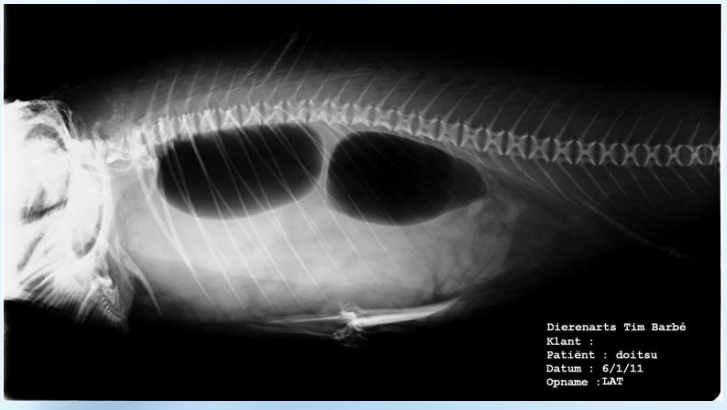
ISSN 2329-5562

The Aquatic Veterinarian



Radiograph of a koi, by Dr. Tim Barbé.
See Clinical Case Report on pages 24-27.

Volume 13, Number 1
First Quarter, 2019

World Aquatic Veterinary Medical Association

WHO ARE WE

MISSION

The Mission of the World Aquatic Veterinary Medical Association is to serve the discipline of aquatic veterinary medicine in enhancing aquatic animal health and welfare, public health, and seafood safety in support of the veterinary profession, aquatic animal owners and industries, and other stakeholders.

OBJECTIVES

A. To serve aquatic veterinary medicine practitioners by developing programs to support and promote our members, and the aquatic species and industries that they serve;

B. To be an advocate for, develop guidance on, and promote the advancement of aquatic animal medicine within the veterinary profession and with associated industries, governments, non-governmental entities and members of the public;

C. To develop and implement aquatic veterinary education programs, certifications and publications, including a credentialing process to recognize day-one competency in aquatic animal medicine;

D. To foster and strengthen greater interactions among: aquatic veterinarians, related disciplines, veterinary allied and supportive groups and industries, governments and animal owners.

The ideas presented in this publication express the views and opinions of the authors, may not reflect the view of WAVMA, and should not be implied as WAVMA recommendations or endorsements unless explicitly stated.

Information related to the practice of veterinary medicine should only be used within an established valid Veterinarian-Patient-Client Relationship.

ISSN 2329-5562

CONTENTS

Page numbers are hyperlinked to articles. If you are reading a digital copy of this, Control click on page number to go to that page.

EDITORIALS

Editor's Note

Welcome to a new year of exciting aquatic veterinary news. Spring has sprung for those of us in the Northern hemisphere, and Winter is coming (after autumn, anyway) for those in the South. And there are a lot of fishy activities going on all around the world (see the continuing education offerings on pages 37-39).

In this issue, we have a great clinical case report by Dr. Tim Barbé from Belgium on his experiences treating koi with swimbladder problems (page 24-27). Also, I published an article on Anesthesia and Euthanasia in Ornamental Fish (pages 28-33). There are no student reports from the John L. Pitts Aquatic Veterinary Education Awards yet for this year, but there should be some coming in soon. There is a Student Chapter report from the University of Illinois (page 14), and I encourage all of our student chapters to send reports of their activities.

This is the 7th year of *The Aquatic Veterinarian*, since switching from a newsletter (*Aquatic Vet News*—2007-2012) to a journal format in 2013. We have had some remarkable research papers and clinical studies submitted by our members in the past, and I encourage all our members, even student members, to submit articles, news items, or anything of interest to our members for future issues. We really would like to make a world renowned journal for aquatic veterinarians, but need your support. And, please consider joining the Communications Committee to help get the word out about Aquatic Medicine to other veterinarians!

Nick Saint-Erne, **DVM, CertAqV**
Executive Editor
TAVeditor@wavma.org

Seahorses at the Dallas North Aquarium (see pages 18-21).

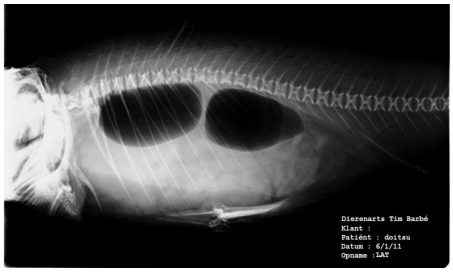
Download a QR reader onto your Smart Phone and scan the Quick Response Code to the right. It will take you to the WAVMA.org website page for accessing all of the past WAVMA Newsletters.

You will need your WAVMA User ID and Password to access the most recent issues of *The Aquatic Veterinarian.*

The latest editions are available for download at https://www.wavma.org/TAV-Current-Issues.

Past years' editions are available for download at https://www.wavma.org/TAV-Archives.

Cover Photo:



Radiograph of a koi, by Dr. Tim Barbé. See Clinical Case Report on pages 24-27.

President's Report

The year 2019 began under the mandate of a new board with an impressive mix of individuals from Africa, Asia, Europe and the Americas. With three members sitting on the board for the first time, they bring new perspectives to the table, which is important for taking the organization into 2020.

As the 2019 President, my goal is to focus on WAVMA as an organization with a view of strengthening its capacity to fulfil the mandate on which it was founded. These include more efficient and effective ways of executing the functions of the organization, streamlining the programs and benefits to members, and reviewing the committees that exist in the organization.

I am pleased to announce that at the very first board meeting held in January, the board approved the WAVMA Code of Ethics and Code of Conduct which can be downloaded here:
https://www.wavma.org/media/Documents-for-download/WAVMA%20Code%20of%20Ethics%20and%20Code%20of%20Conduct.pdf

This, along with the Conflict of Interest declarations that those in leadership are required to sign, are important steps to enhancing transparency, accountability and good governance of WAVMA.

With more than 80 members already certified as Certified Aquatic Veterinarians and with the program being one of the most popular member benefits, there is a need to have more hands on deck. As President, I am encouraged by the overwhelming response by the CertAqVs to my call to them to join the committee. This is the first stage in streamlining the work of this important committee and these new members have already been engaged in the evaluation process of several new applicants.

I have also met with the chairs of the Student's Committee, Membership/Education Committee, Credentialing Committee and Communication's Committee with a view of improving the functionality of these committees, since they are crucial committees that address our large student membership and the benefits offered to our members in general.

As the year progresses, I will continue to work along with the members of the Executive Board and Committees in advancing these initiatives and I am positive that in future reports, I will be able to inform you of very good outcomes.

Devon Dublin PhD, DMVZ, MSc, CertAqV
WAVMA President 2019
201 Leopalace FONTEINE,
Hatsunegaoka 37-14, Hodogaya-ku,
Yokohama, Kanagawa
240-0016, Japan
President@wavma.org

President Devon Dublin in Egypt.

Secretary's Report

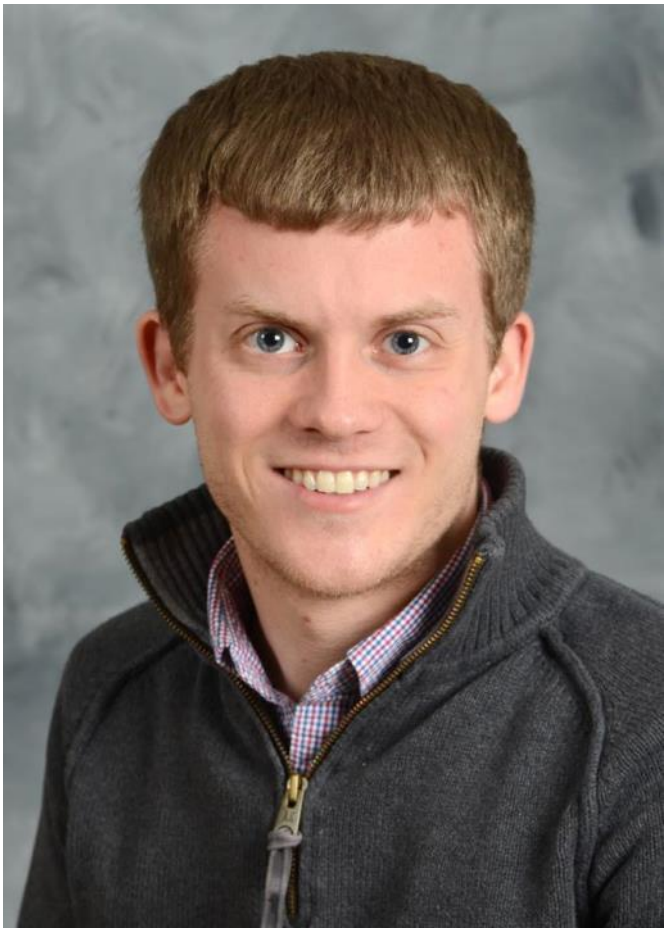
The WAVMA Secretary is also the Chair of the Communications Committee. The other members of this committee include: *Devon Dublin, Chris Walster, Andrei Bordeianu, John Griffioen, Miguel Grilo, Nick Saint-Erne, David Scarfe,* and *Irene Yen.* Members of this committee are responsible for creating *The Aquatic Veterinarian* journal, edited by Nick Saint-Erne, who is doing a great job on this high-quality publication; the WAVMA e-News, which is emailed out to members by Miguel Grilo, who is doing an excellent job with this.

As Secretary, I manage the WAVMA Social Media accounts. Our Facebook Page has just shy of 6,500 followers, and the WAVMA Group has approximately 500 members.

We also manage the WAVMA.org website, which is due for some critical website improvements. These were reviewed by the committee members in the January conference call and the suggestions were submitted to the WAVMA Executive Board for review and approval. Watch for updates to the website.

The next Communications Committee conference call is scheduled for June. Please let me know if you would like to join in, as we always welcome more committee members.

Stephen Reichley, DVM, PhD, CertAqV
WAVMA Secretary
Secretary@wavma.org



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TO SUPPORT FUTURE STUDENT SCHOLARSHIPS, PLEASE MAKE A DONATION TODAY TO THE SCHOLARSHIP FUND! WWW.WAVMA.ORG/SCHOLARSHIPS.

Below: Cichlids from Dallas North Aquarium

New Members—1st Quarter 2019

Members are the life-blood of any professional Association. Please join us in welcoming the following new WAVMA members:

Veterinarian Members

Dondrae Coble	USA
Susan England-Foster	St. Kitts & Nevis
Emma Hall	Australia
Andrew Martin	United States
Allison Peterson	USA
Patinan Rookkachard	Thailand
Cyrus So	Australia

Vet Graduate Student, Intern or Resident

Rachel Brown	UK
Jessica Eisenbarth	USA
Elizabeth Leuchte	UK
Yu Chen Li	Taiwan
Miranda Torkelson	USA

Vet Student Members

Merna Abdo	St. Kitts & Nevis
Samantha Antolick	Australia
Olivia Armstrong	Australia
Alexandra Baker	Grenada
Audrey Bolanos	St. Kitts & Nevis
Adam Borsheim	Grenada
Yun Jung Byeon	St. Kitts and Nevis
Dominique Capaldo	St. Kitts & Nevis
Megan Cecil	St. Kitts & Nevis
Brian Chambers	USA
Erica Chang	USA
Rachel Clark	USA
Alec Colosi	USA
Tiffany Cosey	USA
Anjuli Dabydeen	Australia
Stephanie Dawes	St. Kitts & Nevis
Melissa Diaz	St. Kitts & Nevis
Jodie Espy	USA
Beatriz Faisca	St. Kitts & Nevis
Nicole Fernous	St. Kitts & Nevis
Bailey Flint	St. Kitts & Nevis
Ashley Foster	St. Kitts & Nevis
Jacquelyn Garcia	Granada
Justin Garretto	St. Kitts & Nevis
Georgia Goh	Australia
Camille Gonzalez	St. Kitts & Nevis
Rachel Griffith	St. Kitts & Nevis
Kailey Gullickson	Australia
Jade Hall	
Carl Harris	St. Kitts & Nevis
Dermot Hutchinson	USA
Brianna Jacobs	Grenada
Nevada Jordan	Australia
Kelsey Joyner	St. Kitts & Nevis
Holly Kalua	St. Kitts & Nevis
Kristina Kelley	Grenada

Vet Student Members—continued

Ava Kent	St. Kitts & Nevis
Delia Large-Hart	St. Kitts & Nevis
Lindsay MacDonald	USA
Cassaundra Martel	Grenada
Samantha Marzano	St. Kitts & Nevis
Brandi McClellan	USA
Laura McPherson	St. Kitts & Nevis
Timmantha Micielli	St. Kitts & Nevis
Kayla Mochizuki	
Sydney Mordoh	USA
Jessica Murden	St. Kitts & Nevis
Jaclyn Nicklas	St. Kitts & Nevis
Brittani Nicolaci	St. Kitts & Nevis
Kwamina Otseidu	USA
Dean Pappas	Australia
Bailey Percival	St. Kitts & Nevis
Sofia Perez	St. Kitts & Nevis
Jorge Pineiro	St. Kitts & Nevis
Sydney Chanel Price	St. Kitts & Nevis
Pratheek Reddy	
Marie Rosario	St. Kitts & Nevis
Erica Rudolf	Grenada
Lauren Saroli	St. Kitts & Nevis
Tiffany Sastre Carreras	St. Kitts & Nevis
Morgan Schriber	St. Kitts & Nevis
Kenzie Schwartz	USA
Corey Spies	USA
Sydney Sult	St. Kitts & Nevis
Rebecca Sutcliffe	St. Kitts & Nevis
Cheryl Theile	USA
Samantha Tirone	St. Kitts & Nevis
Corrin Toben	St. Kitts & Nevis
Anastasia Towe	USA
Natalie Tym	Australia
Ali Vavlas	USA
Alexander Viere	USA
Courtney Walker	St. Kitts & Nevis
Skyler West	St. Kitts & Nevis
Laura Whalen	USA
Cassie Willrett	St. Kitts & Nevis
Simona Zduoba	Australia
Kathryn Ziegner	USA
Joshua Zlotnick	USA

Vet Tech/Nurse Member

Jennifer MacDonald	Canada

Nick Saint-Erne, DVM CertAqV
WAVMA Treasurer
Treasurer@WAVMA.org

PRIVILEGES & BENEFITS OF WAVMA MEMBERSHIP

Enjoy on-line *e-Learning* programs & courses to advance your knowledge & skills

Get continuing education credit through *WebCEPD*, *PubCEPD* & *Clinical Corner*

Discover core knowledge, skills & experience needed to become a WAVMA Certified Aquatic Veterinarian *(CertAqV)*

Receive *discounted* subscriptions to publications & meetings

Utilize *WAVMA's picture & video libraries* for your own presentations

Join *listservs* to discuss clinical cases & other issues

Mentor & be mentored to expand your and other's aquatic veterinary skills

Publish your articles in WAVMA's quarterly journal: *The Aquatic Veterinarian*

Find world-wide externships, internships, residencies & jobs in all aquatic vet areas

Access *Member Directories* & have your Clinic/ Hospital listed on-line

Benefit from *Educational grants* for vet students & new veterinary graduates

Form & participate in *veterinary school chapters* throughout the world

Participate in veterinarian and client surveys

Help build additional member programs by serving as an Officer, Director or Committee Member

WAVMA Committees

As a member-driven organization, WAVMA relies on volunteers to help implement programs useful for all members. Any WAVMA member can volunteer on a Committee to help shape the direction of the Association, meet new colleagues, forge valuable and lasting relationships, and help address key issues affecting aquatic veterinary medicine today. To find out more about serving on a Committee, please contact the Committee Chair or the WAVMA Parliamentarian.

Budget and Finance Committee

This Committee develops and regularly revises the Association's annual budget and assists the Treasurer, as necessary, in developing the Association's annual financial reports and tax materials.

This Committee shall consist of the Treasurer (Chair); the President-Elect; and one other member of the Executive Board who will volunteer to serve a one-year renewable term.

Chair: Nick Saint-Erne, Treasurer@wavma.org

Communications Committee

This Committee manages the communications among members and others involved with aquatic veterinary medicine. It oversees the listservs, membership lists, publication of WAVMA's quarterly journal *The Aquatic Veterinarian*, e-News, Facebook, Twitter, LinkedIn and other social media accounts.

Chair: Stephen Reichley, Secretary@wavma.org

Credentialing Committee

This Committee oversees and administers the CertAqV Program for credentialing aquatic veterinary practitioners, and evaluates aquatic veterinary educational programs useful to members.

Chair: David Scarfe, dscarfe@ameritech.net

Meetings Committee

This Committee oversees and coordinates logistics for WAVMA-organized or sponsored aquatic veterinary educational meetings, including the Annual General Meeting.

Chair: Julius Tepper, cypcarpio@aol.com

Membership / Education Committee

This Committee oversees membership issues to optimally serve individual members and the organization. Chris Walster, chris.walster@onlinevets.co.uk

Student Committee

This Committee facilitates networking between student members and helps development of student programs and services.

Chair: Emily Munday, emily.munday@gmail.com

Credentialing Committee

The WAVMA CertAqV Program is administered by the WAVMA Credentialing Committee, along with the assistance of other Certified WAVMA members who serve as mentors and adjudicators.

To be credentialed by WAVMA as a Certified Aquatic Veterinarian and utilize the CertAqV honorific, individuals must be a WAVMA member, have a veterinary degree from a nationally recognized veterinary school, college or university and have demonstrated general knowledge and competency in core subject areas that are currently considered necessary to practice aquatic veterinary medicine. Students of a nationally recognized veterinary institution of higher education can register for the program, but will not be certified or entitled to utilize the CertAqV honorific until they graduate.

Individuals that desire to participate in the WAVMA CertAqV Credentialing Program are required to:

- Register for the Program (application at https://www.wavma.org/CertAqV-Pgm).
- Identify a mentor to assist the registrant through the Program. The potential mentors would be available WAVMA Certified Aquatic Veterinarians.
- Provide the mentor with written evidence of satisfactory completion of each of the core Knowledge, Skills and Experience (KSE) subject areas.
- Be adjudicated by the Credentialing Committee for recognition of completion of all KSE requirements after the mentor has approved the documentation.
- Have the CertAqV certification approved by the WAVMA Executive Board.

The WAVMA Certified Aquatic Veterinarian (CertAqV) program has now certified 78 aquatic veterinarians from 23 countries. Congratulations on our newest Certified Aquatic Veterinarians:

Jessica Allen
Jenice Bell
Nadav Davidovich
Antonella Fabrissin
Jessica Koppien-Fox
Sally Nofs
Lily Parkinson
Atisara Rangsichol
Brittany Stevens

There are an additional 50 other WAVMA members currently in the process of being certified. For more information, see the WAVMA website: http://www.wavma.org/CertAqV-Pgm.

David Scarfe, DVM, CertAqV
2019 Credentialing Committee Chair
dscarfe@ameritech.net

Certified Aquatic Veterinarians

Jessica	Allen	USA
Madison	Barnes	St. Kitts & Nevis
Giana	Bastos-Gomes	Australia
Jenice	Bell	USA
Heather	Bjornebo	USA
James	Bogan	USA
Pierre-Marie	Boitard	France
Erika	Brigante	St. Kitts & Nevis
Michael	Corcoran	USA
Emily	Cornwell	USA
Rebecca	Crawford	St. Kitts & Nevis
Nadav	Davidovich	Israel
Darren	Docherty	UK
Simon	Doherty	UK
Devon	Dublin	Japan
Jacqueline	Elliott	USA
Ashley	Emanuele	USA
Azureen	Erdman	USA
Antonella	Fabrissin	Italy
Ari	Fustukjian	USA
Krystan	Grant	USA
Miguel	Grilo	Portugal
Stephanie	Grimmett	UK
Orachun	Hayakijkosol	Australia
John	Howe	USA
Kerryn	Illes	New Zealand
Jimmy	Johnson	USA
Kasper	Jorgensen	Denmark
Brian	Joseph	Canada
Parinda	Kamchum	Thailand
Fritz	Karbe	Germany
Sherri	Kasper	USA
Elizabeth	Kaufman	Israel
Amy	Kizer	USA
Jessica	Koppien-Fox	USA
Jack	Kottwitz	USA
Eric	Littman	USA
Richard	Lloyd	UK
Richmond	Loh	Australia
Adolf	Maas	USA
David	Marancik	Grenada
Colin	McDermott	USA
Matthijs	Metselaar	UK
Haitham	Mohammed	Egypt
Alissa	Mones	USA
Danny	Morick	Israel
Ross	Neethling	UK
Sally	Nofs	USA
Brian	Palmeiro	USA
Christine	Parker-Graham	USA
Lily	Parkinson	USA
Ayanna	Phillips	Trinidad & Tobago
Jena	Questen	USA
Atisara	Rangsichol	Thailand
Aimee	Reed	USA
Stephen	Reichley	USA
Komsin	Sahatrakul	Singapore
David	Scarfe	USA
Khalid	Shahin	UK
Galit	Sharon	Israel
John	Shelley	USA
Constance	Silbernagel	USA
Melissa	Singletary	USA
Esteban	Soto	USA
Brittany	Stevens	USA
Win	Surachetpong	Thailand
Gillian	Taylor	South Africa
Sharon	Tiberio	USA
Greta	Van de Sompel	Belgium
Claudia	Venegas	Chile
Sarah	Wahlstrom	USA
Scott	Weber	USA
Marcus	Webster	USA
Trista	Welsh	USA
Peter	Werkman	Holland
Howard	Wong	Hong Kong
Taylor	Yaw	USA
Irene	Yen	St. Kitts & Nevis

COMMITTEE REPORTS

Fellows Advisory Council

WAVMA has established a fellowship program to recognize those world-renowned veterinarians who have advanced aquatic veterinary medicine as a discipline and devoted their time and efforts to serve WAVMA's mission. The Fellows Advisory Council allows Fellows to advise the Executive Board with guidance on their initiatives, and mentor applicants for Aquatic Veterinarian Certification (CertAqV).

Our WAVMA Distinguished Fellows are:

Dr Peter L. Merrill
Dr Ronald J. Roberts
Dr A. David Scarfe
Dr Julius M. Tepper
Dr Christopher I. Walster
Dr Dusan Palic
Dr Grace Karreman
Dr Marian McLoughlin
Dr Mohamed Faisal
Dr Nick Saint-Erne
Dr Richmond Loh

See: http://www.wavma.org/wavma-fellows.

Executive Board Responsibilities

The Executive Board has the responsibility for charting the course of WAVMA, fiduciary oversight of all issues, and, with input of committees, provides the oversight and approval for all WAVMA programs and services that fulfill the Mission and Objectives of the organization. The Board generally meets once a month through teleconferences, to discuss and approve WAVMA programs, services, and policies that drive the organization and issues that affect aquatic veterinary medicine. Members may submit items for discussion at the next Executive Board by contacting the *WAVMA Secretary*.

Student Committee

The committee plans to talk with the WAVMA website manager (IT person) about adding externship listings to the website and adding some fields to the submission form. There are already externship entries on the WAVMA website, but they need to be edited and updated. The entries should be divided into "externships", "internships", "fellowships" using a drop down menu (like the video page). These could potentially be broken up by externship type (e.g., aquaculture, aquariums) depending on the difficulty of doing so. When clicking a link, it can open a new page/pop-up window so the person looking doesn't lose their place on the list. When the list is active, share on the WAVMA list-serve, Facebook, etc. to make sure people know about it (including non-members).

The committee also wants to start a Journal Club via the student member listserv (Students-L). There are currently about 80 subscribers. Some might have graduated or just subscribe even if they aren't a student. A Journal Club might help get students talking more. We can pick out an article to read each month and discuss by email on the listserv. Can ask the Members-L for article recommendations. Can also tell the Members-L to sign up for the Student-L if they want to participate. This will allow for inclusion of newer grads or anyone who would be interested.

Use the Student-L to communicate with other students about informal events / meet-ups / room sharing for veterinary conferences, to help facilitate activities for students.

Now, students can use the member directory to search for potential mentors in their area / by geographic region. Include the mentors program in the PSA/email about opportunities to vet students to spread word about the program. In future, when we email/blast about WAVMA student opportunities, include the mentoring program information.

WAVMA VETERINARY SCHOOL CHAPTERS
https://www.wavma.org/WAVMA-Student-Chapters

There are 17 WAVMA Student Chapters in veterinary schools around the world. If you are a veterinary student, please join your school's WAVMA chapter, or start one if your veterinary school does not have one yet! Find out more about the veterinary school chapters on the WAVMA website, where you can download the WAVMA Student Chapter Guidelines to help create or run your own school's chapter.

Click here to get the WAVMA Student Chapter Guidelines.

Coral at Dallas North Aquarium

WAVMA is on Facebook!

Find us on Facebook

"Like" WAVMA's Facebook Page and join the WAVMA Facebook group to keep up-to-date with WAVMA activities and aquatic veterinary medicine topics from around the world.

Search for WAVMA at www.facebook.com.

www.facebook.com/WAVMA

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TO SUPPORT FUTURE STUDENT SCHOLARSHIPS, PLEASE MAKE A DONATION TODAY TO THE SCHOLARSHIP FUND! WWW.WAVMA.ORG/SCHOLARSHIPS.

DO YOU HAVE A STORY TO TELL ABOUT HOW YOU BECAME INVOLVED WITH AQUATIC VETERINARY MEDICINE?
Send your article (<1,000 words) with pictures to TAVeditor@wavma.org.

Aquatic Veterinary e-Learning
Supporting WAVMA's WebCEPD, PubCEPD, CertAqV & Clinical Cases Programs

Did you know?

WAVMA maintains an aquatic vet video library. Currently the videos cover a wide range of topics, including surgical procedures, diagnostic methods and guidance on how to be an aquatic veterinarian.

The videos can be accessed at:
http://www.wavma.org/WAVMAs-Aquatic-Vet-Video-Library

In addition, if you have a video that you would like to make available to other WAVMA members, kindly contact WebAdmin@wavma.org.

Meetings Committee

The Meetings Committee has been continuing to prepare for our conference schedule for this year. We will again have a booth at the AVMA Convention on August 2-6, 2019. As we can always use people to help man our WAVMA booth for short periods, please let me know if you are planning to attend this conference and can help out.

I would like to spotlight our day-long meeting KoiPrax2 which will be held prior to the World Small Animal Veterinary Association Conference in Toronto, Canada. This will also be the site for our WAVMA Annual General Meeting. This meeting will be a program of great interest to all pet fish practitioners, as it will be focused on the viral diseases of koi. We are looking forward to seeing you in Toronto.

KoiPrax 2
2nd Annual Koi Practitioners Working Group
July 15, 2019

This second annual meeting of the Koi Practitioners Working Group (KoiPrax2) titled "**Viral Diseases of Koi: Current Clinical Presentations and Diagnostic Resources"** will take place as a pre-conference meeting of the World Small Animal Veterinary Association. We have put together a group of veterinary specialists in the field of fish viruses to focus on updates of the major viral diseases affecting koi. We anticipate a very lively discussion on the subject.

Our honored keynote speaker will be **Dr. Thomas B. Waltzek**, Associate Professor, Research Coordinator, Aquatic Animal Health Program, Department of Infectious Diseases and Immunology at the University of Florida School of Veterinary Medicine. Also speaking will be **Dr. Pedro Henrique de Oliveira Viadanna,** Professor at UNIPAC and at UNA, Uberlândia, Brazil.

The mission of KoiPrax will be to serve the discipline of koi health, welfare and medicine. The objective will be to meet annually to discuss and catalog the collective knowledge about this veterinary specialty. We welcome the input and participation of all aquatic veterinarians interested in this subject. We also invite those in the hobby and industry to help us identify issues of interest and concern pertaining to koi keeping.

This meeting will be open to all WAVMA members free of charge, but reservations are required as space will be limited. Non-members fee is $100. Please contact: J.M. Tepper, Meetings Chair for info and reservations at cypcarpio@aol.com.

The next day following the KoiPrax2 meeting will be the aquatic stream of lectures by Drs. Tepper and Saint-Erne at the WSAVA conference. New this year will be a series of talks by both veterinarians aimed at instructing vet techs to assist in pond calls. We look forward to our continued role each year in this organizational collaboration.

The International Veterinary Student Association will hold its annual congress later this year in Zagreb, Croatia. We have budgeted funds to represent WAVMA at this event. Watch for more info coming about this congress.

Julius M. Tepper, DVM, CertAqV
Meetings Committee Chair
cypcarpio@aol.com

2019 Applications for the John L. Pitts Aquatic Veterinary Education Awards Program

The John L. Pitts Aquatic Veterinary Education Awards Program is excited to announce applications are now open for the 2019 Award Year!

This Program offers financial support to veterinary students or recent graduates of recognized veterinary schools, allowing recipients to explore a career in aquatic veterinary medicine through a variety of aquatic veterinary educational activities. Awards are intended to assist veterinary students and veterinarians, who have graduated in the past 24 months, to become involved in aquatic veterinary medicine. Awards (generally $250-$1,000) may be used towards offsetting personal costs associated with aquatic veterinary conferences, symposia, continuing education and professional development, aquatic veterinary externships, or equipment and supplies needed for aquatic veterinary research projects not funded by other sources. These activities or projects **must be completed between November 1, 2018 and March 31, 2020**.

Applicants must submit an online application form and e-mail a resume or curriculum vitae. They must also have someone who can attest to their interest and/or involvement in aquatic veterinary medicine as well as their potential to contribute to the profession send a letter of recommendation directly to the Program on their behalf.

All application materials are due April 15, 2019; late or incomplete applications are not considered. Awards will be announced by June 2019 After completion of their activity, all awardees must provide a written report for publication in ***The Aquatic Veterinarian***, a quarterly publication of the World Aquatic Veterinary Medical Association (WAVMA) and are encouraged to give a presentation about their experience to other veterinary students.

For more information on this Program and to submit an online application form, please visit www.wavma.org/scholarships.

We look forward to your applications. Any inquiries about the application process can be sent to: PittsEduAwards-Admin@wavma.org.

The John L. Pitts Aquatic Veterinary Education Awards Program

Since its inception in 2010, the John L. Pitts Aquatic Veterinary Education Awards Program has awarded over $50,000 to 82 veterinary students and recent graduates from 40 colleges and universities across 4 continents. These funds, which have come from a small number of individuals and organizations, allow recipients to explore a career in aquatic veterinary medicine through participation in externships at public, private, and academic institutions and attendance at conferences, workshops, and short courses all over the world.

The Program was started to honor the late John L. Pitts, DVM, who was passionate about student involvement in the profession and a global approach to aquatic veterinary medicine. His service to the profession began as a veterinary student in 1969 when he helped create a national chapter for the Student American Veterinary Medical Association. John also helped in the formation of the National Association of State Aquaculture Coordinators, the Aquaculture and Seafood Advisory Committee of the AVMA (now called the Aquatic Veterinary Medicine Committee), and he worked tirelessly to shape and encourage the passage of the Minor Uses and Minor Species Act of 2004. To continue John's vision, a small all-volunteer committee comprised of individuals representing private practice, academia, past recipients, WAVMA student members, and the Pitts family work to administer this program.

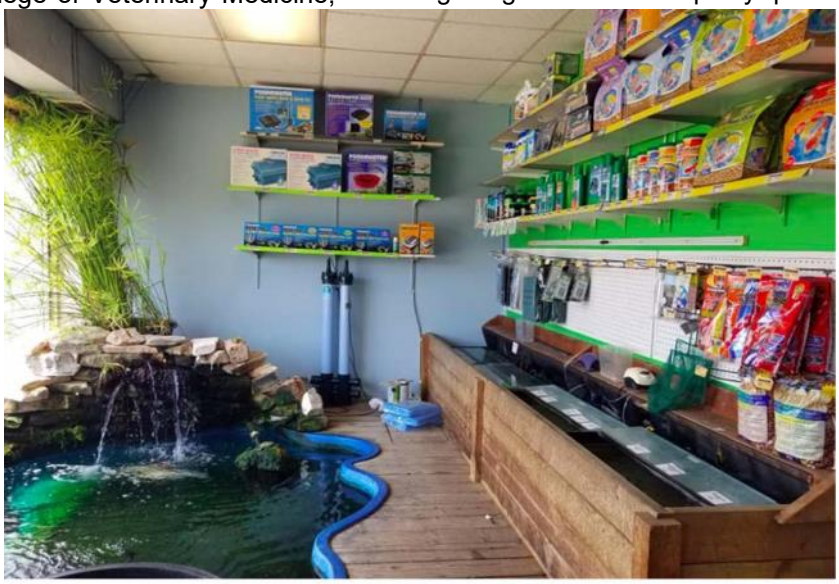
For more information regarding the Program and to make a donation for future awards, please visit www.wavma.org/scholarships. Please help us support the next generation of aquatic veterinarians, donations of all amounts help tremendously.

Stephen Reichley, DVM, PhD, CertAqV
PittsEduAwards-Admin@wavma.org
Chair, John L. Pitts Aquatic Veterinary Education Awards Program

DO YOU HAVE A STORY TO TELL ABOUT HOW YOU BECAME INVOLVED WITH AQUATIC VETERINARY MEDICINE?
Send your article (<1,000 words) with pictures to: TAVeditor@wavma.org.

An Active Year for the WAVMA Illinois Student Chapter

By Chelsea Ciambrone,
University of Illinois, College of Veterinary Medicine, Class of 2020



Sailfin Pet Shop Champaign, IL

This past school year at the University of Illinois, we had a year filled with numerous lectures from those in the aquatic industry. The year kicked off with a talk and tour at our local exotic animal store, Sailfin Pet Shop. The owner John, who has years of experience as store owner and a background in fish health and husbandry, spoke about basic fish health, water quality, and proper husbandry practices for salt and freshwater fish. In addition, students hosted a lunch lecture to discuss prior experiences and programs in aquatic medicine, such as AQUAVET® and MARVET.

Throughout the rest of the year, speakers from near and far presented to us on various topics. Dr. Samantha Sander, a lecturer at our College, presented on shark medicine and surgery. Senior staff veterinarian Dr. Caryn Poll from the John G. Shedd Aquarium in Chicago traveled to talk to us about the wide array of cases she encounters being an aquarium vet.

We ended 2018 with a joint lunch lecture with the Wildlife Disease Association University of Illinois Chapter by hosting a video conference with the Clinic for the Rehabilitation of Wildlife's (CROW) hospital director Dr. Heather Barron in Sanibel Island, Florida. She presented on the daily activities of CROW and their student externship.

We started the new year by hosting another video conference with Dr. Barbara Linnehan and Dr. Jenny Meegan from The National Marine Mammal Foundation, in which marine mammal transportation, career paths, public education, and the uniqueness of working with the U.S. Navy were discussed. To provide more hands-on experience, our members can participate in tank feedings and cleanings of our salt and freshwater tanks.

The John G. Shedd Aquarium in Chicago graciously hosts our members annually. For the past several years, staff veterinarian Dr. Matt O'Connor has given us a behind-the--scenes tour of their hospital, pathology lab, water quality lab, and microbiome center. Furthermore, he discussed Shedd's conservation efforts and ongoing research with turtles and a specific fungus affecting their population. Dr. O'Connor also explained the fun aspects of his position, such as getting to know a quirky pufferfish personality and working with Beluga whales. The tour ended with a discussion over a pregnant Beluga ultrasound followed by Dr. O'Connor's career path. Members were provided a highly educational and fun experience that will help guide members with their future veterinary career aspirations.

The Shedd Aquarium with Dr. Matt O'Connor Chicago, IL

AUTHOR'S INSTRUCTIONS

Instructions for Authors and Contributors

While any information relevant to aquatic veterinary medicine might be published, we particularly invite contributions for the following regular columns in *THE AQUATIC VETERINARIAN*:

Colleague's Connection
An article explaining why and how a veterinarian became interested in aquatic veterinary medicine and what that veterinarian has done in their aquatic veterinary career.

Peer-Reviewed Articles
Original research or review of any aquatic veterinary topic. Articles will be reviewed by 3 veterinarians and comments and changes referred back to the author prior to publication. The text for an article begins with an introductory section and then is organized under the following headings:
-Materials and Methods
-Results
-Discussion (conclusions and clinical relevance)
-References (cited in the text by superscript numbers in order of citation).

Clinical Cases
Clear description of a distinct clinical case or situation and how it was resolved. These may be submitted for peer-review. Begin with the signalment (species, age, sex, body weight or length) of the animal or animals, followed by a chronologic description of pertinent aspects of the diagnostic examination, treatment, and outcome, and end with a brief discussion.

Book Reviews
Brief review of a published book, including an overview and critique of the contents and where to obtain the book.

Publication Abstracts
Abstracts of published veterinary and scientific journals with full citation/reference (authors, date, title, and journal volume and page numbers – ½-1 page length).

News
Brief synopsis or information about aquatic veterinary news published elsewhere. List original source of information.

Legislative & Regulatory Issues
Synopsis or description of emerging legislation or regulations with information on how to access further detailed information or a link to website.

Meetings and Continuing Education and Professional Development (CE&PD) Opportunities
Description or synopsis of upcoming aquatic veterinary or (veterinarian-relevant) non-veterinary in-person or on-line educational meetings noting the meeting title, dates, location, and contact person or website.

Jobs, Internships, Externships or Residencies
Description with specific contact information for veterinary student externships and post-graduate internships or residencies at private practices, institutions, universities or organizations. Description of available full or part-time employment for aquatic veterinarians, with contact information.

Advertising
See advertising rates on page 4.

Please send articles, clinical reports, or news items to the editor by the following submission dates:
Issue 1 – February 15 (published in March)
Issue 2 – May 15 (published in June)
Issue 3 – August 15 (published in September)
Issue 4 – November 15 (published in December)

All submissions should be in 10-point Arial font, single spaced. Submissions may be edited to fit the space available.

We can also use editors to proof-read submissions or review articles. Please contact the Editor if you are interested in assisting.

The World Aquatic Veterinary Medical Association also has opportunities for members to assist with committees. Contact any member of the Executive Board to volunteer to help.

DO YOU HAVE A STORY TO TELL ABOUT HOW YOU BECAME INVOLVED WITH AQUATIC VETERINARY MEDICINE?

Send your article (<1,000 words) with pictures to TAVeditor@wavma.org.

Aquatic Veterinary Abstracts: Swim Bladders
Compiled by David Scarfe

The Volume of Air Within the Swim Bladder and Breathing Cavities of the Anabantoid Fish *Colisa lalia* (PERCIFORMES, BELONTHDAE)
STEFAN SCHUSTER
Haldenstrasse 11, D-7069 Berglen-Rettersburg, FRG
Journ. Exp. Biol. 144, 185-198. 1989.

Abstract

The suborder Anabantoidei is characterized by the presence of a pair of air-filled cavities which lie above the branchial apparatus and are therefore called suprabranchial chambers. These chambers fulfil a variety of functions. First, they serve as an oxygen reservoir enabling these fishes to breathe atmospheric air - an absolute necessity in their extremely deoxygenated habitats. They also seem to serve as aids to buoyancy, as sound radiators and as pressure-displacement transducers necessary for hearing.

The swim bladder volume and air volume within the breathing chambers of the anabantoid fish *Colisa lalia* have been measured. These data help in the understanding of some of the functions of these organs and are necessary for an analysis of their role in hearing and sound production. By means of a simple trick (based on new data) it was possible to analyze the time course of air volume changes in the breathing chambers at different temperatures. The results are well described by a simple diffusion model.

The temperature-dependence of the time course suggests an interesting increase of the diffusion constant with temperature. Under constant conditions the chambers were always filled with about the same volume of air. No excess pressure was found. Typical values of a single chamber's air content range from 34 to 58 microliters. Air content increases with about the third power of fish length. By using the present data, the time course of air volume changes in the chambers of a given fish can be estimated.

Swim bladder volumes, determined using Boyle's law, ranged from 70 to 220 microliters and were also found to increase with about the third power of fish length, in accordance with a simple estimation. The data are discussed in relation to buoyancy, diffusion processes, blood circulation, hearing and sound production and suggest some interesting new work.

The volume and rate of volume change of the swimbladder of the goldfish
E.M.Overfield, J.A.Kylstra
Respiration Physiology. Volume 13, Issue 3, December 1971, Pages 283-291.

Abstract

The volumes of the swimbladders of 7 unanesthetized goldfish (*Carassius auratus*), ranging in weight from 20.0 to 40.2 g and kept in water at a constant temperature of 29°C, were measured by displacement plethysmography. The plethysmograph was located inside a hyperbaric chamber so that pressure could be applied to the fish without applying pressure across the walls of the plethysmograph. The mean volume of the swimbladders was 1.78 (S.D. ± 0.010) ml. The volumes of the swimbladders were measured again periodically after some gas had escaped through the pneumatic ducts during a brief exposure of the fish to a partial vacuum. The mean rate of change of the volume of the swimbladder was 0.22 (S.D. ± 0.08) ml /24 hr, independent of the weight of the fish; initial swimbladder volume; volume of gas expelled; or change in specific gravity of the fish. In 3 other fish exposed to a constant ambient pressure of 1.5, 1.75, or 2.0 atm, the rate of volume change of the partly evacuated swimbladder was + 0.056, − 0.025 and − 0.065 ml/24 hr. It is concluded that the net transfer of gas into the swimbladder of a goldfish is affected by the ambient pressure.

Acoustic Observations of Gas Bubble Release by Pacific Herring (*Clupea harengus pallasi*)
Richard E. Thorne, G. L. Thomas
Canadian Journal of Fisheries and Aquatic Sciences, 1990, Vol. 47, No. 10 : pp. 1920-1928
https://doi.org/10.1139/f90-216

Evidence is given to show that Pacific herring (Clupea harengus pallasi) release gas bubbles during diel vertical migration and while holding in strong currents. The evidence includes hydroacoustic observations of echoes from both fish concentrations and gas bubbles. The fish are identified as herring on the basis of historical fisheries data and, in some cases, direct capture. Echoes from objects emanating form the fish concentrations are attributed to gas bubbles based on similarity to acoustic observations of gas bubbles in many other circumstances, as well as direct observation of bubbles at the surface in some cases. Since conclusive evidence exists that herring do not have gas secretion capability, two alternative hypotheses are presented to explain the source of the gas. One hypothesis is that the gas results from fermentation in the gut. A second is that herring gulp gas at the surface prior to descent to daytime depths. One consequence of differing amounts of gas would be changes in the acoustic target strength of herring, which is a critical parameter in acoustic assessment techniques.

Physical Properties and Hydrostatic Function of the Swimbladder of Herring (*Clupea harengus* L.)
Vivien M. Brawn
Published on the web 13 April 2011.
Journal of the Fisheries Research Board of Canada, 1962, 19(4): 635-656,
https://doi.org/10.1139/f62-043

Abstract

Living herring at the depth of adjustment had a mean sinking factor of 1003, density of 1.026 g/ml, relative sensitivity of 0.8 and percentage swimbladder volume of 4.2%. Neutral buoyancy was attained at a mean pressure reduction of 5.5% from the adjusted pressure. Swimbladder gas was under an average excess pressure of 1 cm Hg. Gas was released through the posterior swimbladder duct during pressure reduction in 105 out of 109 herring observed. Gas release occurred at a mean pressure decrease of 6% in rapidly swimming herring, at 32% in moderately swimming fish and brought the herring to within 19% of perfect adjustment to a new reduced pressure within half an hour.

Herring could compensate for their increased buoyancy during pressure decrease until this was reduced by gas release. Decompression at rates up to 123 cm Hg/sec was not fatal after 16 hours at the greater pressure. No recovery of buoyancy after gas loss occurred in herring held 24 hours in running sea water even if fine air bubbles were present. Recovery occurred if these fish had access to the surface.

Gas production by bacterial activity as a means of restoring buoyancy was not established. Herring responded to rapid pressure increases by swimming upwards. They could compensate for their increased density following pressure increase of 300% and survive increases of 430%. Herring from 10 to 25 feet depth at sea were positively buoyant at surface pressure when anaesthetized. Thus, in nature herring are adjusted to pressures greater than surface pressure. It is suggested that they take in air when feeding at the surface at night and slowly pass this to the swimbladder on returning to greater depths by day.

In situ acoustic estimates of the swim bladder volume of Atlantic herring (*Clupea harengus*)
Redwood W. Nero, Charles H. Thompson, and J. Michael Jech.
ICES Journal of Marine Science, 61: 323e337. 2004.
https://academic.oup.com/icesjms/article/61/3/323/671089

Abstract

Marine fish with swim bladders generally maintain swim bladder gas volumes of 5% of their body weight in order to maintain neutral buoyancy. In the herring family, Clupeidae, the swim bladder is hypothesized to provide a dual function, acting to provide buoyancy and as a reservoir of gas for the acoustico-lateralis system. Herring are physostomes, and as such lack an internal organ dedicated to maintain gas in their swim bladder. Instead, they possess two ducts that allow its inflation and deflation. The anterior duct connects the middle of the swim bladder to the pyloric caecae and is the primary duct for its inflation.

Gas in a herring's swim bladder is hypothesized to have three possible origins. The first is that atmospheric air is obtained by ''gulping'' air at the sea surface. The second is that the gas is a product of bacterial action in the digestive tract, while the third is that the gas is excreted from the walls of the swim bladder or ducts. This study lends support to a primary atmospheric origin of swim bladder gas.

Regardless of the mechanism, knowledge of the volume of gas in the swim bladder is important to fisheries acoustics because of the large proportion (90-95%) that the swim bladder contributes to acoustic backscatter at high frequencies

Acoustic measurements at 1.5-5 kHz on fish in the Gulf of Maine showed a swim bladder resonance peak near 2.5 kHz at 160-190 m depth. Midwater trawls confirmed that the fish were likely to be Atlantic herring (*Clupea harengus*) of 19-29 cm length. Calculation using a model of swim bladder resonance gives swim bladder volumes of 1.2% of fish weight at 160-190 m. Extrapolation of this volume of gas using Boyle's Law suggests that at the sea surface, these herring would need to inflate their swim bladders by up to five to six times the volume required for neutral buoyancy.

If these fish were to maintain this volume of gas with surface ''gulping'', they would need to submerge from the sea surface with a 30% excess buoyancy. In general, swim bladders of the Clupeidae may have greater volumes of gas than if the fish were neutrally buoyant at the sea surface and the interpretation of HF -echosounder surveys may be additionally complex when the volume of gas and swim bladder volume are difficult to predict.

FEATURED AQUARIUM

Dallas North Aquarium

This is unusual for our featured aquarium because it is not a public aquarium, but an actual aquarium retail store. Dallas North Aquarium has the largest selection of marine and freshwater life in the Dallas-Fort Worth, Texas area. They sell large, custom aquariums, products and both fresh water and saltwater fish. They specialize in cultured corals, cichlids, and live plants. Dallas North Aquarium boasts of having one of the largest selections of aquariums, filtration, and lighting in the country, including products from all the leading aquarium manufacturers, such as Planet, Aqueon, DSA, and Marineland. They have everything you need for any aquarium need!

Dallas North Aquarium Service was started in 1982 by Mr. John Holcomb, offering custom installation and aquarium service from a single truck out of his residence. From those humble beginnings Dallas North Aquarium has become one of the finest aquarium maintenance suppliers and specialty stores in the country, servicing over 1800 happy clients throughout the Dallas/Fort Worth area. The Dallas North Aquarium retail location has something for everyone no matter what their level of aquarium keeping and experience

The store is a 14,000 square foot facility featuring four 215-gallon display aquariums in wall installations, large coral ponds, 6,500 square feet of dry goods and aquariums, as well as 10,000 gallons of fresh and saltwater livestock. Dallas North Aquarium has the largest inventory of aquarium products in Texas. Dallas North Aquarium's friendly and knowledgeable staff has collectively over 200 years of experience in filtration, livestock and general aquarium keeping.

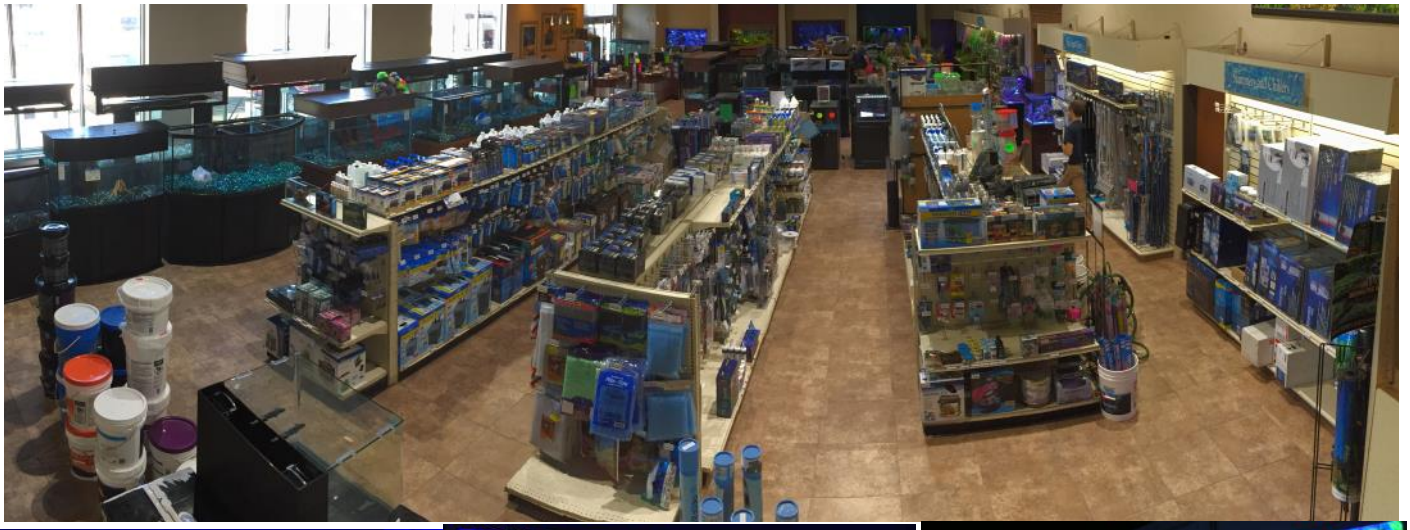
Dallas North Aquarium is also a licensed and insured full-service aquarium installation and maintenance company that caters to both residential and commercial clients. They offer a variety of services to keep clients' aquariums healthy, thriving and looking their best. Dallas North Aquarium has a fleet of trucks and a professionally trained, knowledgeable uniformed staff ready to come to either business or homes to provide aquarium maintenance service.

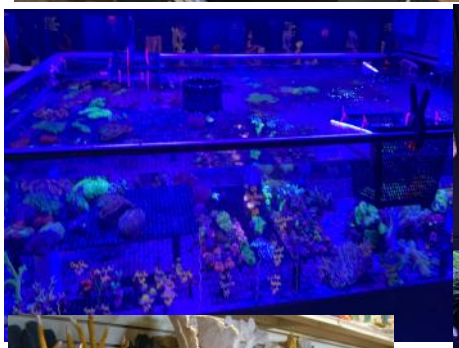
- Weekly, Bi-Weekly, or Monthly Maintenance for any size salt of fresh aquarium in home or office
- Aquarium Delivery and Setup
- Custom Design and Installations
- Aquarium Moving Service
- Emergency Services

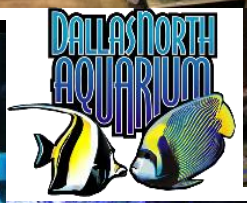
The unique feature I found here at Dallas North Aquarium is that they take in old aquariums and equipment as trade-ins for upgrades to larger tanks. They refurbish the used equipment and have a section of the retail store that sells the used products, which can be a bargain for those on a budget who want to get started keeping aquariums.

Dallas North Aquarium
2910 E. Trinity Mills
Carrollton, Texas 75006
http://dallasnorthaquarium.com/

FEATURED AQUARIUM







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Questions & Answers from the WAVMA Listserv
(WAVMA_Members-L@wavma.org)

How to Euthanize Trout So They Can Still Be Fed To Other Animals

Dear WAVMA Members,

A local aquarium has about 150 trout that measure roughly 6-8 inches in size. They need to relocate the animals but permit requirements might be cost prohibitive to move them, so they are looking for ways to humanely euthanize the fish and still be safe to be fed to other animals, such as bigger fish, reptiles, and otters. Any thoughts or suggestions would be greatly appreciated,
Thank you all!

Jena Questen, DVM, CertAqV
fish@drquesten.com
'DrQ' and Aspen Park Vet Hospital
Veterinarian and Life Coach for People with Pets
See what we do at www.DrQandU.org; check out our on-line learning courses, DrQ's new book, and invite DrQ to come educate and inspire you!
www.stealmoreyears.com

Hi Jena,

According to the *AVMA Guidelines for the Euthanasia of Animals: 2013 Edition*, here are some effective methods:

"Manually applied blunt force trauma (cranial concussion) followed by pithing. Manually applied blunt force trauma (a rapid, accurately placed blow of sufficient energy to the cranium with an appropriate-sized club) can cause immediate unconsciousness and potentially death, but should be followed by pithing to ensure death. The finfish's size, species, and anatomy and characteristics of the blow (including its accuracy, speed, and club mass) will determine the efficacy of manually applied blunt force trauma. This procedure requires training and monitoring for proficiency. Anatomic features, such as the location of the eyes, can help serve as a guide to the location of the brain."

We use a pithing tool, called an ike jime, to ensure death after cranial concussion.

Bridget B. Baker, MS, DVM
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Jena,

I would be cautious about toxicity and adverse taste/refusal with clove oil. It is relatively safe, but there have been case reports in humans about toxicity from ingesting clove oil. It really depends on what they are going to be fed to, too. Clove oil is a skin and eye irritant, so if there is residual water (i.e. in the gills) there may be issues depending on the species offered. I've seen aquatic reptiles refuse fish euthanized in clove oil, but eat other fish at the same time. So, in my mind the clove oil caused the aversion.

Jack

Hi Jena,

A percussion stun to the head will kill them. This is an accepted humane way and often kills them if done properly. You can follow up with either destruction of the brains or cut a kill arch to bleed them.

Matt

Jena,

We routinely use a spring-loaded penetrating captive bolt device for exactly this purpose - it's efficient, effective, and slightly more 'cosmetically appealing' to observers than typical blunt force (though of course, that is certainly appropriate in skilled hands). Very similar to the ike jime concept, but requires a little less practice/skill on the part of the user. The key is to aim for the brainstem, so a little more caudal than you might initially think - though even if you're a little off-target on the first strike, you'll still render the fish insensible through concussive force.

We usually follow up by scrambling with a pick through the hole to ensure pithing/complete destruction of the brainstem, but once you have the hang of it, death is clearly instantaneous.

I presented information on it at IAAAM last year. I'm not really attempting to advertise for this company, and I have no connection with them, but this is where we acquired ours (it's a German product, so probably more widely available in Europe):
https://www.bunnyrancher.com/store/p43/The_Arbalest_-_Penetrating_Bolt_Gun.html

For trout of the size in question, you may be able to use the smaller version - we have successfully used our Arbalest (older version) for 12-18" trout (and the otters were very pleased with their snacks...).
Let me know if you have any questions!

Emily Christiansen
NC Aquariums
emily.christiansen@ncaquariums.com

Jena,

While clove oil is an effective fish anaesthetic, its use in human food fish is prohibited in Canada and US, as the active ingredients have been linked to liver cancer. We've banned its use in laboratory fish at my organization due to OHS concerns around repeated exposure to staff.

When we cull surplus stocks for donation to a wildlife rescue group, we use the previously discussed blunt trauma and pithing, performed by competent personnel.

Christine MacWilliams DVM MSc
Research Veterinarian
Fisheries and Oceans Canada
3190 Hammond Bay Road, Nanaimo, BC V9T 6N7
Ph/fx: 250-729-8377 / 250-756-7053
christine.macwilliams@dfo-mpo.gc.ca

I've tried refeeding trout euthanized with clove oil to personal pets (caiman and aquatic turtles) and the taste was aversive, and the fish ultimately wasn't consumed.

When I culled larger rainbow trout colonies, I did what others have said – blunt force trauma to the head and cutting of gill arches to exsanguinate.

Anonymous

Right:
Clove oil marketed for euthanasia of tropical fish .

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The Aquatic Veterinarian Journal
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WAVMA Student Chapters
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John L. Pitts Aquatic Veterinary Education Awards Program

Clove Oil for Euthanasia

Clove oil is an essential oil derived from the clove plant, *Syzygium aromaticum*. It is a clear oily liquid with an extremely aromatic odour and flavour. The active ingredient is eugenol and it is present in clove oil at between 70 to 90% by volume. Clove oil has been used as a mild topical anaesthetic for centuries and in particular it is used to ease toothaches in people. Clove oil and its derivatives that utilise iso-eugenol (the active constituent of clove oil) are readily available chemical agents suitable for the euthanasia of fish.

Clove oil and its derivatives are recommended for the euthanasia of finfish by the AVMA (Leary et al. 2013) and ANZCCART (Reilly 2001) guidelines. A study by Holloway et al. (2004) showed that euthanizing fish with clove oil caused no increase in either cortisol or glucose levels, which are considered the hallmark indicators of stress. Similarly, a study by Rahmanifarah et al. (2011) found that clove oil induced rapid anaesthesia and death in common carp (*Cyprinus carpio*) with none of the aversive behaviour observed in response to asphyxia, carbon dioxide (CO_2) or chilling.

Clove oil can be purchased over the counter from chemists and health food stores. The purity of clove oil may vary between brands and this can cause some variation in response. The dose of clove oil recommended for euthanasia is 0.25 - 0.50 ml per 1 litre of water (= 250-500 ppm). This is higher than the previously reported dose of 150 ppm (Holloway et al. 2004). The rationale for recommending such a high dose is to allow for any potential variation in the purity of the clove oil preparation being used, the relatively poor dissolution of clove oil in water, as well as to ensure that there is no chance of the fish recovering from the euthanasia procedure due to an insufficient dose (i.e. the procedure needs to be irreversible).

It is important to add this dose slowly to the water with the fish. If a fish is placed directly into a high concentration of clove oil it appears to distress the fish with rapid swimming, etc. (personal observation). It is suggested to add the required dose slowly over a period of five minutes. Whilst clove oil appears to be an effective euthanasia agent for ornamental fish, the fact that there is not a registered product available means that a firm recommendation cannot be made supporting its use. One proposal is to encourage the development of an APVMA registered (non-prescription) product available to fish owners, as is currently available in the UK and EU.

Excerpt from:
Humane Euthanasia Techniques for Ornamental Fish.
By Dr Rob Jones and Dr Jon Daly,
Pet Industry Association of Australia; 2013.
http://www.frdc.com.au/-/media/Fish-FRDC/Environment/Animial-Health-and-Biosecurity/Humane-Euthanasia-Techniques-for-Ornamental-Fish-AAWS-Document.ashx?la=en

Some cases of swim bladder infections in Koi
By Tim Barbé, DVM, Belgium

Introduction

The first thing I do when I am on a house call for inspection of a fish pond is take a look at the common behaviour of all the fish present in the pond. Sometimes clients tend to take out the fishing net or remove the protective net above the pond too soon, so it gets difficult to still see the normal behaviour. As soon as fish are in alert modus or think that food might be given soon you might not be able any more to spot sign related to sickness in the pond. Just taking one minute of time to see which fish are separated from the group, lay at the bottom, don't have much appetite, or whose fins are not standing up straight, etc. can give you a lot of information on how to approach the situation, and help determine which fish you want to examine or take samples from.

Typical symptoms

Often I see a fish that is not swimming with the group and is laying still at the bottom of the pond with its pectoral fins open and resting against the floor for stabilisation. When there is no anamnesis of the addition of new fish, fish flashing, or poor appetite, this fish should definetely be netted. When you let this fish swim a while before taking him out with the net you might see that such fish may have difficulties to glide normally through the water, tends to rest several times in between movements and has difficulties coming to the surface of the pond. When they try to pick some food at the surface they start to swim really heavyily. After taking a bite you see them diving to the bottom of the pond again.

Unfortunately, the symptoms are often not this clear, but after seeing those symptoms the chance that there is a problem with the swim bladder is very high. Using their swim bladder, fish can eventually adapt their specific weight or mass density in the water to neutral bouyancy, giving them the ability to swim in different water layers in a pond. In addition, the swim bladder has functions linked with the hearing of a fish and it can be used as a pressure and depth sonar. Because the swim bladder is connected with the esophagus via the ductus pneumaticus, a fish can push atmospheric air in and out the bladder and function like a submarine.

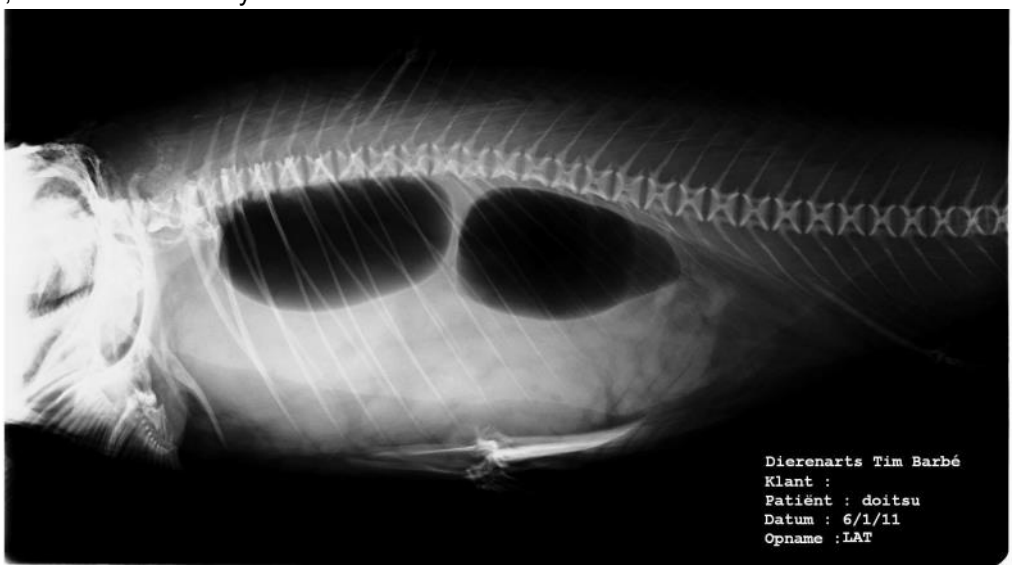
Sanke Koi, one of the patients

Sanke Koi

A sanke (red and white koi, with limited black markings) I recently saw was such a typical case, where the signs of a swim bladder infection were pretty obvious. While the other fish were swimming eagerly, this fish was laying still at the bottom of the pond. Bringing the net in his surroundings made him move some length, after which he stopped again and rested on the bottom of the pond.

After netting and bowling this fish, one of the other signs that can help make the diagnosis of a swim bladder problem more obvious was seen: the ventrum of this fish was completely flat and reddish/ inflammated because of the constant touching to the bottom of the pond. Erosions on the ventral fins were also seen.

Picture below: Under normal circumstances the two chambers of the swim bladder of a koi are filled with air, which make them appear black on X-Ray. The size of the cranial or caudal bladder chamber is variable, but normally the cranial chamber is oval and the caudal chamber is pointed at the back end.

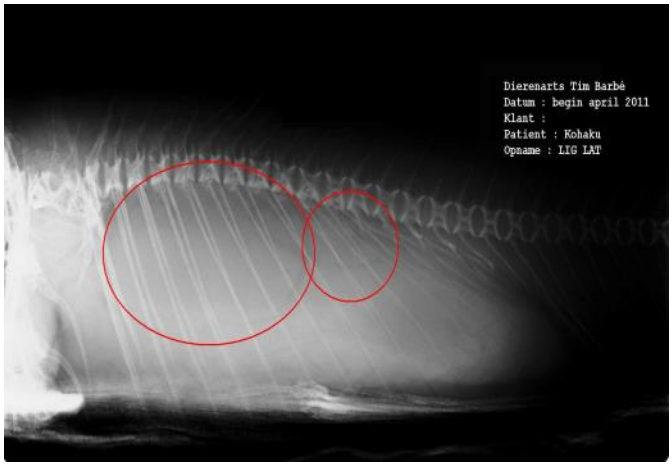


Sanke Koi: the ventrum of the fish was flat, inflamed and infected

Ultrasound examination quickly revealed the diagnosis. The swim bladder was over-inflated and filled with fluid. The anterior as well as the posterior chamber were completely fluid filled.

Ultrasound revealed the problem in this case

By taking an X-ray, we can also visualise the swim bladder nicely and in some cases this can be preferred over ultrasound when, for example, air is still present in the swim bladder. Ultrasound in this particular Sanke case could give me my diagnosis right on the spot where as for X-Ray I would be able to take some shots but I would need to drive back to the clinic to develop them what takes extra time and costs.



X-ray of a similar case, where there is no more air inside the swim bladder and all you can see are the contours of where the swim bladder is situated.

To treat this fish, the fluid will have to be removed as much as possible and replaced by air so that the fish can float again in a normal way in the water and it can go up to the surface more easily. Therefore, an aspiration through the body wall into the swim bladder will be needed; we call this a pneumocystocentesis. For this operation, the swim bladder is approached by a lateral or dorsal manner with a long rigid but not too large needle (I prefer the dorsal approach). You need to remove some liquid, add the same volume of air after and repeat this several times until the swim bladder is nearly empty of fluid.

The next thing I do is add about 10 milliliters of a water-based antibiotic like gentamycin and move the fish all around so this can spread inside the swim bladder. Make sure not to inject this amount of gentamycin antibiotic in the abdomen as it is nephrotoxic and will kill the fish in a few days. You can rinse some more with sterile water but be sure to leave about 1 or 2cc of antibiotic into the bladder.

You probably will need to repeat this procedure for emptying the second chamber of the bladder (the anterior or posterior chamber depending which one you started with). Puncture site is based on anatomic location or under ultrasound guidance, if possible. Removing one scale helps to better point the needle into the right direction and of course disinfection of the skin with an iodine solution is recommended.

Before taking out the needle(s) in the end you need to check to see f the fish has gained its floating ability again. If not, you need to add more air. In the contrary, you need to deflate. Using a 3-way valve between the syring and needle comes in very handy.

Sanke Koi: while the koi is under anesthesia, I remove the fluid, flush the bladder and add antibiotics. The swim bladder is filled with air so the fish is just able to float again.

This Sanke koi had half a liter of fluid built up in his swim bladder! Even knowing this fish is about 70 cm long, this is quite a lot. In normal conditions, the bladder would take up about 5 to 10% of the total volume of the fish. Unfortunately, the swim bladder volume can vary tremendously. Some fish can have a very small swim bladder where other fish have a really big bladder (bigger fish like chagoi may tend to have smaller swim bladders sometimes).

The colour of the fluid gives you some information about how severe the problem has gotten over time and might give some prognosis to discuss with the owner and determine if you would be repeating this procedure or not when the fish gets worse again later. Clear transparant fluid (water-like) would provide the best prognosis. The more it gets yellow or even white and at the same time has an odore, the more you have to warn the owner things might get worse soon after.

Check the fluid that came out of the swim bladder also with the microscope. You might be lucky to find some flagellates or lots of bacteria. Many cases like this grow *Aeromonas* or *Shewanella* bacteria on a culturing plate. Sometimes even fungal hyphae were seen.

Over half a liter of yellow exudate was removed from the Sanke Koi's swim bladder.

In addition to the procedure, I would recommend to inject the fish intramusculary with antibiotics and anti-inflammatory agents. Also, disinfect and close the puncture site with some propolis tincture. And of course like any other patiënt, check for parasites (skin, feces, gills). A fish laying still most of his time is more vulnerable for *Ichthyobodo* infestation, for example.

As in this case, further local treatment of the inflamed ventrum might be necessary. Fortunately, as soon as this fish stops laying at the bottom such lesions seem to heal quite fast. Salted and heated water also help for recovery in such cases.

Last but not least, even when you have seen many cases like this with a good endings, you still want to ask the owner to say a prayer because the chance for recurrence is realistic. The sooner you can treat such fish the less chronic changes will have occurred and the better the survival rates. When, for example, the wall of the swim bladder has thickened badly chances for recovery are low (I have seen swim bladder walls of about 0.5 cm thick!)

Some more cases:

<u>Case in Duisburg:</u>

In this case a fish was seen with the typical symptoms: difficulties to swim, parked on the bottom of the pond. Inspection showed ventral signs of irritation. The operation field was prepared: injections, antibiotics for flushing. The fluid that came out was very purulent so not a good sign. Immediately after surgery the fish was acting normally again and this remained for some weeks, but the fish got worse after that and had to be euthanised.

<u>Case in Relegem:</u>

Louis, a big chagoi (tea-brown colored koi) of about 10 to 12 kg, was laying still on the bottom of the pond most of the time recently. Examination showed no parasites, no problem with the water quality and there were no other signs seen in the other fish. Since this fish was so big the owner was not equipped with

materials for handling him out of the water: bowl, appropriate net, koi sock. The fish was sedated with alfaxan by injection intramusculary, but this didn't work at all. So an appointment was made later when the owner had the appropriate equipment to handle the fish.

X-Ray then showed a swim bladder half filled with fluid and, obviously, half filled with air. The same procedure was performed by dorsal approach and immediately after surgery the fish was swimming normally again. About 2 weeks later, the fish was rechecked and doing fine. From time to time he would still go laying for a moment on the bottom, but most of the time he was swimming in the school with the rest of the fish. A very small amount of fluid was then still taken out of the swim bladder. All fluid removed was clear and transparent and without odor. No precedures since then were necessary and until now, 2 years later, Louis is doing great even though he is actually swimming in a pond that is too small and not deep enough for his size.

Case in Nederokkerzeel:

A large kohaku (red and white) koi was treated because of a filled swim bladder. Nearly 400 ml of yellowish liquid was removed. The procedure went fine and the fish had a good recovery. By the time I moved on he was swimming normally again and the owner was very happy, but couldn't believe his eyes while the fish underwent surgery. In fact the owner just went through a similar procedure after being treated for a cancer, his lungs also filled with fluid so he knew more or less what his fish was going through. Unfortunately, because of the owner's medical condition he was not able to monitor his fish closely and the fish got worse again. Some months later, they called to ask to euthanise the fish.

Case in Londerzeel:

A showa (red and white with significant amount of black markings that extend onto the head) koi that was recently purchased was seen gasping air on the surface of the water occasionally. Over time, this got worse and eventually the fish was doing nothing more than laying on the bottom of the pond, gasping air and repeating this over and over again. X-Ray showed no fluid in the swim bladder, but the position of the cranial bladder was dislocated and the caudal bladder was enlarged. On the X-Rays you could also see that the wall of the cranial bladder had enlarged severely making it seem less translucent on lateral views.

This fish was treated with antibiotics and anti-inflammatory agents with no success. After euthanasia, necropsy showed that the caudal bladder had a normal structure but the cranial bladder was half a cm thick and inside the wall there was one location where fluid was being built up. Bacteriology of this fluid was negative, but maybe the antibiotic treatment had something to do with this.

Case in Schiplaken:

This fish had all the symptoms of a swim bladder disorder. X-Ray or Ultrasound were declined by the owner, but I could do a needle aspiration. Unfortunately no fluid was found inside the swim bladder; nothing but air. Most likely the wall of the swim bladder had already undergone some changes, but no build up of fluid, yet. This fish was given antibiotics and anti-inflammatory agents. So far no more news from this fish.

Histology.

In almost all such cases there was a severe aerocystitis (with granulation tissue, neoangiogenesis, and multifocal inflammatory infiltrates, mainly lymphocytes) together with epithelial hyperplasia (and occasional mucous and/or squamous epithelial metaplasia) and hyperplasia of the muscular layer.

Bacteriology.

In my experience, most of these cases grow bacteria from the fluid: *Aeromonas* spp and *Shewanella putrefaciens* are the two main bacteria that are cultured.

Conclusion

So far, no etiology or pathogenesis is known, but scientists are looking into this right now. In my experience, these cases are seen more often than before. Recently, I had another case of a showa koi that needed swim bladder surgery, so roughly I estimate that I see about 5 to 10 cases per year in my practice. Luckily, I feel that as the procedure gets more and more refined the survival rates are going up as well.

Tim Barbé, DVM
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Anesthesia and Euthanasia in Ornamental Fish

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Definitions

Sedation - the administering of a sedative drug to produce a state of calm or sleep.

Tranquilization – administration of a drug to reduce stress and anxiety for handling, examination, transportation.

Anesthesia - loss of sensation (with or without loss of consciousness) artificially produced by the administration of drugs that block the impulses along nerve pathways to the brain.

Analgesia - insensibility to pain without loss of consciousness.

Euthanasia - Euthanasia is derived from the Greek terms 'eu' meaning good and 'thanatos' meaning death. The term is usually used to describe ending the life of an animal in a way that minimizes or eliminates pain and distress.

Fish Anesthesia

When handling fish, especially larger ones such as koi, for examination or disease treatment, it is often desirable to use an anesthetic agent to calm the fish to reduce stress and trauma. Sedation aids in handling fish during physical examination, for biopsy sampling or for purposes such as egg stripping during artificial spawning. Sedation or tranquilization drugs have also been added in the water when transporting fish for long journeys to lower their metabolism and reduce stress during transportation.

Anesthesia and analgesia are required for surgical or invasive procedures. Surgery can be performed on anesthetized fish to repair wounds, remove skin and fin tumors, or to remove abdominal masses. And sometimes euthanasia is needed to end the suffering of a sick or injured animal, or for research or other purposes, and using an overdose of anesthetic agents can make this process quick and painless.

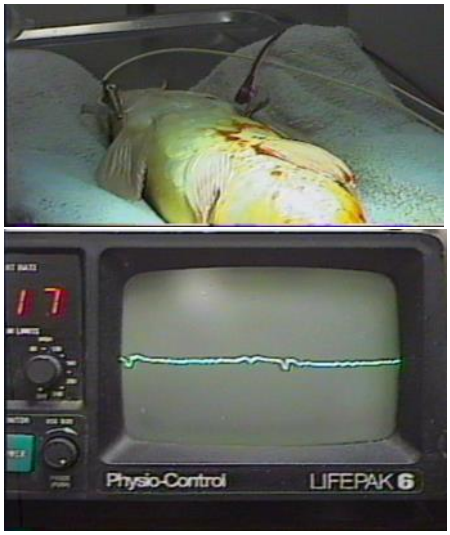
Each of these techniques can be accomplished with fish by adding anesthetic medications to the water, and sometimes by injection or oral administration of anesthetics. Food fish have specific limitations to medications that can be used with them, and withdrawal times for approved medications must be observed. This paper will focus on anesthetics used for ornamental and pet fish.

Many chemicals have been used to induce tranquilization or anesthesia in fish (See Table 1). All have some element of risk, but when used carefully they have successfully induced sedation or anesthesia. Anesthetic agents used in lower doses produce tranquilization, and at higher doses they are used for anesthesia purposes. Care must be taken not to overdose the fish or leave them anesthetized too deeply for too long of time. It is recommended to start with a lower dose and add more as needed if using a new drug or working with an unfamiliar species of fish. Monitor heart rate, blood oxygen concentration, and operculum (gill cover) motion during anesthesia to ensure fish is not too deeply anesthetized.

Most fish anesthetics are added to clean, well-oxygenated water in a suitable glass or plastic container. The water is thoroughly mixed to ensure all the chemical is dissolved and dispersed evenly. The anesthetic solution should be the same temperature and pH as the aquarium or pond water. The water should be tested to ensure all the water quality parameters are in the correct range for the fish species. Use a thermometer to monitor the water temperature during surgery, and if an oxygen meter is available, also monitor the dissolved oxygen concentration of the anesthetic solution. An aquarium air pump with and air stone should be placed into the water to circulate it to maintain adequate oxygen level, especially with a large fish such as koi.

Never leave a fish unattended while it is under anesthesia. Monitor the respiration rate (opercular movements) to assess the depth of anesthesia. The fish will lie on its side and the respiratory rate will slow as the chemical induces anesthesia. Introduce fresh water into the container of anesthetic solution if the level of anesthesia becomes too deep.

A pulse oximeter can be clipped onto the caudal fin of large fish such as koi, near the tail base, to monitor the pulse and blood oxygen concentration. Electrocardiogram (ECG) monitors can also be used in large fish by attaching the monitor clips to hypodermic needles placed into the muscles on either side of the body by the pectoral fins. This will create a 2-lead ECG that will show the heart rate of the fish. It is important to get a baseline heart rate and monitor for slowing, rather than to see if the heart stops, as the heart in fish can continue to beat long after the fish is dead!



Koi under anesthesia for surgery is connected by 2-leads to an ECG machine to monitor heart rate.

Table 1: Commonly utilized chemicals for anesthesia and tranquilization of fish: [1, 2, 3, 4, 5]

Alfaxalone (3-alpha-hydroxyy-5-alpha-pregnane 11,20-dione) –
Immersion in alfaxalone can be used in koi carp at a concentration of 2.5 mg/L.

Benzocaine (ethyl p-aminobenzoate) –
Dose at 12.5 milligrams/Liter of water for a shipping sedative,
25–500 mg/L for anesthesia (may need to dissolve in ethanol first).
Induction time in 1-3 minutes, recovery in fresh water in 3-15 minutes.
The longer the fish is under anesthesia, the longer it usually takes to recover.

Carbon Dioxide (CO_2) –
A dose of 100–400 mg/L bubbled through the water will cause unconsciousness,
high exposure will cause death. Use with caution, under constant observation!
Use in ventilated area. Avoid breathing CO_2 released from the water.
Induction is in 1-2 minutes and recovery in 5-10 minutes in fresh water.
Effective to use for euthanasia in absence of other anesthetic agents.

Diazepam (Valium) –
A sedative and muscle relaxant used as a pre-anesthetic agent.
Can be injected intramuscularly at 0.1-0.5 mg/kg, or given orally at 1-4 mg/kg.

Ethanol (ethyl alcohol) –
1% added to the water will produce sedation, 3% or more will result in euthanasia.
20 ml of 100 Proof (50%) Grain Alcohol in 1 Liter of water will produce a 1% solution.

Ether (dimethyl ether) –
Dose at 10-15 ml/L water.
Induction occurs in 2-3 minutes, recovery in clean water in 2-3 minutes.
HIGHLY EXPLOSIVE! Do not use near flames or sparks!

Eugenol / Isoeugenol (clove oil) –
Eugenol: 1 drop = 0.029 ml = 28.6 mg
Use 30-60 mg/L (1-2 drops / Liter of water).
Mix vigorously. Induction occurs in 2-3 minutes.
Excellent for short duration physical examinations.
A dose of 4 drops per liter (114 mg/L) induces euthanasia in 10-60 minutes.

Isofluorane (1-chloro-2,2,2-trifluoroethyl difluoromethyl ether) –
Dose at 0.5-1 ml/L water for anesthesia. Euthanasia dose 4 ml/L.
Spray the required dose through a 25-gauge needle under the water while mixing.
Induction in 2-8 minutes, recovery in clean water in 3-30 minutes.

Ketamine Hydrochloride –
Dose at 1 gram/L water, or 66-100 mg/kg injected intramuscularly.
Provides sedation and immobilization for handling or transportation.

Metomidate Hydrochloride (Aquacalm) –
Sedation concentration: 0.1–1.0 mg/L of water; Anesthesia: 1.0–10.0 mg/L of water.
The dosage should be individualized, depending upon the fish species and the degree of anesthesia required. May need buffering if water is at a low pH.

Propofol (2,6-diisopropylphenol) –
Anesthesia induction dose is 1.5-2.5 mg/kg intravenously.
Induction time is 5 minutes, recovery in 60-75 minutes.
Can be used as a sedative at 1 mg/L in the water.

Table 1—continued: Commonly utilized chemicals for anesthesia and tranquilization of fish: [1, 2, 3, 4, 5]

Quinaldine Sulfate (2-methylquinoline sulfate) –
Dose at 5-10 mg/L for sedation, 25-200 mg/L for anesthesia.
Induction in 2-6 minutes, recovery in fresh water in 5-20 minutes.
Acidifies low alkaline water, use sodium bicarbonate buffer in water as necessary.

Tricaine Methane Sulfonate, MS-222 (3-Aminobenzoic acid ethyl ester) –
Dose at 10-40 mg/L for sedation (handling/ shipping).
Dose at 50-400 mg/L for anesthesia induction, 50-100 mg/L for maintenance.
Induction in 1-5 minutes, recovery in 3-15 minutes in clean water.
Acidifies water – buffer with equal volume of sodium bicarbonate or use hard water.

Methods of Anesthesia Delivery

The most common method of administering anesthetics to fish is by adding the drug directly to the water. Fish rapidly absorb many chemicals through the gill membranes into the blood stream. With this method, it is very important to accurately measure the volume of water that is being medicated so that the correct dosage of anesthetic can be used. Some anesthetic agents (e.g., MS-222, metomidate) alter the water quality and corrective actions may be necessary. Using an equal volume of sodium bicarbonate powder (baking soda) with the powdered anesthetic will buffer the water to prevent pH decreases.

When the fish is placed into the container with the anesthetic in the water, it will gradually begin to lie on its side and the respiratory rate will slow as the chemical induces anesthesia. In some cases, there may be an excitatory stage, so the anesthetic chamber may need to be covered to prevent fish from jumping out. After the fish is anesthetized in the anesthetic bath, it can be removed from the water for short-term examination or diagnostic procedures. If the fish is removed for longer procedures, anesthetic solution can be dripped across the gills through an IV bag and drip line, by hand with a syringe, or with a recirculating water pump or aquarium filter powerhead.

Have oxygenated fresh water on hand to syringe across the gills if the plane of anesthesia becomes too deep. Keep the body moist if out of the water for examination or surgery. Use ophthalmic ointment on the eyes to keep them from drying. Monitor the respiration rate (operculum movements) to assess the depth of anesthesia.

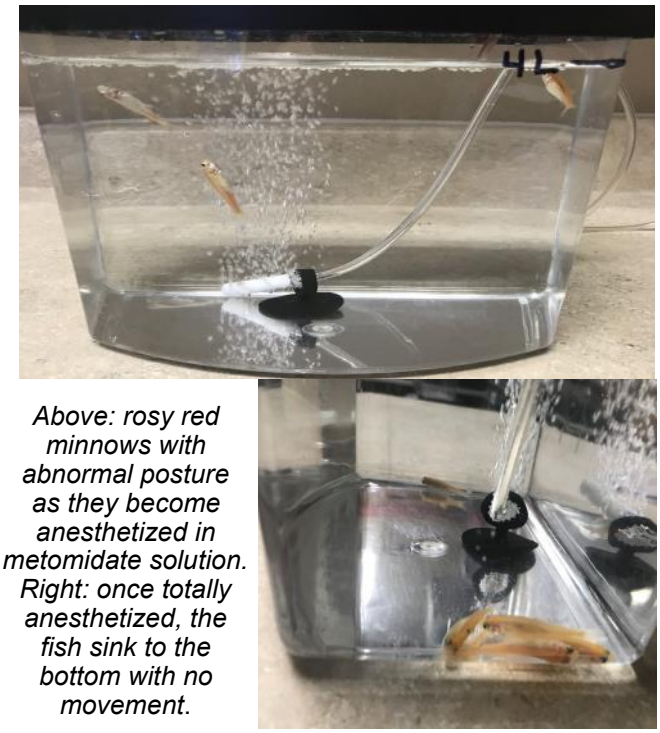
Some anesthetic agents can also be injected intramuscularly (IM), intravenously (IV) or intraperitoneally (IP), which is actually intracelomically in fish.

Oral (per os, PO) anesthetic drugs can be given via stomach tube, or by mixing the anesthetic (Diazepam, Ketamine) into a suitable food fish that is fed to the patient (including injecting into food fish given to large carnivorous species). Onset of sedation may be variable with this method.

Some anesthetic solutions, such as Benzocaine or Tricaine at 1 g/L solution, can be topically applied to gills with a spray bottle or bulb syringe for faster induction in larger species, such as elasmobranches.

Recuperation after anesthesia is accomplished by transferring the fish into a container of fresh, well-aerated water without any anesthetic. Never leave a fish unattended while it is under anesthesia. Some large fish tend to jump during induction or recovery from anesthesia. Moving the fish gently in a forward direction will aid the flow of fresh water across the gills, hastening anesthesia release from the gills. Do not slosh the fish back and forth in the water. Once there are steady operculum movements let the fish rest and gradually recover in a quiet, dim environment.

The longer a fish is under anesthesia, the longer it will take to recover from the anesthetic. Monitor the fish until it has regained its equilibrium and is swimming normally and can be transferred back into the aquarium or pond.



Above: rosy red minnows with abnormal posture as they become anesthetized in metomidate solution. Right: once totally anesthetized, the fish sink to the bottom with no movement.

Table 2: Stages of Anesthesia in Fishes (adapted from Brown[6] and Ross[7])

Stage	Plane	Description	Signs
0	0	Normal	Swimming actively, equilibrium normal
I	1	Light sedation	Reduced motion, ventilation decreased
I	2	Deeper sedation	Motionless unless stimulated
II	1	Light anesthesia	Partial loss of equilibrium
II	2	Deep anesthesia	Total loss of equilibrium
III	1	Surgical anesthesia	Total loss of reactivity when stimulated
III	2	Deep surgical anesthesia	Decrease in respiratory and heart rates
IV	1	Medullary collapse	Cessation of respiratory movements
IV	2	Cardiac arrest	Death

Fish Euthanasia

As veterinarians, we should treat aquatic animals, as with any other animals, in a way that would reduce their stress and pain, alleviate suffering, and, when required, cause humane death. As stated by the AVMA, "The aim of euthanasia is to accomplish death rapidly with the minimum amount of distress practicable."[4] Anesthetic solutions can be used for euthanasia of tropical ornamental fish at a recommended dose of 5-10 times that used for anesthesia, leaving the fish in the solution long enough for all opercular motion to stop, and then waiting another 30 minutes or more to ensure their death from anoxia while anesthetized and not respiring.

Some species of fish are very tolerant of low oxygen conditions in the water, so death from anoxia while anesthetized. even though respiration has ceased, may not occur as quickly as in other fish species. A secondary method of euthanasia (pithing or decapitation) may be used after the fish is anesthetized if time does not permit waiting to ensure the fish has expired.

The following methods are acceptable for use in ornamental fish:[4]

AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, American Veterinary Medical Association, Schaumburg, IL, 2013. https://www.avma.org/kb/policies/documents/euthanasia.pdf

(1) Immersion in solutions of buffered tricaine methane sulfonate (MS-222), buffered benzocaine, isoflurane or sevoflurane, quinaldine sulfate, and 2-phenoxyethanol.
(2) Injections of pentobarbital, ketamine followed by pentobarbital, a combination of ketamine and medetomidine followed by pentobarbital, and propofol followed by pentobarbital. Owners should be advised about the possibility of ketamine-induced muscle spasms during induction when using that agent.

The following methods are acceptable with conditions for use in fish:
(1) Immersion in eugenol or clove oil. Fish should be left in the solution for a minimum of 60 minutes after cessation of opercular movement.

The following methods are not recommended for use in the presence of pet owners:
(1) Immersion in CO2-saturated water is not recommended because some fish exposed to this method may become hyperactive, which can be disconcerting for staff and owners.
(2) Manually applied blunt force trauma to the head, decapitation, and pithing are not recommended because their application can be distressing for owners and staff.

The following are unacceptable methods of euthanasia in any situation:
(1) Flushing of fish into sewer, septic, or other types of outflow systems is unacceptable for many reasons. Water chemistry and quality may delay time to death and result in exposure to noxious compounds. For systems near or connected to natural waterways, pathogen release or transmission may occur from diseased or carrier animals.
(2) Slow chilling or freezing of unanesthetized animals, including placing fish into a freezer without prior anesthesia, is also an unacceptable method.
(3) Death by anoxia and desiccation after removal from the water or by anoxia in water; any death due to exposure to caustic chemicals; and death including prolonged traumatic injury prior to unconsciousness are unacceptable.

Experimental Use of Metomidate Anesthesia for Ornamental Fish Euthanasia

While Metomidate has been used for euthanasia of some fish species in many countries, its listing in the Index of Legally Marketed Unapproved New Animal Drugs for Minor Species by the United States Food and Drug Administration (with a specified use for sedation and anesthesia) means that its extra-label use for euthanasia is currently prohibited for general use by veterinarians. This test is done as an experiment to see if it could have practical use for fish euthanasia in countries where it can legally be used.

Materials

Metomidate hydrochloride (Aquacalm™) - acts on the central nervous system to induce sedation or anesthesia in fish immersed in water containing the drug.

Fish Species – the species selected for testing are representative of the common ornamental fish families kept by freshwater aquarists.

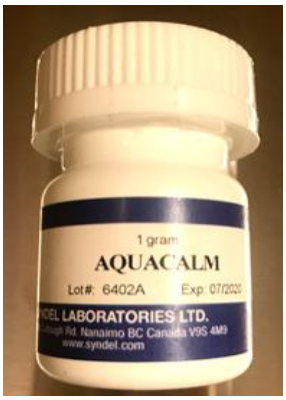
Procedure

Common species of ornamental fish were used to test metomidate at various dosages for euthanasia. Different individual fish were used for each test. Not all the same species of fish were used for each dosage test. Fish were held in metomidate solution (pH 6.2-7.8; Temperature 21-28 C) for an additional 30 minutes after reaching medullary collapse, *Stages of Anesthesia in Fishes:* Stage IV, Plane 1.

After the 30 minutes at Stage IV, Plane 1, the fish were returned to normal aquarium water (pH 7.4-7.8) to check for recovery and monitored for signs of life for a minimum of 6 hours.

Data

The data, presented in Table 3, indicates that some species of ornamental fish were euthanized even at the lower doses of metomidate (two times the therapeutic anesthetic dose) after 30 minutes of respiratory arrest. However, fish species that are adapted to low oxygen conditions (some catfishes, goldfish, betta) required higher metomidate doses to achieve consistent euthanasia.



AQUACALM brand of metomidate from Syndel Laboratories

Conclusion

Fish were kept in the metomidate solution for 30 minutes after cessation of opercular movements to ensure that they were not respiring and therefore would likely be affected by anoxia. As the concentration of metomidate increased, the number of fish surviving decreased. For the species tested at 100 mg/L metomidate solution (10 times the standard dosage used for anesthesia), the fish tested were all effectively euthanized. Some species of fish (e.g., Corydoras catfish) were not euthanized at the dosages used for them in this test and may require euthanasia at higher concentrations (250 mg/L or more) or for a longer duration of exposure to the drug.

For aquatic veterinarians who have access to metomidate for use as a euthanasia agent, this drug at a minimum dosage of 100 mg/L in buffered water is effective for many ornamental fish species, and the fish showed minimal signs of aversive reaction to its use.

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Table 3: Effect of Metomidate Dosages for Euthanasia in Ornamental Fish

Fish Species	Scientific Name	Fish Family	Metomidate Dose	# of fish tested	Survival %
Rosy Reds (Golden Fathead Minnows)	*Pimephales promelas*	Cyprinidae	20 mg/L	5	0%
Betta	*Betta spendens*	Osphronemidae	20 mg/L	5	40%
Comet Goldfish	*Carassius auratus*	Cyprinidae	20 mg/L	5	80%
Guppies (3 males; 2 females)	*Poecilia reticulata*	Poeciliidae	20 mg/L	5	20%
Endlers Livebearer (3 males; 3 females)	*Poecilia wingei*	Poeciliidae	20 mg/L	6	100%
Pictus Catfish	*Pimelodus pictus*	Pimelodidae	20 mg/L	5	0%
Dalmatian Molly	*Poecilia latipinna*	Poeciliidae	20 mg/L	5	60%
Peppered Corydoras Catfish	*Corydoras paleatus*	Callichthyidae	20 mg/L	5	100%
			Total at 20 mg/L	41	**51%**
Rosy Reds (Golden Fathead Minnows)	*Pimephales promelas*	Cyprinidae	30 mg/L	3	0%
Betta	*Betta spendens*	Osphronemidae	30 mg/L	4	25%
Comet Goldfish	*Carassius auratus*	Cyprinidae	30 mg/L	4	25%
Guppies (2 males; 2 females)	*Poecilia reticulata*	Poeciliidae	30 mg/L	4	0%
Endlers Livebearer (4 males; 2 females)	*Poecilia wingei*	Poeciliidae	30 mg/L	6	67%
Dalmatian Molly	*Poecilia latipinna*	Poeciliidae	30 mg/L	2	0%
Green Corydoras	*Corydoras aeneus*	Callichthyidae	30 mg/L	3	100%
			Total at 30 mg/L	26	**35%**
Betta (3 male; 2 female)	*Betta spendens*	Osphronemidae	50 mg/L	5	0%
Guppies (4 males; 1 female)	*Poecilia reticulata*	Poeciliidae	50 mg/L	5	0%
Endlers Livebearer (4 males; 2 females)	*Poecilia wingei*	Poeciliidae	50 mg/L	6	33%
Golden Moon Platy (5 females)	*Xiphophorus maculatus*	Poeciliidae	50 mg/L	5	0%
			Total at 50 mg/L	21	**10%**
Rosy Reds (Golden Fathead Minnows)	*Pimephales promelas*	Cyprinidae	100 mg/L	5	0%
Betta	*Betta spendens*	Osphronemidae	100 mg/L	5	0%
Comet Goldfish	*Carassius auratus*	Cyprinidae	100 mg/L	5	0%
Guppies (5 males)	*Poecilia reticulata*	Poeciliidae	100 mg/L	5	0%
Endlers Livebearer (3 males; 3 females)	*Poecilia wingei*	Poeciliidae	100 mg/L	6	0%
Golden Moon Platy (2 females)	*Xiphophorus maculatus*	Poeciliidae	100 mg/L	2	0%
Auratus African Cichlid	*Melanochromis auratus*	Cichlidae	100 mg/L	2	0%
			Total at 100 mg/L	30	**0%**

Recent Asian origin of chytrid fungi causing global amphibian declines.
O'Hanlon SJ, *et al.*
Science. 2018 May 11; 360(6389): 621-627.
doi: 10.1126/science.aar1965.

Globalized infectious diseases are causing species declines worldwide, but their source often remains elusive. We used whole-genome sequencing to solve the spatiotemporal origins of the most devastating panzootic to date, caused by the fungus *Batrachochytrium dendrobatidis*, a proximate driver of global amphibian declines. We traced the source of *B. dendrobatidis* to the Korean peninsula, where one lineage, BdASIA-1, exhibits the genetic hallmarks of an ancestral population that seeded the panzootic.

We date the emergence of this pathogen to the early 20th century, coinciding with the global expansion of commercial trade in amphibians, and we show that intercontinental transmission is ongoing. Our findings point to East Asia as a geographic hotspot for *B. dendrobatidis* biodiversity and the original source of these lineages that now parasitize amphibians worldwide.
https://www.ncbi.nlm.nih.gov/pubmed/29748278

Batrachochytrium salamandrivorans
Scientific classification
Kingdom: Fungi
Division: Chytridiomycota
Order: Rhizophydiales
Family: uncertain
Genus: Batrachochytrium
Binomial name *Batrachochytrium salamandrivorans* Martel A., Blooi M., Bossuyt F., Pasmans F. (2013).

Batrachochytrium salamandrivorans (Bsal) is a pathogenic chytrid fungus that infects salamanders and newts and emerged only recently as a potentially important threat to species in Europe and North America. It was described in 2013 based on a strain collected from skin tissue of fire salamanders. Molecular phylogenetics confirmed it as related to the well known chytrid *B. dendrobatidis*. Like this species, it causes chytridiomycosis, which is manifested in skin lesions and is lethal for the salamanders.

It was shown that while frogs and caecilians were immune to *B. salamandrivorans*, it was lethal to many European and some North American salamanders. East Asian salamanders were susceptible but able to limit the infection. The fungus was also detected in a more-than-150-year-old museum specimen of the Japanese sword-tailed newt. This suggests it had originally emerged and co-evolved with salamanders in East Asia, forming its natural reservoir, and was introduced to Europe rather recently through the trade of species such as the fire belly newts as pets.
https://en.wikipedia.org/wiki/Batrachochytrium_salamandrivorans

Will trade bans stop a deadly salamander plague from invading the US?
BY JEREMY HANCE
30 OCTOBER 2018
Mongabay Series: Salamanders

In 2008, scientists started noticing that populations of fire salamanders were disappearing in Western Europe. A few years later, nearly all had vanished from large portions of Germany, Belgium and the Netherlands. The culprit turned out to be a fungus called *Batrachochytrium salamandrivorans*, or Bsal, which infects the skin of salamanders and often kills them. Research indicates Bsal came from Asia and was spread to Europe via the importation of Asian salamanders.

The U.S. is home to the world's highest diversity of salamander species, many of which are thought to be susceptible to Bsal infection. So far, scientists haven't detected the pathogen in North America, but many believe it's just a matter of time until it gets here unless drastic action is taken.

In response, the U.S. Fish and Wildlife Service imposed a ban on the trade of 201 species of salamander species in 2016, under the Lacey Act. However, the recent discovery that frogs can also carry Bsal led to an outcry from scientists urging government to ban the import of all salamander and frog species. However, many hobbyists think a total ban is overkill. They instead favor a "clean trade" in which some imported animals would tested for Bsal.

Scientists have since discovered that a new Bsal fungal spore can survive for up to 30 days in the water or air and may even survive on the feet of water birds, potentially traveling from waterway to waterway with ease.

Where scientists and hobbyists appear to agree is that the best thing going forward would be quickly establishing a so-called "clean trade." What that means is every single amphibian — salamander or frog — would be tested before being allowed into the U.S. If the animal was found to be infected it would then be treated when they arrived.

The best way to prevent a disease in a pet from affecting wild populations is to ensure that pets are not released into the wild. Of course, it's impossible to make sure every pet owner does the right thing. And even if it were, things go wrong, pets escape. Even throwing water from a salamander or frog cage outside could be perilous because that water could contain Bsal spores. Should Bsal reach the shores of the U.S., the North American Bsal Task Force has established a rapid response plan to give us a chance to contain the spread.

Excerpt from:
https://news.mongabay.com/2018/10/can-trade-bans-stop-a-deadly-salamander-plague-from-invading-the-us/

Deadly fungus spread by trade in amphibians could wipe out British newts
Josh Gabbatiss, Science Correspondent
The Independent

A deadly "salamander-eating" fungus that is already causing havoc for European amphibians is rife in the pet trade, prompting fears it could spread to the UK's vulnerable newts. In a study partly funded by the British government, scientists found that seven of the 11 private amphibian collections tested from Western Europe were positive for the "Bsal" infection.

The salamander disease is caused by *Batrachochytrium salamandrivorans*, a fungus that has spread from Asia and killed 99 per cent of fire salamanders in the Netherlands. The name "*salamandrivorans*" translates as "salamander eating", a reference to its deadliness and the destruction of amphibian skin that results from infection.

Experts are concerned some of the UK's newts, which are already teetering on the edge of extinction thanks to habitat loss and intensive farming, could be the next victims of this plague. They have warned that once the infection enters wild populations it could be "impossible to stop".

Europe is known to be a major importer of live amphibians, with the most recent UK figures suggesting over 100,000 are imported legally each year as pets.

"The presence of Bsal in amphibian collections increases the risk of Bsal infection being transferred to nearby wild amphibian populations, for example, through contaminated wastewater or released or escaped animals," said Professor Andrew Cunningham from the Zoological Society of London.

After years of relatively unregulated trade, the EU has recently brought in regulations to control the movement of captive salamanders and newts to prevent the disease spreading. Perhaps the biggest concern for scientists is that Bsal will take on the epidemic proportions of Bd, a closely related disease that has decimated hundreds of frog species around the world and caused many to go extinct.

"Once the fungus is in a wild population it is likely to be impossible to stop its spread and the loss of susceptible species," said study leader Dr Liam Fitzpatrick. "We already know that Bsal can be lethal to a number of European salamander species, so understanding ways in which the fungus could be introduced to new areas is essential in our efforts to conserve wild amphibians."

Publishing their work in the journal Scientific Reports, the scientists called for biosecurity and sanitisation guidance to be given to those working in the pet trade so the problem can be stopped at its source.

Excerpt from:
https://www.independent.co.uk/environment/amphibian-fungus-deadly-newts-uk-bsal-chytrid-pet-trade-a8537386.html

Vanishing in the Wild, These Salamanders Found Refuge in a Convent
By Geoffrey Giller,
New York Times,
July 30, 2018

PÁTZCUARO, MEXICO —

Atop the highest hill in this lakeside town sits the Basílica de Nuestra Señora de la Salud, built in the 1500s with whitewashed walls and red stone columns. On a street around the corner from the basilica, a wooden door framed in carved stone and marked with a cross fleury stands open. "We pray for you," reads a sign on the door in Spanish. Inside, the room is sparse and dark save for a wooden window and three locked doors. Behind them is a convent, home to two dozen nuns of the Dominican Order.

But the convent also hosts an even larger number of very unexpected residents: a thriving colony of endangered salamanders. Scientists call them *Ambystoma dumerilii*, but the nuns and everyone else in Pátzcuaro call them achoques. The achoques live their entire lives underwater and keep the external gills that most salamanders have only as aquatic larvae.

Carefully tended by the nuns, about 300 achoques live in glass aquaria and white enamel bathtubs lining the walls of a long hallway and two adjoining rooms in the convent. Their tanks are spotless, each with a bubbling aerator made from half of a plastic soda bottle filled with stones and coiled fabric. In a glass case above the tanks, a baby Jesus dressed as a doctor keeps watch.

The nuns support themselves partly by selling a cough syrup called jarabe made from the salamanders' skin. But the basilica's achoques are increasingly valuable for another reason. They are found nowhere but Lake Pátzcuaro, and outside the convent their numbers are falling fast. There are smaller captive colonies elsewhere in Pátzcuaro, but none as large as the one in the basilica. It may be critical to the salamanders' prospects in the wild. The sisters used to make their syrup using salamanders collected from the lake. When they began to disappear, the nuns established the convent's colony because they were worried about losing the jarabe business.

"What would we do — not make any syrup?" Sister Ofelia Morales Francisco said in Spanish. But eventually she and the other nuns also came to recognize a conservation imperative in their work. "It's about protecting a species from nature," she said. "If we don't work to take care of it, to protect it, it will disappear from creation."

"Being part of a religious order like ours is not an obstacle for scientific progress," said Sister Ofelia. "The order is devoted to the research of theological and scientific knowledge in benefit of humanity," she added. Part of the order's mission is "to work in favor of a more humane conscience full of love and justice for nature."

MEETINGS OF INTEREST TO AQUATIC VETERINARIANS

Veterinarians attending these meetings may be awarded veterinary CEPD credit towards annual re-licensure or re-registration to practice veterinary medicine. Individuals should check with the organizers to see if CEPD certificates are provided.

35th WORLD VETERINARY ASSOCIATION CONGRESS
San Jose, Costa Rica | April 27 - 30, 2019

Life connects all - Pura Vida

44th WSAVA World Congress & 71st CVMA Convention
16-19 July 2019

The WSAVA hosts a veterinary congress once a year for companion animal veterinarians from across the globe. The WSAVA World Congress is an internationally recognized veterinary congress with a scientific program of the highest standard produced in alternating regions reflecting the local culture and veterinary diversity. The scientific program includes two streams organized by the local host association designed for the regions' practicing veterinarians. The congress is held for three to four days and generally presented in English with translations as needed. WAVMA will produce a day of Fish Medicine lectures at the Toronto Conference.
Visit the website here

Future WSAVA Conferences

45th WSAVA World Congress
Dates: 23-26 September 2020
Warsaw, Poland
Visit the website here

46th WSAVA World Congress
Dates: 13-16 November 2021
Hyderabad, India
Visit the website here

47th WSAVA World Congress
Dates: 29-31 October 2022
Lima, Peru

Discover core knowledge, skills & experience needed to become a WAVMA Certified Aquatic Veterinarian *(CertAqV)*

Did you know that WAVMA's ***CertAqV Program*** offers members the opportunity to become recognized and certified as having competency in 9 core areas deemed necessary to practice aquatic veterinary medicine? Find out more information online at: http://www.wavma.org/CertAqV-Pgm.

ICARE 2019
April 28 – May 2, 2019
London, Great Britain.
For more information: http://www.icare2019.eu

ExoticsCon 2019
Association of Avian Veterinarians,
Association of Exotic Mammal Veterinarians,
Association of Reptilian and Amphibian Veterinarians, and AAZV
September 27–October 5, 2019
St. Louis, MO, USA
For more meetings, see information at: https://www.wavma.org/Aquatic-Veterinary-Educational-Meetings-Conferences-Symposia-Workshops

25th Annual U.S. FWS, Aquaculture Drug Approval Coordination Workshop
July 30 - Aug 1, 2019
Bozeman, MT

AVMA Convention
Aug 2-6, 2019
Washington DC
More info

23rd Biennial Society of Marine Mammalogy / 2nd World Marine Mammal Science Conference
Dec 9-12, 2019
Barcelona, Spain
More info

American Fisheries Society Conference
September 29-October 3, 2019
Reno, Nevada
https://afstws2019.org/

DO YOU HAVE A STORY TO TELL ABOUT HOW YOU BECAME INVOLVED WITH AQUATIC VETERINARY MEDICINE?

Send your article (<1,000 words) with pictures to TAVeditor@wavma.org.

2019 American Association of Fish Veterinarians Conference Announcement
September 29 & 30, 2019
St. Louis, Missouri USA

Join us for the **2019 AAFV Annual Conference** and **ExoticsCon** on Sept 27 – October 5, 2019. We are excited to be a part of this joint conference and hope you will be as well. This event will bring together the best exotic pet, zoo and wildlife veterinarians to contribute to the scientific, continuing education, networking and hands-on learning that make our careers enriching and fulfilling.

AAFV Annual Conference concurrent with ExoticsCon registration will be through AAZV. If you register for the Monday-Friday Conference, this includes the AAFV Monday sessions.
Visit https://www.aazv.org/ for more information.,

2019 AFS FISH HEALTH SECTION ANNUAL MEETING AND 60TH WESTERN FISH DISEASE WORKSHOP
June 17, 2019 - June 20, 2019
Ogden, Utah

The 2019 joint AFS Fish Health Section Annual Meeting and the 60th Western Fish Disease Workshop will be held at the Hampton Inn and Eccles Conference Center located in Ogden, Utah.
https://fisheries.org/events/2019-afs-fish-health-section-annual-meeting-and-60th-western-fish-disease-workshop/

19th International Conference on Diseases of Fish and Shellfish
9 -12 September 2019
Porto, Portugal

The Conference will provide a platform for all participants to take full advantage of the many opportunities for formal and informal interaction with colleagues from all around the world, sharing knowledge of the most recent advances on Fish and other Aquatic Organism's Pathology. The scientific programme will include distinguished key note speakers from countries across the world, as well as oral and poster presentations.
https://www.eafp2019.com/