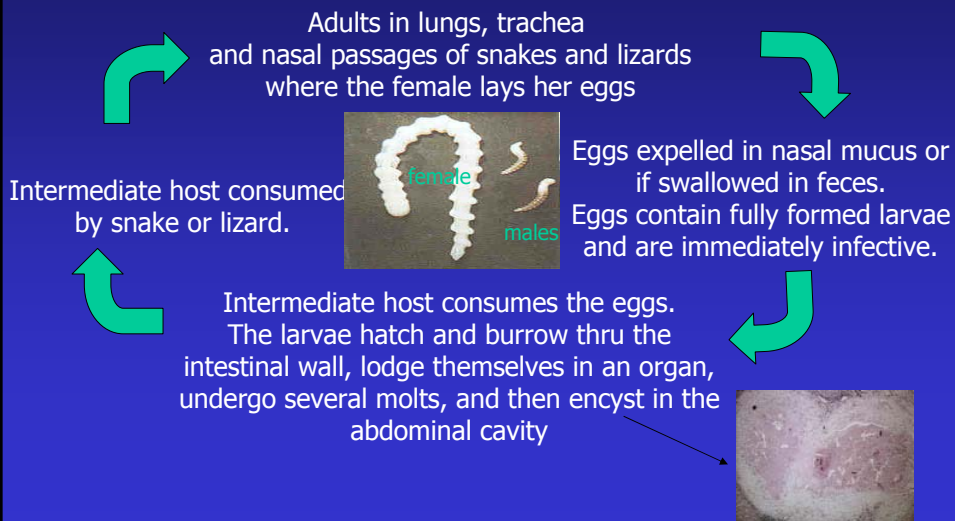
Two genera affect man, *Armillifer armillatus* and *Linguatula serrata*. They live mainly in the respiratory passages of snakes but also in birds and nares of mammals where they produce eggs which are released in the environment. Contamination occurs by ingesting the eggs with larvae which spread through various organs forming encysted niphae which at the surface of the liver form small encapsulated whitish nodules.

Mesocestoides

Pentostomiasis



Armillifer armillatus Life Cycle



Pentostomiasis (*Armillifer armillatus*)

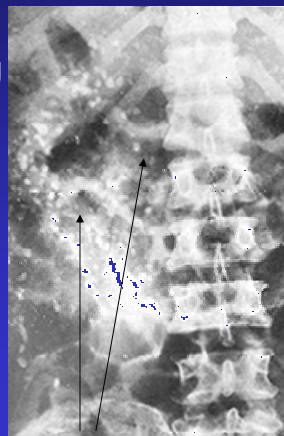
Clinical Signs

- **Reptiles**
 - none
- **Humans**
 - Often asymptomatic with parasites in the lungs, liver and mesentery
 - Death is rare
 - Hypersensitivity reactions to toxin release
 - Can cause neurological signs and death
 - Case
 - Congolese man with paresis, seizures & dysarthria
 - All tests normal: CT, MRI, CSF, EMG, EEG

Pentostomiasis (*Armillifer armillatus*)

Diagnosis, Treatment and Prevention

- **Diagnosis**
 - Often by accident during surgery or via radiographs
- **Treatment**
 - none
- **Prevention**
 - Wash hands after handling reptiles
 - Wash food in endemic areas



Calcified c-shaped nymphs

Mesocestoides Infection

Clinical Signs

- **Reptiles**

- none

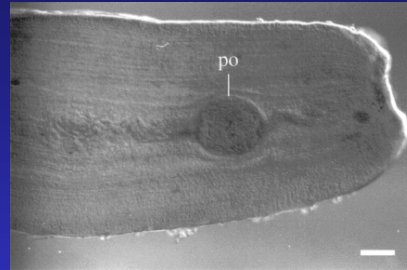
- **Humans**

A few cases (7 in the USA, 27 worldwide)

- One Case in a child in California in 1990, could have been exposed to reptiles.

Diarrhea and “rice grains like stuff” in child stools).

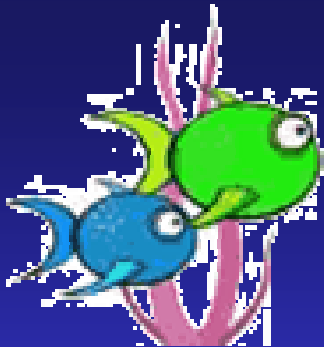
- Treatment: Niclosamide, Praziquantel



Gravid proglottid of the tapeworm isolated from the case in Louisiana.

po = parauterine organ (chlorhydric alcoholic carmine-stained).

Bar = 200 μ m.



Zoonoses of Fish

Bacterial

Parasitic

Fungal

FISH TANK –SWIMMING POOL GRANULOMA

- Infection caused by inoculation with *M marinum*.

- **In the US:** Infections are rare. Estimated annual incidence is 0.27 case per 100,000 patients.

- Most case reports of cutaneous infection (about 150).

Infection often follows abrasions to an extremity occurring in non-chlorinated water.

- **Individuals at increased risk** for infection are:

- Fishermen and workers who process saltwater fish
- Workers who clean saltwater aquariums
- Home aquarium owners.
- **Immunocompromised patients** (increased risk of disseminated infection)



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FISH TANK –SWIMMING POOL GRANULOMA

- Incubation period: about 2-3 weeks.

- A papule or nodule initially appears at the site of trauma.

- Localized pain and induration are common. Fever, localized lymphadenopathy, and systemic infection rarely are observed (exception for immunosuppressed patients).

- In 25-50% of patients, the nodules proliferate along the path of lymphatic drainage in a sporotrichotic type of distribution.

Patients may have deeper involvement, with tenosynovitis, septic arthritis, and osteomyelitis of the underlying bone.

Dissemination to the bone marrow and abdominal viscera rarely develops (mainly in immunocompromised).

- Infection responds slowly to appropriate antibiotic therapy (treatment for 2 weeks to as long as 18 months).



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M. Marinum Clinical Signs in the Fish



- Anorexia/ emaciation
- Exophthalmos
– Pop eye

Loss of normal coloration

Multiple granulomatous nodules affecting multiple organs



Fish Tank Granuloma
Mycobacterium marinum
Infection – Forearm



Dorsal hand,
Sporotrichoid
lymphocutaneous
Granuloma

Mycobacterium

Diagnosis and Treatment

- Diagnosis
 - TB skin test (humans)
 - Radiographs
- Treatment
 - Not recommended in reptiles
 - Antibiotics for humans
 - Isoniazid, rifampin, pyrazinamide, ethambutol, streptomycin

M. Marinum

Transmission and Prevention

- **Contact with fish or contaminated water.**
 - Organism enters through breaks in the skin or inoculation by stab wound.
- **Major concern for immune compromised persons**
- **Wear protective gloves when cleaning fish aquaria or diving**

Erysipelothrix rhusiopathiae

- Saprophytic, gram-positive rod
- Not recognized as a fish pathogen
- Associated most with commercial fishing and fish processing
- Clinical presentation similar to nodular lymphangitis, but lesion is not suppurative.
 - In the disseminated septicemic form may lead to endocarditis.

Within a week of injury, a characteristic raised, purplish red, non vesiculated, indurated, maculopapular rash appears, accompanied by itching and burning.



Erysipelothrix rhusiopathiae, *and E. insidiosa*

- **Diagnosis:** Culture of wound or blood
- **Treatment:** Very responsive to Penicillins and cephalosporin
 - Localized infection may resolve on their own
- **Prevention:** adherence of occupational safety, and wearing gloves when handling fish.

Melioidosis

- Disease caused by *Burkholderia pseudomallei*
 - Gram negative bacillus
- Local abscess at site of inoculation
 - Septicemic shock seen in endemic area – South East Asia
 - Chronic febrile wasting condition
- Not recognized as a disease in fish.
 - Acquisition of infection is most associated with the water



Lobe of lung with multiple abscess formation following *B. pseudomallei* infection.

Streptococcus iniae infection

- Four patient admitted to Toronto Hospital (1995-1996)

3 / 4 with upper limb cellulitis originating from puncture or laceration

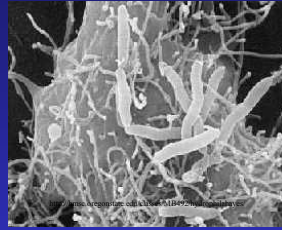
One patient present with dyspnea, confusion and arthritis of the right knee.

All four patient were preparing fish, three were preparing tilapia



Streptococcus iniae
culture from all patients

Aeromonas



- Gram negative
- Fermentative
- Oxidase positive
- Part of normal Alligator flora
- Can cause disease in fish, frogs and reptiles
- Common in lakes, ponds, and water housing reptiles, amphibians or fish

Aeromonas

Disease in Humans and Reptiles

- Reptile disease
 - Ulcerative stomatitis
- Transmission
 - Contact with water on open wounds
 - Bites or scratches
- Human disease
 - Acute gastroenteritis
 - Diagnose with stool culture
 - Treat with Sulfamethoxazole-Trimethoprim

Zygomycetes

- Ubiquitous in the environment
 - Soil, dead plant material, fruits, bread
- Grow rapidly, ferment Carbohydrates, form fuzzy mycelia with aseptate hyphae
- Disease is **Zygomycosis**
 - Orders Mucorales and Entomophthorales
- Isolated from 112/200 garden lizards' intestinal contents

Zygomycosis

- Transmission
 - inhalation, ingestion or inoculation of spores
- Opportunist infection in reptiles
- Immunocompromised individuals at risk
 - DKA, leukemia, lymphoma, transplants, steroid use, prolonged neutropenia
 - 3rd most common cause of invasive fungal disease

Zygomycosis

Clinical Signs in Reptiles

- Upper Respiratory
 - Nasal discharge
- Pneumonia
- Cutaneous
 - Necrotizing skin or shell lesions
 - Reported in crocodiles, turtles and lizards
- Prognosis
 - Death rate of >50% reported in Florida Softshell outbreak

Zygomycosis

Clinical signs in humans



- Rhinocerebral
 - Acute sinusitis, fever, eye swell
- Pulmonary
 - Fever, cough, dyspnea, hemoptysis
- Cutaneous
 - Plaque, pustule, ulcer, deep abscess
- GI
 - Abdominal pain, vomiting blood
- Prognosis
 - 50% overall mortality, 85% for rhinocerebral

Zygomycosis

Diagnosis, Treatment, Prevention

- Diagnosis
 - CT or MRI
 - Staining nasal discharge
 - Culture (not in humans)
- Treatment
 - Surgical removal of dead and infected tissue
 - Antifungals
 - Amphotericin B (humans)
 - Ketoconazole (reptiles)
- Prevention
 - control risk factors for immunosuppression
 - keep environment clean to avoid fungus growth