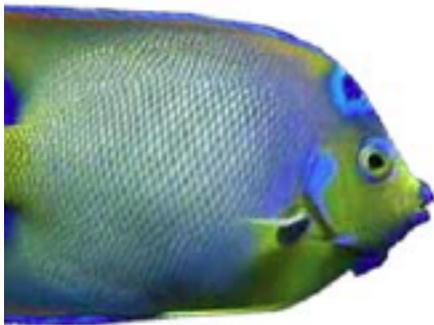




# Aquatic Animal Diseases

## Training Guide



**SART Training Media**



# **Aquatic Animal Diseases**

## **Training Guide**

### **Prepared in 2007 by:**

**Kathleen Hartman, DVM, PhD**

Aquaculture Epidemiologist

USDA - APHIS - Veterinary Services

### **Denise Petty, DVM**

Assistant Professor, Large Animal Clinical Sciences

College of Veterinary Medicine

University of Florida, Gainesville

### **Charles M. Brown**

Coordinator for Information/Publication Services

Agriculture and Biological Engineering Department

University of Florida, Gainesville

### **Carol J. Lehtola**

Associate Professor

Agriculture and Biological Engineering Department

University of Florida, Gainesville

### **Updated in 2018 by:**

**Kathleen Hartman, D.V.M., Ph.D.**

Aquaculture Program Leader

USDA-APHIS-Veterinary Services

### **Denise Petty, D.V.M.**

Assistant Professor

University of Florida, College of Veterinary Medicine-LACS

Owner of North Florida Aquatic Veterinary Services

### **Katharine Starzel, D.V.M.**

Field Operations (FiOps), District 1 (D1)

USDA-APHIS- Veterinary Services

Copyright by Florida Department of Agriculture and Consumer Services Published January 2007

**SART Training Media** are available for download from the Florida SART Web site <[www.flkart.org](http://www.flkart.org)>.

---

## **Contents**

<b>About Florida SART</b>	<b>1</b>
<b>Specific Learning Objectives</b>	<b>2</b>
<b>Resources</b>	<b>3</b>
<b>Training Slides</b>	<b>Appendix A</b>

---

## About Florida SART

- SART is a multi-agency coordination group.
- SART is made up of over 25 partner agencies (state, federal and non-governmental organizations).
- SART provides preparedness and response resources for Emergency Support Function 17 [(ESF 17) Animal and Agricultural Issues].
- SART statutory authority
  - State Emergency Management Act (Section 252.3569, Florida Statutes)

### SART Mission

Empower Floridians through training and resource coordination to enhance all-hazard disaster planning and response for animal and agricultural issues.

### SART Goals

- Support the county, regional and state emergency management efforts and incident management teams.
- Identify county resources available for animal and/or agricultural issues.
- Promote the cooperation and exchange of information of interested state, county and civic agencies.

---

## Specific Learning Objectives

At the end of this training module, participants will be able to:

- Identify the difference between an emerging and an endemic disease
- Provide examples and characteristics of emerging aquatic diseases affecting finfish, crustaceans and molluscs
- Provide examples and characteristics of endemic aquatic diseases affecting finfish, crustaceans and molluscs
- Identify key resources available for additional information

---

## Resources

The following are sources of additional information about the subjects mentioned in this introduction.

**University of Florida Tropical Aquaculture fact sheets**

<https://tal.ifas.ufl.edu/extensionoutreach/extension-publications/>

**USDA Southern Regional Aquaculture Center / Texas A&M and Mississippi State**

<https://fisheries.tamu.edu/aquaculture/diseases/>

**Florida Division of Emergency Management**

<http://www.floridadisaster.org>

**United States Department of Agriculture (USDA)**

<http://www.usda.gov>

**Florida Department of Agriculture and Consumer Services (FDACS)**

<http://www.doacs.state.fl.us>

**Florida Division of Aquaculture home page**

<https://www.freshfromflorida.com/Divisions-Offices/Aquaculture>

**Aquaculture Best Management Practices manual can be accessed directly at**

<http://www.floridaaquaculture.com/BAD/BMP%20Rule%20-%20Manual%206-9-04.pdf>

**eXtension Freshwater Aquaculture Community**

<https://articles.extension.org/pages/58798/freshwater-aquaculture-community-page>

**USDA Animal and Plant Health Inspection Service (APHIS)**

<http://www.aphis.usda.gov>

**World Organisation for Animal Health (OIE)**

<http://www.oie.int>

**Safety for Fish Farm Workers video on the National Ag Safety Database (NASD), English and Spanish versions available from the following link**

<http://nasdonline.org/search.php?query=safety+for+fish+farm+workers>

---

## Resources, continued

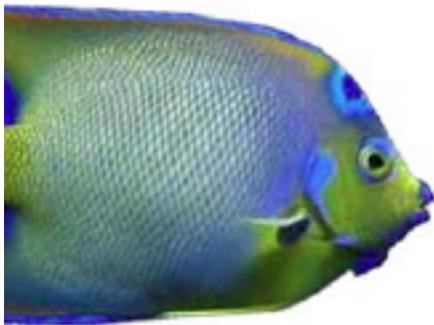
**Spawn, Spat, and Sprains book produced by the Alaska Sea Grant College Program. The entire book can be downloaded from the following link**  
[http://www.uaf.edu/seagrant/Pubs\\_Videos/pubs/AN-17.pdf](http://www.uaf.edu/seagrant/Pubs_Videos/pubs/AN-17.pdf)

**University of Florida Institute of Food and Agricultural Sciences Electronic Data Information Source (EDIS) fact sheets for aquaculture, including diseases, can be found at the following links**  
[http://edis.ifas.ufl.edu/DEPARTMENT\\_VETERINARY\\_MEDICINE](http://edis.ifas.ufl.edu/DEPARTMENT_VETERINARY_MEDICINE)  
[http://edis.ifas.ufl.edu/DEPARTMENT\\_FISHERIES\\_AND\\_AQUATIC\\_SCIENCES](http://edis.ifas.ufl.edu/DEPARTMENT_FISHERIES_AND_AQUATIC_SCIENCES)



# Aquatic Animal Diseases

## Appendix A: Training Slides



**SART Training Media**



---

---

---

---

---

---

---

---

## Aquatic Animal Diseases



 State Agricultural Response Team 2

---

---

---

---

---

---

---

---

## Aquatic Animal Diseases

<p>Prepared by: <b>Kathleen Hartman, D.V.M., Ph.D.</b> Aquaculture Epidemiologist, USDA-APHIS-VS</p> <p><b>Denise Petty, DVM</b> Assistant Professor Large Animal Clinical Sciences College of Veterinary Medicine University of Florida, Gainesville</p> <p><b>Charles M. Brown</b> Coordinator for Information/Publication Services Agriculture and Biological Engineering Department University of Florida, Gainesville</p>	<p><b>Carol J. Lehtola</b> Associate Professor Agriculture and Biological Engineering Department University of Florida, Gainesville</p> <p>Updated December 2018 by: <b>Kathleen Hartman, D.V.M., Ph.D.</b> Aquaculture Program Leader USDA-APHIS-Veterinary Services</p> <p><b>Denise Petty, D.V.M.</b> Assistant Professor University of Florida, College of Veterinary Medicine- LACS Owner of North Florida Aquatic Veterinary Services</p> <p><b>Katharine Starzel, D.V.M.</b> Field Operations (FIOps), District 1 (D1) USDA-APHIS- Veterinary Services</p>
--	---

 State Agricultural Response Team 3

---

---

---

---

---

---

---

---

## Learning Objectives

- Identify the difference between an emerging and an endemic disease
- Provide examples and characteristics of emerging aquatic diseases affecting finfish, crustaceans and molluscs
- Provide examples and characteristics of endemic aquatic diseases affecting finfish, crustaceans and molluscs
- Identify key resources available for additional information



---

---

---

---

---

---

---

---

## Aquatic Disease Categories

- **Emerging**
  - Exotic disease with potentially significant impact
  - Not common or not present
- **Endemic**
  - Common in United States
  - May show regional or seasonal patterns



---

---

---

---

---

---

---

---

## Emerging Diseases for Florida Aquaculture

- **Finfish**
  - Spring Viremia of Carp (SVC)
  - Tilapia Lake Virus (TiLV)
- **Crustaceans**
  - White Spot Virus
  - Taura Syndrome
  - Yellowhead Virus
  - Early Mortality Syndrome
- **Molluscs**
  - Bonamiosis (*Bonamia exitiosus*, *B. ostrea*, *Mikrocytos roughleyi*)



---

---

---

---

---

---

---

---

## Endemic Diseases for Florida Aquaculture

- **Finfish**
  - Koi Herpesvirus (KHV)
  - Largemouth Bass Virus (LMBV)
  - Other parasitic, fungal and bacterial diseases
- **Molluscs**
  - Perkinsosis
  - Multinucleate Sphere X (MSX)



---

---

---

---

---

---

---

---

## Emerging Diseases



---

---

---

---

---

---

---

---

## Finfish

- **“True” fish with fins and permanent gills**
  - Term distinguishes true fish from crayfish, jellyfish, starfish, etc.
- **Groups include**
  - Cyprinids (e.g., common grass and bighead carps)
  - Centrarchids (e.g., largemouth and smallmouth bass)
  - Cichlidae (e.g., tilapia)
- **Species harvested or in culture include**
  - Common carp (*Cyprinus carpio*), Goldfish (*Carassius auratus*)
  - Tilapia (Nile *Oreochromis niloticus* or Blue (*O. aureus*))
  - Largemouth bass (*Micropterus salmoides*)



---

---

---

---

---

---

---

---

## Spring Viremia of Carp (SVC)

- OIE notifiable disease
- Caused by a virus
- First official U.S. report in spring 2002
  - Farmed koi in NC, VA
  - Wild carp in WI
  - Recent outbreaks in WA, MO
- Major industry concern
- Can cause mortalities up to 70% in younger fish



---

---

---

---

---

---

---

---

---

---

## Spring Viremia of Carp (SVC)

### General Facts

- One of several Rhabdoviruses that cause diseases in fish
- Distribution – Reported in Europe, Middle East, Russia, North and South America, Asia
- Species affected – Koi/Common carp, Grass carp, Bighead carp, Silver carp, Crucian carp, goldfish (*C. auratus*)



---

---

---

---

---

---

---

---

---

---

## Spring Viremia of Carp (SVC)

### Disease Risk Factors

- Water temperature very important – 54-68°F (12-28°C)
- Fish age, other stressors, temperature fluctuation and immune status are also factors
- Transmitted through gills, feces, fish lice, birds, equipment, water and mud



---

---

---

---

---

---

---

---

---

---

## Spring Viremia of Carp (SVC)

- **Treatment**
  - No treatment available
  - Virus infective in mud for up to 42 days
- **Depopulate infected fish, then disinfect tank/pond**
- **Disinfection agents/techniques**
  - Gamma/UV radiation
  - Chlorination at 500 ppm for 10 minutes
  - pH less than 4.0 or greater than 10.0
  - Heating to 140°F (60°C) for 15 minutes



---

---

---

---

---

---

---

---

---

---

## Spring Viremia of Carp (SVC)

### Prevention

- Buy from SVC-free source
- Quarantine/Biosecurity
  - Keep shipments separate
  - Keep species separate (e.g., koi separate from goldfish)
  - Refrain from Japanese-style shows where fish are commingled
- Reputation of fish supplier
- Among finfish, only SVC-affected species require USDA-APHIS import permit and inspection at time of import



---

---

---

---

---

---

---

---

---

---

## Crustaceans

- **Invertebrates characterized by a hard outer shell and jointed appendages and bodies**
- **Two major classes**
  - Malacostracans (i.e., crab, shrimp, lobster)
  - Entomostracans (i.e., fairy shrimp, water fleas, barnacles)
- **Species harvested or in culture include**
  - Pacific White shrimp (*Litopenaeus vannamei*)
  - Blue shrimp (*Litopenaeus stylirostris*)
  - Giant Tiger shrimp (*Penaeus monodon*)



---

---

---

---

---

---

---

---

---

---

## White Spot Disease

- **Baculovirus** affecting mostly juvenile Pacific White shrimp with high mortality
- **Distribution**
  - Asia, North, Central and South America
  - Native Florida shrimp may harbor similar virus
- **Outbreak in Kaua'i, HI in April 2004**
- **Listed disease in the Florida Division of Aquaculture's Best Management Practices (BMP)**



White spot disease in giant black tiger shrimp, showing classic white spots



---

---

---

---

---

---

---

---

---

---

## Taura Syndrome Virus

- **Affects the Pacific White shrimp; all cultured species susceptible**
  - Affects post-larval, juvenile, sub-adult life stages
    - Mortality rate for these life stages 40 to 90%
    - Survivors may become carrier for life
- **Distribution**
  - Asia, Central, South and North America
  - Infected Central and South American shrimp introduced disease into Asia
  - Outbreaks in Texas and South Carolina in late 1990s



---

---

---

---

---

---

---

---

---

---

## Taura Syndrome Virus

- **Risk factors**
  - Seagulls feeding on infected/dead shrimp may carry virus pond to pond, farm to farm
- **Listed disease in the Florida Division of Aquaculture's BMP**



---

---

---

---

---

---

---

---

---

---

## Yellow Head Virus

- **Affects juvenile Giant Tiger shrimp**
  - High mortality in early and late juvenile life stages
- **Afflicted shrimp show signs of gross yellowing of the cephalothorax**
- **Distribution**
  - Asia
  - Americas – Possible, however not yet documented
- **Listed disease in the Florida Division of Aquaculture’s BMP**




---

---

---

---

---

---

---

---

---

---

## IHHNV

- **Infectious Hypodermal and Hematopoietic Necrosis Virus**
- **Affects Blue shrimp (*L. stylirostris*) – up to 90% mortality**
- **White leg shrimp (*L. vannamei*) less affected**
  - Resistant lines have been developed
  - Affected shrimp exhibit bent rostrum and broken antennae
- **Distribution**
  - SE Asia
  - Americas – Pacific Coast (NW Mexico to Chile)




---

---

---

---

---

---

---

---

---

---

## Molluscs

- **Invertebrate animals with soft unsegmented bodies, a muscular foot and a body enclosed in a mantle**
- **Groups include**
  - Cephalopods (e.g., squid, octopus)
  - Gastropods (e.g., abalone)
  - Bivalves (e.g., clams, mussels, oysters)
- **Species harvested or in culture include**
  - Eastern oyster (*Crassostrea virginica*)
  - Pacific oyster (*Crassostrea gigas*)
  - Flat oyster (*Ostrea equestris*)
  - Hard clams (*Mercenaria mercenaria*)




---

---

---

---

---

---

---

---

---

---

## Bonamiosis

- Caused by *Bonamia ostrea* (Northern hemisphere), a protozoan parasite
- Affects flat oysters
  - 2 new species affect the Asian oyster (*Crassostrea ariakensis*) and Flat oysters
  - Most infected oysters appear normal
- Distribution
  - France, Ireland, Italy, the Netherlands, Spain, the United Kingdom (excluding Scotland), and the United States (CA, ME and WA)
  - Confirmed cases in VA and NC in 2003 and 2004




---

---

---

---

---

---

---

---

---

---

## Seaside Organism Disease (SSO)

- Caused by the protist, *Haplosporidium costale*
- Affects the Eastern oyster
- Seasonal, complex life cycle ending in final sporulation killing the host
- Distribution on east coast of United States and Canada (from Virginia to Nova Scotia) in water with a salinity over 25 ppt
  - Outbreaks in Canada in 2003




---

---

---

---

---

---

---

---

---

---

## Quahog Parasite X (QPX)

- Net slime mold in phylum, Labyrinthulomycota
- Affects Hard clams
- Can be found from Virginia's east coast to Canada
  - Recent outbreaks in Massachusetts
- Clams entering Florida must be QPX free
- Listed disease in the Florida Division of Aquaculture's BMP




---

---

---

---

---

---

---

---

---

---

## Endemic Diseases



---

---

---

---

---

---

---

---

### Finfish Endemic Disease

## Koi Herpesvirus (KHV)

- **Highly contagious**
  - Transmitted from infected fish, water and/or mud
  - Water temperature important 64 - 81°F (17 - 27°C)
- **High mortalities**
  - 80 to 100% mortality (higher in younger fish)
  - Can occur as soon as 24 to 48 hours after signs of disease onset
- **Not transmissible to humans**
  - Affects koi and common carp
- **Worldwide distribution**
  - Reported in Europe, United States and Asia
- **Reportable to OIE**



---

---

---

---

---

---

---

---

### Finfish Endemic Disease

## Koi Herpesvirus (KHV)



Operculum removed to show gill with patchy white tips



Severe gill necrosis and discoloring



---

---

---

---

---

---

---

---

## Koi Herpesvirus (KHV)

### Treatment

- None – Virus can live in water for up to four hours
- Depopulation, then disinfect
- Disinfection techniques
  - Chlorine at 200 ppm for one hour
  - Quaternary ammonium compounds at 500 ppm for one hour (for nets)

### Prevention

- Quarantine/Biosecurity
  - Keep shipments separate
  - Keep species separate
  - Avoid Japanese-style shows where fish are commingled
  - Reputation of fish supplier



---

---

---

---

---

---

---

---

---

---

## Largemouth Bass Virus (LMBV)

- Iridovirus frequently present in healthy largemouth bass
  - Bass test positive, but show no clinical signs of infection
  - No LMBV-infected fish in Florida



---

---

---

---

---

---

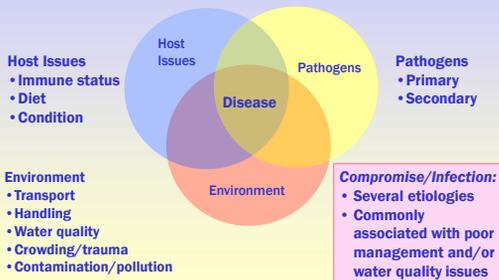
---

---

---

---

## Factors in Disease Development



---

---

---

---

---

---

---

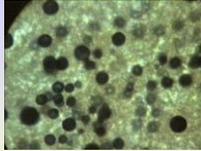
---

---

---

## Perkinsosis

- Also called “dermo” disease
- Caused by *Perkinsus marinus* and *P. olseni*
- Complex life cycle; all stages appear to be infective
- Affects *Crassostrea virginica*, *C. gigas*
  - Could infect other bivalves
- Distribution – U.S. East coast (ME to FL) and Gulf of Mexico
- Listed disease in the Florida Division of Aquaculture’s BMP



---

---

---

---

---

---

---

---

## Multinucleate Sphere X (MSX)

- Caused by protist, *Haplosporidium nelsoni*
  - Does not survive low salinities
- Affects *Crassostrea virginica*, *Crassostrea gigas*
  - Oysters are aberrant hosts
- Distribution
  - East coast of North America, California, France, Korea and Japan
- Listed disease in the Florida Division of Aquaculture’s BMP



---

---

---

---

---

---

---

---

## Things to Remember...

- Carriers and vectors
  - Survivors of viral diseases may be life-long carriers
  - Vectors can include fish, birds, parasites, equipment and personnel (i.e., YOU!)
- Viral diseases do not have treatments
- Make biosecurity/quarantine a habit
  - Personnel and equipment may be sources of disease and/or modes of transmission
  - Prevention is the best treatment in many cases



---

---

---

---

---

---

---

---

## Things to Remember...

### Zoonotic potential

- People with compromised immune systems are most susceptible
- Examples:
  - Atypical mycobacteriosis – bacterial infection
  - *Streptococcus iniae* – food handlers infected from handling live fish
  - Vibriosis – bacterial infection, especially risky for those with liver disease
  - Improper cooking practices can pass on infection



---

---

---

---

---

---

---

---

## Key Resources

- University of Florida Tropical Aquaculture fact sheets  
<https://tal.ifas.ufl.edu/extensionoutreach/extension-publications/>
- USDA Southern Regional Aquaculture Center / Texas A&M and Mississippi State  
<https://fisheries.tamu.edu/aquaculture/diseases/>



---

---

---

---

---

---

---

---

## Key Resources

- Florida Department of Community Affairs, Division of Emergency Management  
<http://www.floridadisaster.org>
- United States Department of Agriculture (USDA)  
<http://www.usda.gov>
- Florida Department of Agriculture and Consumer Services (FDACS)  
<http://www.doacs.state.fl.us>



---

---

---

---

---

---

---

---

## Key Resources

- **Florida Division of Aquaculture home page**  
<https://www.freshfromflorida.com/Divisions-Offices/Aquaculture>
- **Aquaculture Best Management Practices manual can be accessed directly at**  
<http://www.floridaaquaculture.com/BAD/BMP%20Rule%20-%20Manual%206-9-04.pdf>
- **eXtension Freshwater Aquaculture Community**  
<https://articles.extension.org/pages/58798/freshwater-aquaculture-community-page>



---

---

---

---

---

---

---

---

---

---

## Key Resources

- **USDA Animal and Plant Health Inspection Service (APHIS)**  
<http://www.aphis.usda.gov>
- **World Organisation for Animal Health (OIE)**  
<http://www.oie.int>
- **Safety for Fish Farm Workers video on the National Ag Safety Database (NASD), English and Spanish versions available from the following link**  
<http://nasdonline.org/search.php?query=safety+for+fish+farm+workers>



---

---

---

---

---

---

---

---

---

---

## Key Resources

- **Spawn, Spat, and Sprains book produced by the Alaska Sea Grant College Program. The entire book can be downloaded from the following link**  
[http://www.uaf.edu/seagrant/Pubs\\_Videos/pubs/AN-17.pdf](http://www.uaf.edu/seagrant/Pubs_Videos/pubs/AN-17.pdf)
- **University of Florida Institute of Food and Agricultural Sciences Electronic Data Information Source (EDIS) fact sheets for aquaculture, including diseases, can be found at the following links**  
[http://edis.ifas.ufl.edu/DEPARTMENT\\_VETERINARY\\_MEDICINE](http://edis.ifas.ufl.edu/DEPARTMENT_VETERINARY_MEDICINE)  
[http://edis.ifas.ufl.edu/DEPARTMENT\\_FISHERIES\\_AND\\_AQUATIC\\_SCIENCES](http://edis.ifas.ufl.edu/DEPARTMENT_FISHERIES_AND_AQUATIC_SCIENCES)



---

---

---

---

---

---

---

---

---

---

## Summary

- Identified the two categories of diseases in Florida
- Provided examples and characteristics of emerging diseases affecting finfish, crustaceans and molluscs
- Provided examples and characteristics of endemic diseases affecting finfish and molluscs
- Listed key resources available for additional information on aquatic animal health and disease



---

---

---

---

---

---

---

---

## Thank You!



---

---

---

---

---

---

---

---