

FINAL REPORT

Aquatic Animal Health Training Scheme Project Number [CSIRO AAHTS 2017.06]

AWARD RECIPIENT: Dr. Erin E. Kelly BSc BVMS

ADDRESS: 90 South Street, Murdoch WA 6150

HOST ORGANISATION: Murdoch University

DATE: 29th of July, 2018

Activity undertaken: Attendance at AQUAVET® II, a two-week course on the comparative histopathology of aquatic animals, held at Roger Williams University, Rhode Island, USA.

Outcomes achieved to date:

1. Successful completion of the AQUAVET® II course:
 - consisted of 98.5 hours of lectures and 11.25 hours of laboratory work (see Appendix A).
 - included a wide range of topics related to aquatic animal health and disease diagnosis and management including anatomy, physiology, aquaculture management, risk assessment, biosecurity, toxicology, and disease diagnosis.
 - training in dissection and collection of non-lethal and lethal diagnostic samples from a wide range of species, including several that I had not had experience with before including Atlantic horseshoe crab *Limulus polyphemus*, hard clam *Mercenaria mercenaria*, and species of aquatic gastropods, urchin, skate and dog fish.
2. Utilisation of the information and experience gained from this course in the education of veterinary students, my own research, and the research of colleagues. Since returning from the course two weeks ago I have already:
 - applied skills learnt in the course to a veterinary student's research project that I am co-supervising (focussing on histology of a native species).
 - assisted a colleague in identifying several metazoan parasites in tissue sections in an aquatic animal.
 - incorporated information learnt during the course in lectures and practical laboratory classes that will be run in semester 2, 2018 for veterinary and animal science students.
 - begun planning for a lecture or seminar for veterinary students/other students/interested individuals on aquatic animal health is underway.

Acknowledgments

I would like to thank the following organisations and people:

- Fisheries Research and Development Corporation (FRDC) for the financial support to attend AQUAVET® II, without which my attendance would not have been possible.
- Freshwater Fish Group and Fish Health Unit, and School of Veterinary Life Sciences, Murdoch University, for supporting and encouraging my attendance, and providing materials required for the course.
- Associate Professor Alan Lymbery, Dr. Richmond Loh, Dr. Jo Bannister, Dr. Susan Gibson-Kueh, and Dr. Nahiid Stephens, for supporting my FRDC and AQUAVET® II application.

Background

AQUAVET® is a series of world-renowned intensive, total immersion short courses that aim to equip veterinary professionals with the skills to become valuable contributors in the field of aquatic animal health management. There is no course like AQUAVET® currently available in Australia. AQUAVET® II is a two-week course presented by the Cornell University College of Veterinary Medicine, in collaboration with individuals from over thirty universities, fisheries services, institutions, aquariums, hatcheries, research and pathology laboratories, and government departments involved in aquatic animal health management.

The course provides an intensive, high-quality and cost-effective method to up-skill across a vast range of topics related to aquatic animal health, by providing lectures, workshops, wet labs and field trips delivered by experts in the field. The course focuses on the comparative histopathology of aquatic species, and provides training in a range of areas related to aquatic animal health including health investigation, disease management, disease prevention (i.e. vaccinations), surgery, toxicology and biosecurity.

AQUAVET® aims to address the need for veterinarians with aquatic animal health experience, and some of the main goals of the program are “to identify, stimulate, and encourage as many potential leaders of this emerging branch of veterinary medicine as possible” and “to provide for the orderly progression of students into positions of leadership, from which the real contributions of the profession can be made to society. The generation and application of new knowledge must be the ultimate mission.”

Need

The 2008 National Aquatic Animal Health Technical Working Group workshop identified the "... concern that there are too few suitably trained and accredited aquatic animal health professionals to service Australia's fisheries and aquaculture industries and to ensure succession to a new generation of aquatic animal health professionals" (Johnson 2012). Furthermore, AQUAPLAN 2014-2019 indicates that the strength of Australia's aquatic animal health management systems is directly affected by the "availability of appropriately trained and competent personnel" such as veterinarians (Department of Agriculture 2014).

There are very few veterinarians specializing in aquatic animal health in Australia. These veterinarians have a unique skill set that enable them to provide significant contributions to Australia's fishing and aquaculture industries, in areas such as the diagnosis, treatment and management of aquatic diseases, improvement of aquaculture production efficiencies, monitoring disease control programs, and conduction of aquatic animal health research.

Course information provided by AQUAVET® summarises the general need for aquatic veterinarians worldwide:

"Members of the veterinary medical profession are increasingly expressing a desire to contribute to the welfare of the inhabitants of the aquatic world. Furthermore, excessive harvesting, ever more significant pollution problems, and disease have had devastating effects on many sea animal populations, once taken for granted. In a protein-hungry world, control and prevention of disease among aquatic animals, especially those cultured for human consumption, is crucial. The biomedical skills used so effectively by veterinarians to deal with disease and increase productivity among terrestrial animals can be applied to aquatic animals as well. But this will be possible only if schools of veterinary medicine develop programs to train students and stimulate research in aquatic animal medicine."

The AQUAVET® program provides much needed education in aquatic animal health and is presented in a format that makes it accessible for veterinarians from a range of backgrounds and locations worldwide. There are currently only three aquatic animal health veterinarians in Western Australia, and less in each of Australia's other states and territories. As a veterinarian, I am passionate about all areas of aquatic animal health, and strive to provide a high standard of research and veterinary expertise to promote high levels of welfare, health and sustainability of aquatic animals and associated industries in Australia.

Objectives

1. Acquisition of new skills and knowledge in aquatic vertebrate and invertebrate health.

The opportunity to develop my understanding of aquatic species and learn new skills at AQUAVET® II exceeded my expectations. See below in results/discussion.

2. Transfer new knowledge and skills gained from AQUAVET II to students, veterinarians and individuals/groups involved in the fishing and aquaculture industry.

Currently underway/ongoing. See below in benefits and adoption.

3. Meet and network with specialists in aquatic animal health management.

The AQUAVET® II course provided a fantastic opportunity to meet other veterinarians and specialists in aquatic animal health. I have already been in communication with several specialists I met during the course in regard to my own research. Through the course I have made a number of friends that I will stay in contact with. During the course we discussed possible avenues for collaboration and have started a group to discuss aquatic animal care and diagnostic cases and stay in touch.

Methods

The following is an outline of the course, held at Roger Williams University in Bristol, Rhode Island, USA. As outlined, AQUAVET® II is an intensive course, with days running from 8am to approximately 8:30-9:30pm each night.

Sunday, May 27 2018

1200-1300	Registration/check-in
1400	Orientation
1300	RWU Safety Lecture
1600	Normal Anatomy of Bivalves – <i>Dr. Roxanna Smolowitz, RWU</i>
1830	Normal Anatomy of Bivalves continued – <i>Dr. Smolowitz</i>

Monday, May 28 2018

800	Slide Viewing/Conundrums – <i>Dr. Rod Getchell – Cornell U</i>
830	Normal Anatomy of Bivalves continued – <i>Dr. Smolowitz</i>
1000	Diseases of Bivalves – <i>Dr. Smolowitz</i>
1300	Diseases of Bivalves continued – <i>Dr. Smolowitz</i>
1830	Anatomy and Diseases of Cephalopods – <i>Dr. Smolowitz</i>
1930	Icebreaker

Tuesday, May 29 2018

800	Slide Viewing/Conundrums – <i>Dr. Getchell</i>
845	Anatomy and Diseases of Cephalopods – <i>Dr. Smolowitz</i>
1300	Anatomy and Diseases of Echinoderms – <i>Dr. Smolowitz</i>
1830	Parasites in Aquatic Animals – <i>Dr. Poynton, John Hopkins U</i>

Wednesday, May 30 2018

- 800 Slide Viewing/Conundrums – *Dr. Getchell*
845 Anatomy and Diseases of Crustaceans – *Dr. Smolowitz*
1300 Diagnosis of Pathogens Affecting Shellfish: Methods and Regulatory Requirements
– *Dr. Marta Gomez-Chiarri, University of Rhode Island*
1500 Aquaculture Vaccine Reactions Histologically Speaking
– *Dr. Getchell*
1830 Emerging Viral Fish Diseases in the US – SCVC, SHSV, KHV, LMBV – *Dr. Getchell*

Thursday, May 31 2018

- 800 RWU Shellfish Hatchery visit
– *Dr. Dale Leavitt, Robbie Hudson, RWU*
845 Invertebrate Pathology Wet Lab – *Dr. Smolowitz*
1300 Invertebrate Pathology Wet Lab – *Dr. Smolowitz*
1800 AQUAVET® I and II Class Picnic

Friday, June 1 2018

- 800 Using Aquatic Animals in Research and the Role of IACUC – *Dr. Neil Lipman, Memorial Sloan Kettering Cancer Center*
1000 Toxicologic Pathology of Fishes – *Dr. Jeff Wolf, Experimental Pathology Laboratories, Inc.*
1300 Toxicologic Pathology of Fishes continued – *Dr. Wolf*
1830 Toxicologic Pathology of Fishes continued – *Dr. Wolf*

Saturday, June 2 2018

- 800 Toxicologic Pathology of Fishes continued – *Dr. Wolf*
1300 Toxicologic Pathology of Fishes continued – *Dr. Wolf*
1830 Slide viewing – *Dr. Getchell*

Sunday, June 3 2018

- 830 Field trip – whale watch

Monday, June 4 2018

- 800 Neoplasia of Fish/Non-Infectious Diseases of Aquaculture Species – *Dr. Sal Frasca, University of Florida*
1300 Fish Hematology – *Dr. Jill Arnold, National Aquarium, Baltimore*
1630 Fish as Lab Animals – *Dr. Jan Lovy, New Jersey Division of Fish and Wildlife*
1830 Electron Microscopy in Diagnostic Fish Virology – *Dr. Lovy*

Tuesday, June 5 2018

- 800 Diseases of Coldwater Aquaculture Species – Bacterial and Viral Diseases – *Dr. Thomas Loch, University of Michigan, and Dr. Lovy*
1300 Diseases of Coldwater Aquaculture Species – Fungal, Protozoan and Myxozoan Diseases – *Drs. Lovy, Loch, Frasca, Ossiboff*

1830 Amphibian Pathology I – *Dr. Rob Ossiboff, University of Florida*

Wednesday, June 6 2018

800 Amphibian Pathology II – *Dr. Ossiboff*

930 Introduction to Diseases of Aquaculture Species – Warmwater –
Catfish – *Dr. Shermann Jack, Mississippi State University*

1300 Pathology of Catfish Diseases – *Dr. Jack*

1830 Diagnostic Case Studies and Practicum – Aquacultured Species
– *Drs. Jack and Getchell*

Thursday, June 7 2018

800 Fish Diagnostics and Techniques Wet Lab – *Dr. Getchell*

1300 Corals – *Dr. Ilze Berzins, One World, One Water, One Health,
LLC*

1830 Corals continued – *Dr. Berzins*

Friday, June 8 2018

800 Overview of the Principal Infectious Diseases Found in Farmed
Penaeid Shrimp – *Dr. Bob Bullis, Florida Keys Community
College, and Dr. Arun Dhar, University of Arizona, Aquatic
Pathology Laboratory*

1300 Overview of the Principal Infectious Diseases Found in Farmed
Penaeid Shrimp – *Drs. Dhar and Bullis*

1830 Clambake

Saturday, June 9 2018

1000 Checkout

Results/Discussion

Undertaking the AQUAVET® II course provided an invaluable experience to learn about aquatic animal health and meet like-minded veterinarians and researchers. During the 2-week course, I was able to reinforce my existing knowledge of finfish and invertebrate anatomy and histology and advance my understanding of pathogens and disease processes in these animals. Approximately 2-3 hours of each day of the course was spent on examination, diagnosis and discussion of slides, which has developed my confidence in identifying and describing lesions. This was frequently accompanied by discussion of disease investigation and management, which has allowed me to consolidate my knowledge on the entire process of aquatic health and disease from disease surveillance and prevention, risk analysis, monitoring, and outbreak investigation and management, both of wild and farmed species.

The course also involved the discussion and diagnosis of many pathogens currently considered exotic to Australia, which has given me a better understanding of the health issues currently affecting aquatic animals in the United States of America (and elsewhere), including the disease investigation and management practices applied in these situations. The opportunity to examine and diagnose pathogens currently

exotic to Australia and discuss these pathogens with specialists involved in their monitoring, diagnosis and management is an invaluable experience and I feel I have developed a much deeper understanding of these pathogens and feel more confident about applying my knowledge to the investigation of exotic pathogens within Australia. Through the wet laboratory sessions, I have become proficient in the collection and interpretation of non-lethal diagnostic samples from a range of vertebrate and invertebrate aquatic species, including the collection of blood/haemolymph, gill clips, skin scrapes and parasite identification.

It is difficult to summarise the volume of new information I learnt during this course. As mentioned above, the learning experiences provided by AQUAVET® II far exceeded my expectations. The range of aquatic animal species covered in this course has given me a more wholistic understanding of aquatic animals, their individual needs, and their interactions within ecosystems. This course has given me the tools and the confidence to pass on my knowledge of aquatic animals to veterinary students and promote aquatic animal species as an area of interest. The small class size (11 students) provided a fantastic learning environment, and the opportunity to both interact one-on-one with aquatic animal specialists that are leaders in their field and discuss diagnostic cases in a small group. I believe AQUAVET® II an invaluable course and would highly recommend it for any individual who would like further training in the and diagnosis and management of disease in aquatic animals.

Benefits and Adoption

I have already begun to share the knowledge gained from this training opportunity to assist in the education of veterinary students. As a veterinarian with an interest in aquatic animals who assists in the education of veterinary and animal health students, I hope to act as a role model to promote an interest in aquatic animal health management and demonstrate the potential for positions in Australia's fishing and aquaculture industries to be exciting and legitimate career options for veterinarians.

Further Development

As mentioned above, I have already begun planning a seminar/lecture that incorporates some of the information learnt during AQUAVET® II – I originally was considering this to be delivered to veterinary students, however could also be available for the public.

References

Department of Agriculture (2014) AQUAPLAN 2014-2019: Australia's National Strategic Plan for Aquatic Animal Health. Canberra.

Johnson, J (2012) Final report – 2009/315.10 – Aquatic animal health training scheme.

Intellectual property

The learning materials presented during the course remain the intellectual property of the individual presenters and/or their organisations, and as such cannot be shared in the form they were provided without their express consent.

Appendices

Appendix A Certificate of Continuing Education

AQUAVET®



A Program in Aquatic Veterinary Medicine
www.aquavet.org

CONTINUING EDUCATION CREDIT FOR AQUAVET® II

This shall serve to certify that

Dr. Erin Kelly
P. O. Box 575
Margaret River
Western Australia 6285
[Australia](#)

has been enrolled in and completed the

AQUAVET® II course **Comparative Pathology of Aquatic Animals**

presented by Cornell University, College of Veterinary Medicine on the campus of

Roger Williams University
Marine and Natural Sciences Building
One Old Ferry Road
Bristol, RI 02809

during the period May 27, 2018 through June 8, 2018 inclusive. This course consisted of 98.5 hours of lecture and 11.25 hours of laboratory work.

Donald W. Stremme, V.M.D.
AQUAVET® Director
Cornell University, College of Veterinary Medicine

Lorin Warnick, D.V.M., Ph.D.
Austin O. Hooey Dean of Veterinary Medicine
Cornell University, College of Veterinary Medicine

AQUAVET® Director
Donald W. Stremme, V.M.D.
TEL +1-609-350-3044
aquavetmail@gmail.com

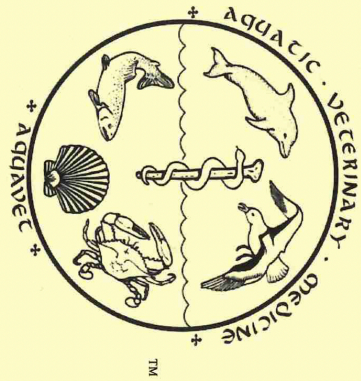
AQUAVET® Associate Director
Rodman G. Getchell, Ph.D.
TEL +1-607-253-3393
rgg4@cornell.edu

AQUAVET® Associate Director
Laurie J. Landeau, V.M.D., M.B.A.
TEL +1-410-221-7900
YankeeHorses@aol.com

AQUAVET® Associate Director
Robert J. Maze, M.S., Ph.D.
TEL +1-443-521-4061
fourfivefive@att.net

Cornell University
College of Veterinary Medicine
Department of Microbiology and
Immunology
CS181 Vet Medical Center
Ithaca, NY 14853-6401

**Appendix B
Certificate of Completion**



*Held at Roger Williams University, Bristol, Rhode Island
27. May to 9. June 2018*

*Sponsored by
Cornell University, College of Veterinary Medicine*

This is to certify that

Dr. Erin E. Kelly

has successfully completed the course

AQUAVET® II 2018
Comparative Pathology of Aquatic Animals


Rodman G. Getchell, Ph.D.
Associate Director of AQUAVET®


Donald W. Stremme, V.M.D.
Director of AQUAVET®

Appendix C Course Timetable



2018 Schedule for AQUAVET[®] II

Locations:

Marine and Natural Sciences Building = MNS

Global Heritage Hall = GHH

Lecture rooms: MNS 200, MNS 210, MNS 213, **GHH G01, GHH G05**

Labs: MNS 103, MNS 107, MNS 203

Sunday, 27. May 2018

12:00–13:30 Registration – Check-In
Bayside
Apartments

14:00 Orientation
GHH G01 Directors

15:00 RWU Required Safety Lecture
GHH G01 Caitlin Conley

16:00 Normal Anatomy of Bivalves
MNS 213 Dr. Roxanna Smolowitz – Roger Williams University

18:30 Normal Anatomy of Bivalves (continued)
MNS 213 Dr. Smolowitz

19:30 Icebreaker – Wine and Cheese
Dorm Courtyard Area (weather permitting)

Monday, 28. May 2018 – Memorial Day

8:00 Slide Viewing / Conundrums
MNS 213 Dr. Rod Getchell – Cornell University
AQUAVET[®] Associate Director

8:30 Normal Anatomy of Bivalves (continued)
MNS 213 Dr. Smolowitz

10:00 Diseases of Bivalves
MNS 213 Dr. Smolowitz

13:00 Diseases of Bivalves (continued)
MNS 213 Dr. Smolowitz

18:30 Anatomy and Diseases of Cephalopods
MNS 213 Dr. Smolowitz

*2018 Schedule for AQUAVET®II***Tuesday, 29. May 2018**

- 8:00
MNS 213 Parasites in Aquatic Animals
Dr. Sarah Poynton – John Hopkins Medical University, School of Medicine
- 10:00
MNS 213 Anatomy and Diseases of Cephalopods (continued)
Dr. Smolowitz
- 13:00
MNS 213 Anatomy and Diseases of Echinoderms
Dr. Smolowitz
- 18:30
MNS 213 Parasites in Aquatic Animals
Dr. Poynton

Wednesday, 30. May 2018

- 8:00
MNS 213 Slide Viewing/ Conundrums
Dr. Getchell
- 8:45
MNS 213 Anatomy and Diseases of Crustaceans
Dr. Smolowitz
- 13:00
MNS 213 Diagnosis of Pathogens Affecting Shellfish: Methods and Regulatory Requirements
Dr. Marta Gomez-Chiarri – University of Rhode Island
- 15:00
MNS 213 Aquaculture Vaccine Reactions Histologically Speaking
Dr. Getchell
- 18:30
MNS 213 Emerging Viral Fish Diseases in the US – SVCV, SHSV, KHV, LMBV
Dr. Getchell

Thursday, 31. May 2018

- 8:00
RWU Shellfish Hatchery visit
Dr. Dale Leavitt – Roger Williams University
Robbie Hudson – Roger Williams University
- 8:45
MNS 103 Invertebrate Pathology – WET LAB
(need dissection kit, lab coats)
Dr. Smolowitz
- 13:00
MNS 103 Invertebrate Pathology – WET LAB (continued)
(need dissection kit, lab coats)
Dr. Smolowitz

2018 Schedule for AQUAVET®II

18:00 AQUAVET® Joint Class Picnic
courtyard

Friday, 1. June 2018

8:00 Using Aquatic Animals in Research and the Role of IACUC
GHH G05 Dr. Neil Lipman - Memorial Sloan Kettering Cancer Center

10:00 Toxicologic Pathology of Fishes
MNS 213 Dr. Jeff Wolf - Experimental Pathology Laboratories, Inc

13:00 Toxicologic Pathology of Fishes (continued)
MNS 213 Dr. Wolf

18:30 Toxicologic Pathology of Fishes (continued)
MNS 213 Dr. Wolf

Saturday, 2. June 2018

8:00 Toxicologic Pathology of Fishes (continued)
MNS 213 Dr. Wolf

13:00 Toxicologic Pathology of Fishes (continued)
MNS 213 Dr. Wolf

18:30 slide viewing
MNS 213 Dr. Getchell

Sunday, 3. June 2018 - OFF

8:30 leave campus for **OPTIONAL Whale Watch - Barnstable, MA**
10:00 check in for Whale Watch
11:00 **OPTIONAL Whale Watch \$40 per person**
Barnstable, MA

Monday, 4. June 2018

8:00 Neoplasia of Fish / Non-Infectious Diseases of Aquaculture Species
MNS 213 Dr. Sal Frasca - U FL - College of Veterinary Medicine
Dr. Rob Ossiboff - U FL - College of Veterinary Medicine

13:00 Fish Hematology
MNS 213 Dr. Jill Arnold - National Aquarium, Baltimore

2018 Schedule for AQUAVET®II

- 18:30 Fish as Lab Animals
MNS 2 13 Dr. Jan Lovy – NJ Div of Fish & Wildlife, Office of Fish & Wildlife Health & Forensics
- 18:30 Electron Microscopy in Diagnostic Fish Virology
MNS 2 13 Dr. Lovy

Tuesday, 5. June 2018

- 8:00 Diseases of Coldwater Aquaculture Species – Bacterial and Viral Diseases
MNS 2 13 Dr. Lovy
 Dr. Thomas Loch – University of Michigan
- 13:00 Diseases of Coldwater Aquaculture Species – Fungal, Protozoan and Myxozoan Diseases
MNS 2 13 Drs. Lovy, Loch, Frasca, Ossiboff
- 18:30 Amphibian Pathology I
MNS 2 13 Drs. Ossiboff

Wednesday, 6. June 2018

- 8:00 Amphibian Pathology II
MNS 2 13 Drs. Ossiboff
- 9:30 Introduction to Diseases of Aquaculture Species – Warmwater – Catfish
MNS 2 13 Dr. Sherman Jack – Mississippi State University, CVM
- 13:00 Pathology of Catfish Diseases
MNS 2 13 Dr. Jack
- 18:30 Diagnostic Case Studies and Practicum – Aquacultured Species
MNS 2 13 Drs. Jack and Getchell

Thursday, 7. June 2018

- 8:00 **Fish Diagnostics and Techniques WET LAB**
MNS 103 **(need dissection kit, lab coats)**
 Dr. Rod Getchell
- 13:00 Corals
MNS 2 13 Dr. Ilze Berzins – One World, One Water, One Health, LLC

2018 Schedule for AQUAVET®II

18:30 Corals (continued)
MNS 213 Dr. Berzins

Friday, 8. June 2018

8:00 Overview of the Principal Infectious Diseases Found in Farmed Penaeid
MNS 213 Shrimp
 Dr. Bob Bullis – Florida Keys Community College
 Dr. Arun Dhar – University of AZ, Aquatic Pathology Laboratory

13:00 Overview of the Principal Infectious Diseases Found in Farmed Penaeid
MNS 213 Shrimp
 Drs. Dhar and Bullis

18:30 **AQUAVET®II Clambake**

Saturday, 9. June 2018

By 10:00 check out – back to reality

Appendix D
Photographs from the course



The Marine and Natural Sciences building, Roger Williams University, location for AQUAVET® II classes



Roger Williams University campus, Rhode Island USA



AQUAVET® II Class of 2018



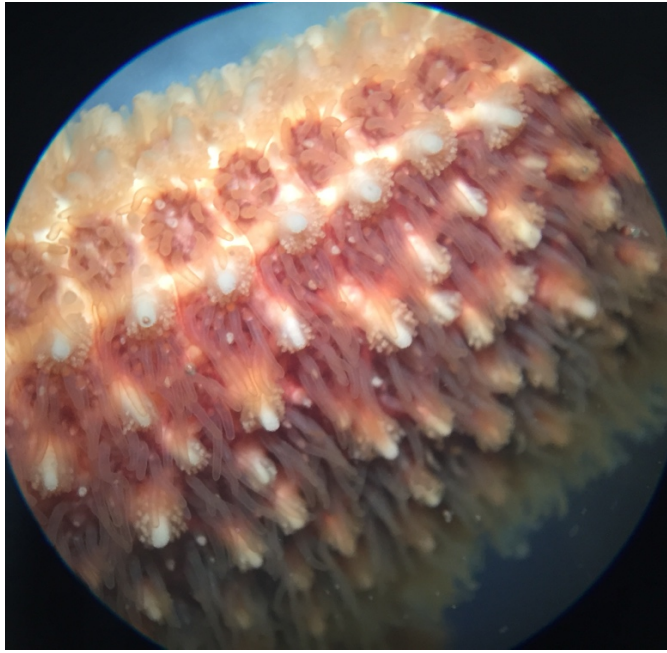
Whale watching field trip, Sandy Neck, Rhode Island USA



Finback whale, Cape Cod USA



Invertebrate slide viewing



Invertebrate Lab, Echinoderm examination



Limulus examination



Invertebrate Wet Lab



Crustacean examination