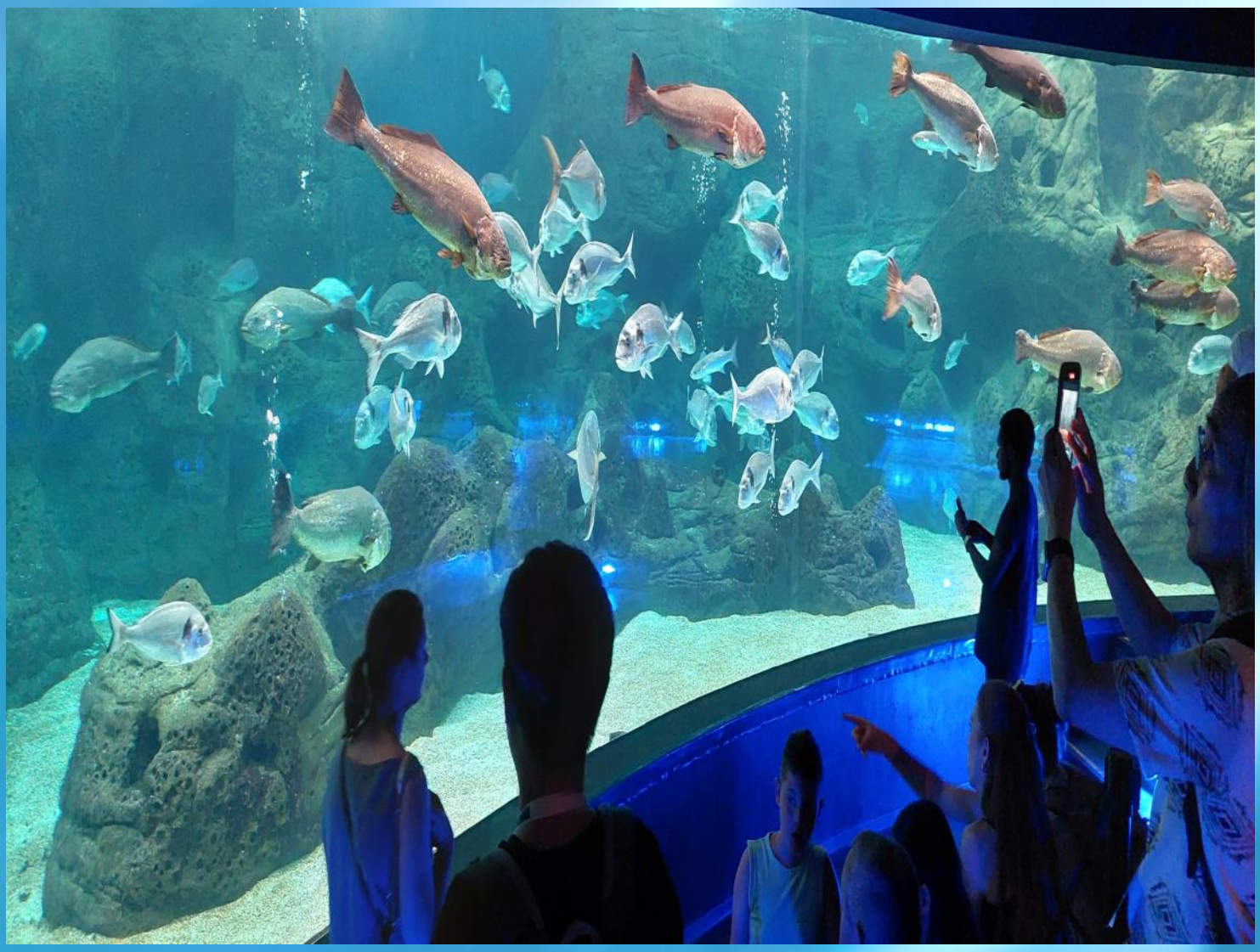
The Aquatic Veterinarian

Journal of the World Aquatic Veterinary Medical Association



World Aquatic Veterinary Medical Association

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WHO ARE WE

MISSION

The Mission of the 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.

To fulfill this Mission, the World Aquatic Veterinary Medical Association has established the following:

Objectives

1. To serve aquatic veterinary medicine practitioners of many disciplines and backgrounds by developing programs to support and sustain members, and the aquatic species industries that they serve.
2. To identify, foster and strengthen professional interactions among aquatic medical practitioners and other organizations around the world.
3. To be an advocate for, develop guidance on, and promote the advancement of the science, ethics, and professional aspects of aquatic animal medicine within the veterinary profession and a wider audience.
4. To optimally position and advance the discipline of aquatic veterinary medicine, and support the practice of aquatic veterinary medicine in all countries.

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.

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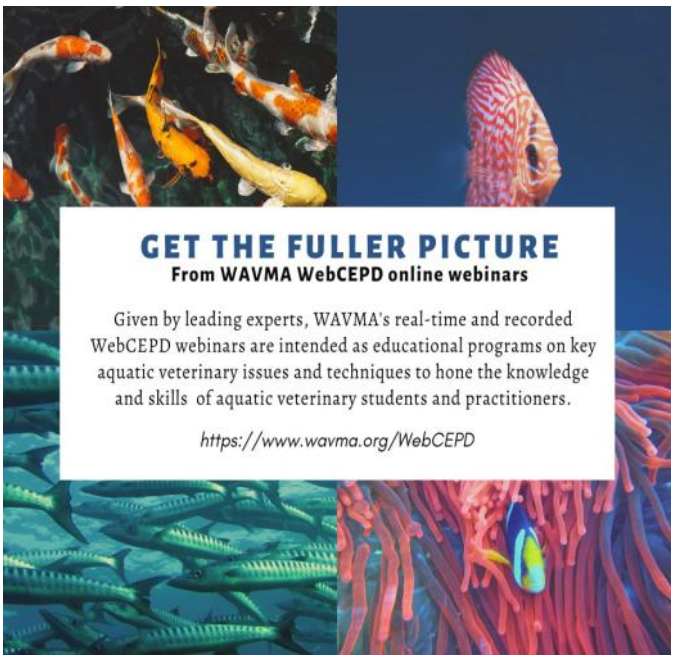
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Cover photo:

The largest marine tank at Cretaquarium in Gournes, Greece. Photograph by: Bart Gorgoglione. See pages 6-9 for full report.





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.

EDITORIAL

Editor's Note

Of great importance in this issue is the call for nominations to our 2026 Executive Board. Please see page 10 for more information, and volunteer for one of our open positions for next year!

Student chapters have the opportunity to get a $500 grant for activities at their school by submitting applications to the ESC by October 19, 2025. See page 17 for more information on receiving grants.

At the SuperZoo Pet Retailers conference in Las Vegas in August of this year, I had the opportunity to spend time with the folks from Fritz Aquatics, one of the largest manufacturers of aquarium water care products in the USA. Previously I had toured their factory in Mesquite, Texas, and have included photos from that in an article about Fritz Aquatics on pages 26 -27. Below is a photograph of me wearing a T-shirt with the vintage Fritz Aquatics logo.

This Third Quarter 2025 issue includes two research articles (pages 28-33 and pages 34-39). We are always looking for original research or clinical case reports to share with the Aquatic Veterinarians. Please submit to me any articles or case reports by December 15, 2025 for the Fourth Quarter edition of *The Aquatic Veterinarian*.

Thank you and I wish you a great Autumn in the Northern Hemisphere, or Spring down under.

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



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.

World Aquatic Veterinary Medical Association

The Aquatic Veterinarian

The Quarterly Magazine of the World Aquatic Veterinary Medical Association

Consider promoting your products, services or programs to aquatic veterinarians, veterinary students, nurses & paraveterinary professionals throughout the world

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WAVMA Members can place a free 1/8 page (business card size) advertisement in the TAV. Contact TAVeditor@wavma.org for information on advertising and payment options.

EXECUTIVE REPORTS

President's Report



Nelly Isyagi
President@wavma.org
WAVMA President
(Uganda)

Dear WAVMA Members,

WAVMA will be holding our Annual general Meeting online on 26th November, 2025. We will have discussion of about 20 minutes for the strategic planning and the CertAqV Program. Then, brief presentations by each of the Regional Directors about activities held this year in their countries, followed by reports from committees.

Proposed AGM Agenda:

(i) Discussion on the strategic action plan by the Fellow' Advisory Council, reviewing the proposals and obtaining feedback from members to get a final agreed draft and finish the document based on outcomes of the GA discussions by December/January.

(ii) The CertAqV - (background, objectives, syllabus, the process, how to make evaluations, etc.). During this discussion we would encourage feedback/ comments from those who have gone through the process, mentors, adjudicators and those planning to apply. Since this is one of WAVMA/s major activities, it may attract participants to attend.

(iii) Directors and Committee Reports— I anticipate each Committee Chair & Director will give a summary of what they were able to accomplish during the course of the year and get feedback from members. We also need to encourage members to become more active within their regions and interact with their respective Regional Directors beyond attending webinars, CertAqV, etc. The Publications Committee will report on the TAV, with the hope of improving the number of submissions to it (and for the webinars) from members.

Also, nominations for next year's Executive Board (Officers and Directors—see page 10) need to be submitted by the 26th October, which will then provide three weeks to vote prior to the annual General Meeting, where we will announce the results. Candidates need to email a completed Nomination Form as well as a head and shoulders photograph to the WAVMA Administrators by the end of business October 26, 2025. The Nomination Form and the WAVMA Executive Board Responsibilities document are available at www.wavma.org/elections. Please note you will need to log in to your WAVMA membership to access the page.

E-news has sent out information about taking our WAVMA Survey. From that, about 412 people have opened the link (around 35%), so roughly where one might expect. 57 individuals have clicked on the contained links 173 times, so those who clicked looked at all three of the links. That again is pretty positive. If you have not done so already, please connect to the survey and fill it out to help us with our future planning.

Thank you!



WAVMA representation to the EAFP XXII International Conference on Diseases of Fish and Shellfish

By Dr. Bartolomeo Gorgoglione,
WAVMA Secretary / ESC Chair,
Fish Pathobiology and Immunology Laboratory,
College of Veterinary Medicine,
Michigan State University, USA

The 22nd edition of the International Conference on Diseases of Fish and Shellfish was held on the fascinating Greek island of Crete, where ancient mythology narrate that the Minoan people gave birth to the oldest European civilization. Delegates gathered in Heraklion during the first week of September, enjoying some wonderful Mediterranean summer climate while participating in the rich scientific and social program organized by the European Association of Fish Pathologists (EAFP).

The recently built Cultural Conference Center of Heraklion welcomed hundreds of scientists from all around the world. The organization of this highly successful scientific event was coordinated by the EAFP Meeting Secretary, Astrid Holzer from the Fish Health Division at VetMedUni Vienna, Austria, and by the local organization team directed by Pantelis Katharios from the Institute of Marine Biology, Biotechnology and Aquaculture of the Hellenic Centre for Marine Research in Heraklion.

The event started with pre-conference workshops, held on 31st August. This year the traditional histopathology workshop was a great success, said one of the workshop organizers, Patricia Noguera from Argentina. The event was opened with a keynote talk given by Jeff Wolf from Virginia, USA and followed by case study specialized presentations. Participants had the opportunity to navigate through digitalized gill histology preparations. The Bioinformatic workshop, organized by an expert team from CEFAS, UK, tentatively introduced participants to the use of the CLIMB platform. Detailed training was given on basic command-line techniques, aiming to enable attendees to perform genomics analysis interrogating big data for research on fish pathogens (Fig. 1).



Figure 1. Bioinformatics Workshop on Genomics of Fish Pathogens Workshop, organized by Nicola Coyle, Chantelle Hooper, Georgia Ward, and Ronny van Aerle from CEFAS, UK. Photo: B. Gorgoglione.

From Monday 1st to Thursday 4th September a great variety of scientific contributions were delivered, including talks through three intense parallel sessions, and posters spread out over three floors of the large hosting building. Each day of the conference was opened by an international keynote speaker. The first day was inaugurated by Jerri Bartholomew from Oregon State University, USA illustrating their effort towards fish health assessment upon a series of dam removals, targeting fish diseases caused by myxozoan parasites (Fig. 2).



Figure 2. Jerri Bartholomew delivering a plenary talk in the main conference room and concluding her successful career. Photo: B. Gorgoglione.

The day continued with several sessions focusing on viral and bacterial diseases, and host-pathogen interactions. In the afternoon a workshop, organized by Ivona Mladineo and Benjamin Costas, illustrated research updates from EU-funded projects, such as Cure4Aqua and IGNITION (Fig. 3). After an intense day of scientific updates, the conference delegates had the opportunity to socialize during an evening welcome reception held at conference site.



Figure 3. Mikolaj Adamek, from TiHO, Germany delivering results from Cure4Aqua founded research about the testing of epithelial or environmental samples for intravital evaluation of fish health status.

The second day of the conference was opened by Eric Stabb from the University of Illinois, USA illustrating the fascinating aspects of the symbiosis between *Vibrio fischeri* and the Hawaiian bobtail squid, thus their use as a model for aquatic infection studies. The day continued with sessions on diagnostics, immunology, salmonid viral diseases, bivalves and crustacean diseases, and climate change. In addition, three short workshops were held during the morning. Oliver Robinson, Andre Van, Hanna Hartikainen, and Jason Holland discussed new knowledge towards the development of sustainable disease management strategies for aquaculture during the Proliferative Kidney Disease workshop (Fig. 4). Another workshop focusing on emerging disease in wild shellfish populations was organized by Francesca Carella, Isabelle Arzul, and Lydie Canier. The workshop on intracellular pathogens was instead organized by Pantelis Katharios and Francesc Padrós.



Figure 4. Active discussion between participants during the PKD workshop. Photo: B. Gorgoglione.

On the third day of conference works, the keynote talk given by Nikos Papandroulakis, the Research Director at the Institute of Marine Biology Biotechnology, HCMR in Heraklion exemplified new challenges in Mediterranean aquaculture, towards digital transformation and precision fish farming. The day was filled up with talks during intense sessions on vaccines, immunostimulants, prebiotics and probiotics, sea lice, genomic approaches to fish pathology, aquatic animal epidemiology, parasitic diseases, nutrition and fish health, and on gill diseases. Even on this day workshops were held, including on Nodavirus in wild fish, organized by Pantelis Katharios and Anna Toffan, who also contributed to organize the workshop on Mediterranean fish health together with Snježana Zrnčić, Francesc Padrós, Alain Le Breton.



Figure 5. Lunch time during the EAFP conference at the Cultural Conference Center of Heraklion. Photo: EAFP Facebook.

On the last day of the EAFP conference Sandrine Baron from the French Agency for Food, Environmental and Occupational Health & Safety, discussed the importance of including aquatic animals and environments relevant issues, such as Antimicrobial Resistance (AMR) in fish, under a One Health perspective. The day was completed by scientific sessions focusing on Myxozoan parasites, AMR, aquatic animal health, and aquatic veterinary education, in which the WAVMA educational program was also illustrated (Fig. 6).

During the afternoon, all the EAFP members gathered for the general assembly, wherein updates were provided by each EAFP Council Board member about activities carried out during the last couple of years and new initiatives were announced (Fig. 7).



Figure 6. Bartolomeo Gorgoglione delivering a talk on innovative aquatic veterinary education approach by taking advantage of virtual partnership and contributions. Photo: Santosh Lamichhane.

The EAFP General Secretary, Jerko Hrabar from Croatia, announced the results of the recently completed elections to refresh several EAFP Council Board positions. Klaus Knopf from Germany was elected again to cover the EAFP President position for the next 4 years, while Edit Eszterbauer from Hungary was reconfirmed as EAFP Treasurer. Maria Constenla Matalobos from Spain became the new EAFP Meeting Secretary. The assembly was ended with the announcement of the next EAFP International Conference, which will be held in Bergen, Norway on 5th to 8th September of 2027, and will be coordinated by the new EAFP Meeting Secretary.



Figure 7. Athina Papadopoulou, with all the EAFP Council Board members, announcing the call for a EAFP Bulletin Special Issue on "One Health" Approaches in Aquaculture during the EAFP general assembly. Photo: B. Gorgoglione.

But the EAFP conferences are also well known for their amazing social program offerings. The conference activities ended indeed with an astonishing Gala Dinner held at the picturesque Arolithos Traditional Cretan Village. International guests were delighted with the degustation of local cuisine specialties and entertained by live local music and dancers. Many scientists exercised in dancing to the engaging Greek music, starting from the stage to continue among the tables (Fig. 8). During the evening the EAFP awards ceremony took place. The winners of the Student Awards, which upon a competitive application granted free conference registration to the awarded students, as well as of the best posters and best talks were announced.



Figure 8. Gala Dinner entertainment at the Arolithos Traditional Cretan Village. Photo: B. Gorgoglione.

The day after the end of the technical works offered a unique opportunity to explore the wonders of Crete Island. On Friday 5th September, the post-conference study tour allowed participants to visit the Cretaquarium, one of the largest and most modern aquariums in Europe, displaying a great variety of fishes and other aquatic creatures, aiming to raise awareness of environmental issues that are impacting them as well as aquaculture practices (Fig. 9).



Figure 9. The largest marine tank at Cretaquarium in Gournes, Greece. Photo: B. Gorgoglione.

The tour continued from the small fishing village of Elounda with a scenic boat ride to the historic island of Spinalonga. A guided walking tour went through the Venetian fortress, built in 1579 to protect the entire gulf against pirates and the Ottomans, explaining how the island became a leper colony from 1903 to 1957 and thereafter was abandoned (Fig. 10). The tour was completed with lunch at a scenic seaside restaurant in Plaka, followed by a short visit to the Agios Nikolaos town, the place where also Jacques-Yves Cousteau attempted the exploration of the dangerously deep Lake Voulismeni.

Together with many participants, WAVMA members had a great opportunity to get updates on research, clinical and industrial advances, enjoying a series of social events, and with great networking opportunities (Fig. 11). Conference proceedings will remain available through the EAFP website.



Figure 10. Visiting the historic leper island of Spinalonga. Photo: B. Gorgoglione.



Figure 11. International myxozoan researchers enjoying the sunny Crete Island. Photo: EAFP.

EXECUTIVE REPORTS

2026 Executive Board Elections

Nominations are now open for the 2026 WAVMA Executive Board! Self-nominations are encouraged. All Executive Board members receive complimentary WAVMA membership during their year of service on the Executive Board:

- President-Elect
- Secretary
- Treasurer
- Director-at-Large for Africa
- Director at Large for Middle East
- Director-at-Large for North America
- Director-at large for Latin America
- Director-at-Large for Asia
- Director at Large for Oceania
- Director-at-Large for Europe

Executive Board members elected will serve as ad hoc advisors to the 2025 Executive Board, until they take office as voting members of the Executive Board on January 1, 2026.

Candidates need to email a completed Nomination Form as well as a head and shoulders photograph to the WAVMA Administrators by the end of business October 26, 2025. The Nomination Form and the WAVMA Executive Board Responsibilities document are available at www.wavma.org/elections. Please note you will need to log in to your WAVMA membership to access the page.

For questions about the 2025 elections, please contact the WAVMA Administrators at administrators@wavma.org.





The WSAVA code for member discount for the 2026 Warsaw Congress has been updated. You will need to be logged in to your WAVMA membership to open the page. You can obtain the code from here: https://www.wavma.org/wsavadiscountcode

This code should be used for the WSAVA member rate for the congress and also is required for the Academy. However, be aware that the amount of discount varies depending on where you reside.

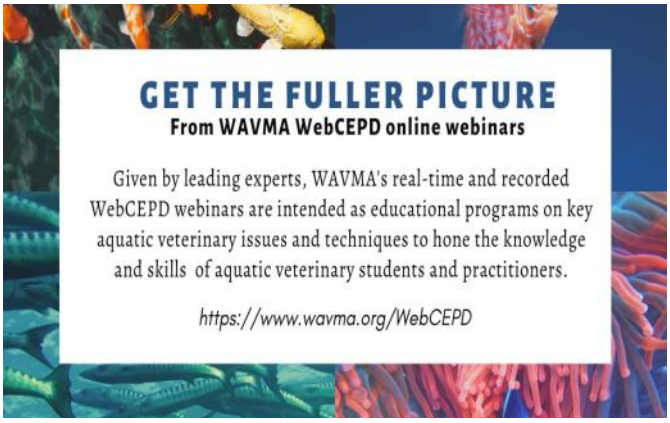
As an associate member of the World Small Animal Veterinary Association, WAVMA members can access discount registration for the upcoming 2026 WSAVA Congress in Warsaw. More information can be found at the Conference website https://wsava-congress.org/.

WAVMA members will also be able to access discounts for CPD course in the WSAVA Academy using the same code supplied above. More information on the academy can be found at https://wsava.org/updates/wsava-academy-member-discounts-on-courses/. Again the amount of discount will depend on the country you reside in.

You can access the registration page here: https://reg.kenes.com/online_reg/2026/wsava/regsuperearly.html.

Please note that this Super Early Bird rate is available until October 7, 2025 but offers a discount up to 50% off.

Chris Walster BVMS MVPH CertAqV MRCVS
WAVMA Administrative Coordinator



EXECUTIVE REPORTS

WebCEPD Program

Since 2013, WAVMA has produced over 180 Webinars that are available to watch on our website: https://www.wavma.org/WebCEPD, and conference recordings on the Video page: https://www.wavma.org/video-library.
You may be able to use these for continuing education credit for veterinary licensing, and you will also sure learn a lot!

Lectures are given by leading experts, and WAVMA's WebCEPD webinars are intended as educational programs on a variety of aquatic health issues and veterinary techniques to hone the knowledge and skills of aquatic veterinarians and veterinary students. To earn Continuing Education and Professional Development (CEPD) credit, you will need to complete a short Knowledge and Skills Assessment (KSA) to ensure you have met the learning objectives. On successful completion, you will receive a CEPD Certificate, which may be useful for licensure/registration to practice veterinary medicine and to earn credit towards becoming a WAVMA Certified Aquatic Veterinarian.

Recent WebCEPD available on the WAVMA.org website include:
B-1089 “Fish ER Medicine”
by Dr Robert Martinez (USA).

B-1090 “Biotechnological strategies to avoid antibiotic use in managing bacterial infections in farmed freshwater fish”
Dr Paola Barato (Colombia).

B.-1091 “Cetacean stranding response”,
by Dr Natalie Arrow (UK).

B-1092: Aquaculture Biosecurity
Presenter: Myron Kebus, M.S., DVM

B-1093: From Concepts to Practices:
Introducing Tilapia Welfare Assessment Tools
Presenters: Mr Wasseem Emam, Dr Sara Barrento, Mr Murilo Quintiliano

B-1094: Unmasking the Ordinary: Challenging cases in Aquatic Pathology (joint WAVMA+TAVA webCEPD)
Presenter: Weerapong “Mac” Laovechprasit (DVM, PhD)

B-1095: Stranding Response in Remote Areas: Managing Dog-Attack Wounds in Sea Turtles
Presenter: Maribel Escobedo Mondragón M.MVZ

See these webinars and more at:
https://www.wavma.org/WebCEPD

WAVMA's Member Programs and Services

Find a Fish Vet Directory - a directory for the public to find aquatic veterinarians

Member Directory - a members-only tool to locate other members and for vet students to locate mentors

The Aquatic Veterinarian - a quarterly publication with news, peer-reviewed contributions, clinical cases, jobs, meetings and more

Certified Aquatic Veterinarian (CertAqV) Program - a program identifying and certifying veterinarians with competency in core subject matter necessary for practicing aquatic veterinary medicine

WebCEPD Program - live and recorded webinars, courses, and presentations;; many are available for CEPD credit

John L. Pitts Aquatic Veterinary Education Awards Program - an international program that provides financial support for veterinary students and new graduates to increase their experience in aquatic veterinary medicine

Employment Opportunities - a list of available aquatic veterinary jobs, available to members only

Image Library - a collection of images useful for presentations, diagnostic interpretations, and more

Video Library - a collection of videos to help members and others understand aquatic veterinary techniques and issues

WAVMA Student Chapters - WAVMA chapters formed by veterinary students and faculty mentors at veterinary schools and colleges around the world

Members-L - (WAVMA_Members-L@.wavma.org). A members-only listserv for discussions on any topic of interest. To post to it, you must be a current member and ticked the appropriate box in your Member Profile Preferences tab.

Students-L - (WAVMA_Student-L@wavma.org). A discussion listserv for WAVMA student members. you must be a current member and ticked the approrpiate box in your Member Profile Preferences tab.

Leadership Roles - All members (including students) have the opportunity, and are encouraged, to serve on any WAVMA Committee. All full members may also be nominated for a position on the Executive Board. If you are interested in more information, please contact the WAVMA President.

COMMITTEE REPORTS

Credentialing Committee

The WAVMA Aquatic Veterinarian Certification Program identifies the core competency or subject matter areas needed to practice aquatic veterinary medicine, and recognizes those veterinarians who have acquired the necessary knowledge, skills and experience (KSE) from a variety of sources. It is over 10 years since WAVMA introduced the CertAqV and since then hundreds of veterinarians around the world have achieved the qualification. Originally the process was manual, but during 2023 WAVMA introduced an online system and also the CertAqVNT for veterinary nurses and technicians. Currently around 30 VN's/VT's have signed up for the certificate, with 11 having achieved the qualification. It is a globally recognized qualification.

The certificates demonstrate to your employer that you have achieved the competence of at least a new graduate, with each of the modules reflecting the areas needed to be competent in aquatic veterinary medicine.

Recently, WAVMA updated the online system to make it easier for all to complete the process, in response to user comments. Most of these changes are visual, making it easier to see where you are in the process. There were also changes to the logic and automation of the system which had caused some confusion among reviewers. Overall, these changes will enhance all users experience of the system.

Whilst the changes were tested first before going live, the real world can throw in some unknowns. If you are currently going through the process and have any questions then please contact the WAVMA Administrators for advice or use the Contact Us page on the website.

All current CertAqV and CertAqVNT are listed on the appropriate pages of the WAVMA website as well as all the information you need to decide if the certificate is right for you. If you are interested in aquatic veterinary medicine, wherever you are in your career, whether student, recently qualified, wishing to take a change in career direction, or simply interested in adding to your knowledge, then the certificates are well worth looking at.

If you have questions about the Certification process, please send me an email, or refer to the website: How to use the automated CertAqV, CertAqVNT system.

Dr. Matthijs Metselaar DVM PhD CertAqV MRCVS
Credentialing Committee Chair
CertAqV-Admin@wavma.org

Certified Aquatic Veterinarians

The following individuals are current Certified Aquatic Veterinarians.

Ali Anwar Ahmad (Singapore)
Jessica Allen (United States)
Sara Alves (United States)
Carrick Anderson (Iceland)
Huay Min June Ang (Singapore)
Brian Anton (United States)
Farah Gonul Aydin (Turkey)
Benjamin Balducchi (Canada)
Guadalupe Bárcenas Pazos (Mexico)
Madison Barnes (United States)
Christa Barrett (United States)
Trista Becker (United States)
Jenice Bell (United States)
Ainjil Bills (United States)
Heather Bjornebo (United States)
James Bogan (United States)
Pierre-Marie Boitard (France)
Tessa Brown (United States)
Clara Camargo (Saint Kitts and Nevis)
Shraddha Cantara (United States)
Ri Chang (United States)
Bryony Chetwynd-Glover (United Kingdom)
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Dana Clark (United States)
Mike Corcoran (United States)
David Craton (United States)
Rebecca Crawford (United States)
Hannah Dadah (United States)
Amanda Day (United States)
Zarah Deutsch (United States)
Nguyen Dinh-Hung (United States)
Darren Docherty (United Kingdom)
Christina Dover (United States)
Devon Dublin (Japan)
Antonella Fabrissin (Italy)
Julie Fithian (United States)
Emmanuelle Furst (United States)
Jennifer Go (Hong Kong)
Christopher Good (United States)
Bartolomeo Gorgoglione (United States)
Krystan Grant (United States)
John Griffioen (United States)
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Vivian Lee (United States)
Eric Littman (United States)
Juan-Ting Liu (Taiwan)
Richard Lloyd (United Kingdom)
Salina Locke (United States)
Richmond Loh (Australia)
Rubén Arturo López Crespo (Mexico)
Jordi Lopez-Ramon (Spain)
Emanuele Lubian (Italy)
Jessica Magnotti (United States)
Paul Manesis (Canada)
David Marancik (Grenada)
Shelly Marquardt (United States)
Robert Martinez (United States)
John Mastrobuono (United States)
Colin McDermott (Hong Kong)
Alicia McLaughlin, DVM, CertAqV (United States)
Margaret McTighe (United States)
Matthijs Metselaar (United Kingdom)
Timothy Miller-Morgan (United States)
David Minich (United States)
Haitham Mohammed (United States)
Katrina Murray (United States)
Kunda Ndashe (Zambia)
Lucie Nedved (Australia)
Jenifer Nix (United States)
Sally Nofs (United States)
Ladislav Novotny (Czech Republic)
Alec Ortiz Colosi (United States)
Courtney Pace (United States)
Dusan Palic (Germany)
Michael Palillo (United States)
Veronica Pardini (United States)
Sarah Pellett (United Kingdom)
Mattison Peters (United States)
Maximilian Polyak (Saudi Arabia)
Eva Marie Quijano Carde (United States)
Jan Raines (United States)
Faith Ramsey (United States)
Amanda Rappaport (United States)
Stephen Reichley (United States)
Camille Richie (United States)
Hery Ríos Guzmán (United States)
Jay RIVAIS (United States)
Michelle Rivard (United States)
Rifky Rizkiantino (Indonesia)
Lucy Robson (United Kingdom)
Patinan Rookkachard (Indonesia)
Justin Rosenberg (Canada)
Benjamin Rosenbloom (Saint Kitts and Nevis)
Jennifer Russell (United States)
Daniel Ruvolo (United States)
Komsin Sahatrakul (United Arab Emirates)
Nicholas Saint-Erne (United States)
Sonja Saksida (Canada)
Maria Eugenia Sancho Santos (United States)
Daniel Savson (United States)
A. David Scarfe (United States)
Johnny Shelley (United States)
Morgan Shields (United States)
Constance Silbernagel (United States)
Sarah Jayne Smith (United Kingdom)
Esteban Soto Martinez (United States)
Heather Srch-Thaden (United States)
Win Surachetpong (Thailand)
Alissa Tepedino (United States)
Sharon Tiberio (United States)
Kaitlyn Upton (United States)
Laura Urdes (Romania)
Greta van de Sompel (Belgium)
Claudia Venegas Morales (Chile)
Jelena Vukcevic (Australia)
Sarah Wahltinez (United States)
Bridget Walker (United States)
Audrie Walkup (United States)
Christopher Walster (United Kingdom)
Lindsey Waxman (United States)
Michael Wenninger (United States)
Laura Whalen (United States)
Harriet Woodhall (United Kingdom)
Sarah Wright (United States)

Students (and others) are encouraged to gain KSE towards the CertAqV prior to applying for the CertAqV. However, the requirements of CertAqV mean students need to have reached the requisite KSE (150 KSE minimum) within one year of application and have graduated as a licensed/registered veterinarian in your country within the one-year time period.

Click here for a list of CertAqV resources.
https://www.wavma.org/media/Documents-for-download/250623-CertAqV-Resources.pdf

This list is not exhaustive.
Please consult with your mentor.

COMMITTEE REPORTS

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 Secretary.

Communications Committee
This Committee manages the communications among members and others involved with aquatic veterinary medicine. It oversees the e-News, Facebook, Twitter, LinkedIn and other social media accounts.
Chair: Claudia Venegas, Secretary@wavma.org

Credentialing Committee
This Committee oversees and administers the Cert-AqV Program for credentialing aquatic veterinary practitioners, and evaluates aquatic veterinary educational programs useful to members.
Chair: Matthijs Metselaar CertAqV-Admin@wavma.org

Education & Students Committee
This Committee facilitates networking between student members and helps development of educational programs and services. It is composed of three subcommittees: WebCEPD, Education Resources, and Student Support.
Chair: Bartolomeo Gorgoglione, BartGorg@msu.edu

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 Committee
This Committee oversees membership issues to optimally serve members and the organization. It oversees the listservs and membership lists.
Chair: Chris Walster, Administrators@WAVMA.org

Publications Committee
This committee oversees the publication of WAVMA's quarterly journal, *The Aquatic Veterinarian*, and other occasional publications.
Chair: Nick Saint-Erne, TAVeditor@WAVMA.org

A variety of items (mugs, t-shirts, hoodies, bags) are available for purchase at WAVMA's Store.

Items in the Zazzle store can be purchased in a variety of sizes, colors, and can even be customized to include your name, clinic name, or to include WAVMA Student Chapter information. For help with customization, please contact the WAVMA Administrator.

https://www.zazzle.com/store/wavma788

WAVMA Shop

A number of WAVMA branded items (including shirts, mugs, caps) are available at the WAVMA Store. Get yours today!



Go to: http://www.wavma.org/Shop



COMMITTEE REPORTS

Fellows Advisory Council Report

The FAC is addressing the following three tasks over the next six months:

1. Continue to work towards implementation of the WAVMA Strategy
2. Consider how to implement a comprehensive communications strategy with a main focus on how to acquire content.
3. Complete the review of the Bylaws. Possibly get the Policy and Procedures manual up to date.

To me all three are interrelated and the basis of getting WAVMA moving forward and being more member inclusive. WAVMA needs to revise how committees work. I believe the Fellows have the remit to do this and report their recommendations to the EB. I am thinking this would be one of the tasks the Fellows could undertake during my six month Chair. This should also include suggestions on how to incentivise committee members and demonstrate how we work collaboratively and support new members.

Chris Walster
Fellows Advisory Council Chair



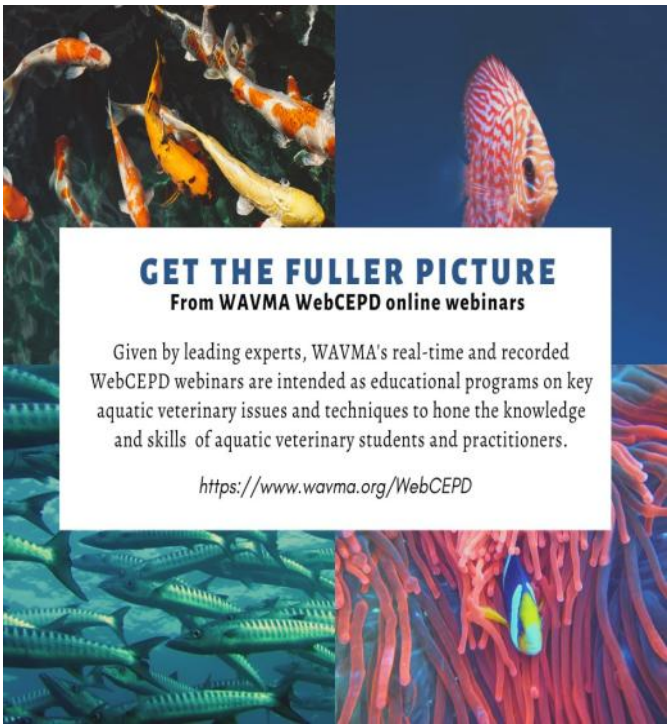
Fellows Advisory Council

A WAVMA Distinguished Fellow is someone who has conferred on them the honorific: *WAVMA Distinguished Fellow*. The Fellows Advisory Council is composed of WAVMA Distinguished Fellows who are current WAVMA members and who wish to contribute to the development of WAVMA. The Chair of the Fellows Committee will be the Fellows Representative to the Executive Board.

WAVMA Distinguished Fellows are:

Peter Merrill (2012)
Ronald Roberts (2012)†
David Scarfe (2012)
Julius Tepper (2012)
Christopher Walster (2012)
Grace Karreman (2013)
Marian McLoughlin (2013)
Dusan Palic (2013)
Mohamed Faisal (2016)
Nicholas Saint-Erne (2017)
Richmond Loh (2018)
Laura Urdes (2019)
Devon Dublin (2020)
Gregory Lewbart (2021)
Matt Metselaar (2022)
Stephen Reichley (2023)
Simon Doherty (2024)†

Chris Walster
Fellows Advisory Council Chair



STUDENT COMMITTEE

WAVMA Student Chapter Guidelines

To initiate a new Student Chapter, download the *WAVMA Student Chapter Guidelines*
A Spanish version of the Student Chapter Guidelines can be *downloaded from the WAVMA website.*

Examples of available Student Chapters programs:

- Assistance in organizing and promoting Chapter programs and activities.
- MiniGrants of up to $500 USD are available to assist official WAVMA Student Chapters with conducting activities intended to engage students in opportunities related to aquatic veterinary medicine. Download the Flyer here and the application form here.
- Access to recorded webinars and live web-based presentations from experts around the world.
- Low annual WAVMA Student Membership ($25)
- 50% Chapter member's dues may be available to support Chapter-organized activities. Get more information here and a Spanish version here.
- Reduced rate (50% off) WAVMA Full Membership the year after graduation.
- John L. Pitts Aquatic Veterinary Education Awards Program
- Access to the latest editions of WAVMA's quarterly journal, *The Aquatic Veterinarian*.
- Access to WAVMA member-only webpages.
- Aquatic veterinary externship and job listings.
- Participation in the WAVMA Certified Aquatic Veterinarian (CertAqV) Program.
- Access to WAVMA e-mail listservs, including Members-L, and Student-L.

A list of all current WAVMA Student Chapters is available on the website:
https://www.wavma.org/WAVMA-Student-Chapters

Consider joining the ***WAVMA Chapter Facebook Group*** to find out what's happening in other Chapters.

TO SUPPORT FUTURE STUDENT SCHOLARSHIPS,
PLEASE MAKE A DONATION TODAY
TO THE SCHOLARSHIP FUND!

WWW.WAVMA.ORG/SCHOLARSHIPS.

WAVMA Student Chapters

University of Pretoria, Onderstepoort Faculty of Veterinary Science, South Africa (established 2017)

Murdoch University, School of Veterinary & Life Sciences, Australia (established 2014)

University of Sydney, School of Veterinary Science, Australia (established 2014)

Auburn University, College of Veterinary Medicine, USA (established 2013)

Colorado State University, College of Veterinary Medicine & Biomedical Sciences, USA (est. 2019)

Cornell University, College of Veterinary Medicine, USA (established 2019)

Michigan State University, College of veterinary Medicine, USA (established 2021)

Mississippi State University, College of Veterinary Medicine, USA (established 2014)

The Ohio State University, College of Veterinary Medicine, USA (established 2018)

Oregon State University, College of Veterinary Medicine, USA (established 2017)

Ross University, School of Veterinary Medicine, St. Kitts & Nevis, West Indies (established 2015)

St. George's University, School of Veterinary Medicine, Granada, West Indies (established 2018)

University of California, Davis School of Veterinary Medicine, (Established 2020)

University of Florida, College of Veterinary Medicine USA (Established 2013)

University of Georgia, College of Veterinary Medicine, USA (established 2015)

University of Illinois, College of Veterinary Medicine, USA (established 2018)

University of Pennsylvania, School of Veterinary Medicine, USA (established 2020)

Western University of Health Sciences, College of Veterinary Medicine, USA (established 2014)

University of Edinburgh, Royal (Dick) School of Veterinary Studies, Scotland UK (established 2020)

University of London, Royal Veterinary College, England UK (established 2021)

Ankara University, Faculty of Veterinary Medicine, Turkey (established 2022)

Makerere University College of Veterinary Medicine Animal Resources and Biosecurity (established 2022)

St. Matthew's University School of Veterinary Medicine West Bay, Cayman Islands (established 2022)

University of Bristol, Bristol Veterinary School, England (established 2023)

University of Calgary, Canada (established 2023)

WAVMA Student Chapter Mini-Grant

A limited number of WAVMA Student Chapter Mini-Grants of up to USD 500 are available to assist official WAVMA Student Chapter with conducting activities intended to engage students in opportunities related to aquatic veterinary medicine.

Administered by the WAVMA Education and Students Committee

Submit your application by 19 October 2025

(for activities from January to June 2026)

Find out more at:
www.wavma.org/WAVMA-Student-Chapters or use the QR code
Questions? Email: ESC@wavma.org

From Corals to Crustaceans -
WAVMA Student Chapter Ross University School of Veterinary Medicine

The WAVMA Student Chapter at Ross University School of Veterinary Medicine (RUSVM) has had an exceedingly productive year, engaging members in activities that combined field exploration, practical aquaculture training, and student-led research. With commendable contributions from our amazing officers, the RUSVM student chapter was thrilled to provide events that contributed uniquely to broadening our understanding of aquatic veterinary medicine, strengthening our skills, and highlighting the relevance of aquatic health to both local and global contexts.

Field Trip to Nevis

This semester, our chapter partnered with local NGO C.A.R.E SKN (Coral Reef Assistance, Restoration, and Education, St. Kitts and Nevis) to organize a field trip to Nevis, the sister island of St. Kitts. Led by C.A.R.E SKN founder, Valerie Gregoire, students were granted the opportunity to engage in discussions on coral reef health, current threats to coastal environments in the Caribbean, and how to identify key indicator species and signs of coral disease.



Figure 1.
Students listen intently to Valerie Gregoire's presentation on coral reef health and restoration in St. Kitts.

Following the lecture, Valerie guided the group on a snorkel excursion to a nearby reef ecosystem. Students were introduced to key coral and fish species, learned methods for identifying reef-associated organisms, and gained an understanding of the ecological interactions that sustain reef health. Valerie also highlighted the role of local species in maintaining ecosystem balance, giving students the opportunity to connect classroom concepts to real-world observations.

To conclude the afternoon, students participated in the construction of coral trees. These trees were later placed at selected C.A.R.E SKN nursery sites, where they serve as a platform for coral growth before transplantation back onto degraded reefs. Contributing to this activity allowed students to actively engage in reef restoration efforts and better understand the role that veterinarians and conservation partners can play in supporting marine ecosystem resilience.



Fig. 2.
WAVMA club members participating in the construction of coral trees, facilitated by Valerie Gregoire.

Beyond ecological learning, the trip aided in strengthening our chapter community by allowing members to share in a memorable and interactive experience. The combination of academic instruction, field observation, and hands-on exploration emphasized the value of experiential learning in preparing veterinary students to contribute to marine conservation and aquatic animal health.

Nile Tilapia Biometric Data Collection Workshop

Back on St. Kitts, our chapter was fortunate to have RUSVM professor and CertAqV Dr. Clara Camargo for a hands-on workshop on biometric data collection in Nile tilapia (*Oreochromis niloticus*). Tilapia are one of the most widely farmed fish species globally, and their production plays a major role in food security in many regions, including the Caribbean.

Prior to the workshop, our group hosted a live zoom session with leading Thai researchers who provided their expertise on the subject of sexual differenti-

ation in Nile Tilapia, a valuable opportunity for students to build global connections and learn from leading experts in the field.



Fig. 3. Dr. Clara Camargo, DVM, CertAqV demonstrates how to perform a fish health assessment, highlighting procedures such as skin scrapes and gill clipping.

During the workshop, students learned standard techniques for fish health evaluation exams. Emphasis was placed on why accurate and consistent biometric data are critical for aquaculture operations and the skills needed to pursue careers in fisheries and aquaculture. This enabled students to gain valuable insights into handling techniques and the importance of minimizing stress during the process.



Fig. 4. Students engage in hands-on physical exams on our campus tilapia, recording data to assess health and growth trends and evaluating samples under a microscope.

This workshop not only provided practical skills but also showed students how veterinarians contribute directly to sustainable food systems through aquaculture health management.

Caribbean King Crab MSc Research Project

In addition to group activities, our chapter is proud to highlight the work of Gabriela Peralta, one of our student members currently pursuing a dual DVM/MSc by Research at RUSVM. Her project focuses on the Caribbean King Crab (*Maguimithrax spinosissimus*), a large native crustacean with potential significance in both aquaculture and coral reef restoration.

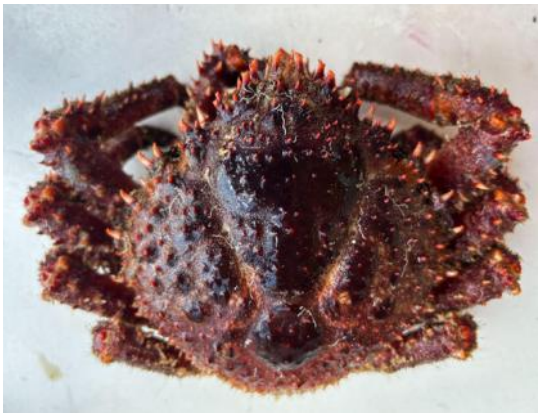


Fig. 5. Caribbean King Crab specimen.

The study examines larval nutrition and development, testing different diet formulations to determine which promotes the highest survivorship, best growth rates, and favorable morphological development. By evaluating food conversion efficiency, the project aims to establish whether this species can be cultivated at scale throughout the wider Caribbean region. This research aligns with regional interests in diversifying aquaculture species, reducing reliance on imported seafood, and supporting local economies.

Importantly, the Caribbean King Crab has ecological value beyond aquaculture. Studies suggest that the species plays a role in reef restoration by grazing algae that would otherwise overgrow corals. Thus, successful aquaculture protocols could contribute not only to food production but also to conservation initiatives. This dual focus highlights the linking of animal health, ecosystem health, and human food security, reflecting the interdisciplinary nature of aquatic veterinary medicine and the mission of the RUSVM WAVMA student chapter.

Conclusion

Through these initiatives the RUSVM WAVMA Student Chapter continues to provide meaningful opportunities for students to engage with aquatic veterinary medicine. By combining hands-on skill building with academic research and community experiences, our chapter fosters professional development and prepares future veterinarians to contribute to aquaculture, conservation, and aquatic animal health worldwide. We sincerely thank our club advisors and board members for their continued commitment towards the advancement of aquatic veterinary medicine and for introducing a new generation of veterinarians to this unique field.

STUDENT REPORTS

John L. Pitts Aquatic Education Award Report
Gretel Keller
August 24, 2025

My name is Gretel Keller, and I am a current final year veterinary student at the University of Edinburgh Royal (Dick) School of Veterinary Studies. Thanks to the generous sponsorship of the John L. Pitts Aquatic Education Award, I was able to complete a 4-week veterinary preceptorship this summer at Shedd Aquarium in Chicago, Illinois USA.

My time at Shedd Aquarium was unlike any veterinary experience I have had before. On my very first day, I was able observe a ground-breaking surgery on a beluga whale, involving the first ever successful general anesthesia performed on this species. It was a hugely collaborative event, bringing together a team of zoo and aquarium veterinary experts from across the country. I was able to rub shoulders with trailblazers in the field of marine mammal medicine and anesthesia. My inclusion in this procedure set the tone for the rest of the placement.



Photo Credits: ©Shedd Aquarium/Brenna Hernandez



It became clear that although aquatic medicine is a very unique field of veterinary medicine involving a menagerie of diverse creatures, at its core are many passionate professionals working together to tackle novel challenges with creative scientific solutions.



The staff at Shedd were very welcoming and helped me to expand my knowledge of aquatic medicine, particularly how to tailor treatments to a wide range of aquatic species. Whether it was using autologous plasma therapy on a bow-mouthed guitarfish, or performing radiographs on a lesser siren, I was always able to get involved in all manner of medical cases. I was able to practice fish necropsies, administer treatments, and participate in weekly veterinary rounds. The vet staff were always willing to answer my questions, while simultaneously encouraging further personal investigation of common aquatic medicine elements.

For my culminating project, I consolidated all the anesthetic monitoring data from the beluga surgical procedure into a single timeline. I then presented how the anesthetic interventions performed during the surgery were reflected in the patient's physiological parameters. I found this project to be particularly enjoyable, not only as it solidified a deeper understanding of complex anesthesia elements, but also because of the many incredible marine mammal adaptations I learned along the way.



Shedd Aquarium Team
Photograph Credit:
©Shedd Aquarium/Brenna Hernandez

STUDENT REPORTS

My interest in aquatic medicine stems primarily from my love of the Great Lakes, and my desire to someday apply my veterinary knowledge toward the conservation of native freshwater species. Looking out on Lake Michigan after leaving the aquarium for the day, I often felt inspired to continue my pursuit of this dream within such an incredible field. I am grateful to WAVMA and the John L. Pitts Aquatic Education Award for helping me toward this goal.

Photographs on this page:

I am not allowed to share any photos from behind the scenes that I took while on placement, so the following are just a few I took around the aquarium from the public facing side!

Some friendly faces from around the aquarium!
Photographs by Gretel Keller





My view of Lake Michigan from outside the aquarium.
Photograph by Gretel Keller



STUDENT REPORTS

John L. Pitts Aquatic Education Award Report

Eli Fraser, DVM Student
Western College of Veterinary Medicine (WCVM)
Class of 2027

My name is Eli Fraser, and I am a salmon farmer. Though my background is in natural resource management, a love of the coast and an interest in food security led me to a career in production finfish aquaculture in British Columbia, Canada. I have held management positions in production as a saltwater farm site manager and in infrastructure as a net manager. These roles gave me the opportunity to work closely with fish health professionals, especially veterinarians, through field sampling and collaborating on treatment plans. It was during these moments, working alongside veterinarians, that I found myself thinking "I'd like to do that job."

I am now a third-year Doctor of Veterinary Medicine student at the Western College of Veterinary Medicine in Saskatoon, Saskatchewan, Canada. The Jon L. Pitts Aquatic Veterinary Scholarship supported my travel to Vancouver Island, where I worked as a summer veterinary student for Mowi Canada West. Mowi Canada West produces Atlantic salmon from hatch to harvest, with operations including hatcheries, saltwater production, broodstock management, and a processing plant. This experience involved routine fish health sampling, data collection for research and development, and opportunities for disease investigation.

I traveled to all Mowi Canada West saltwater productions areas to support both fish health management and research initiatives. In the Klemtu production area on the central coast of British Columbia, I accompanied the company veterinarian to assist with routine fish health assessments. I collected mortalities, performed necropsies, handled live fish for welfare and gill assessments and sea lice counts, and provided staff training. These activities allowed me to assess the health of the fish population and observe how the veterinarian identified and managed health risks. I gained hands-on experience in tissue handling, sampling, and aseptic technique.





In the Port Hardy and Quatsino production areas on northern Vancouver Island, I collected field samples for research and development. This included non-lethal whole blood samples from fish to assess serum chemistry, hematocrit, and hematology, allowing me to apply clinical pathology skills I developed during the past year in school. I assisted with an investigation of unexplained elevated mortality, analyzing gill cytology, production records and environmental data, which ultimately led to the identification of plankton as the cause of death.

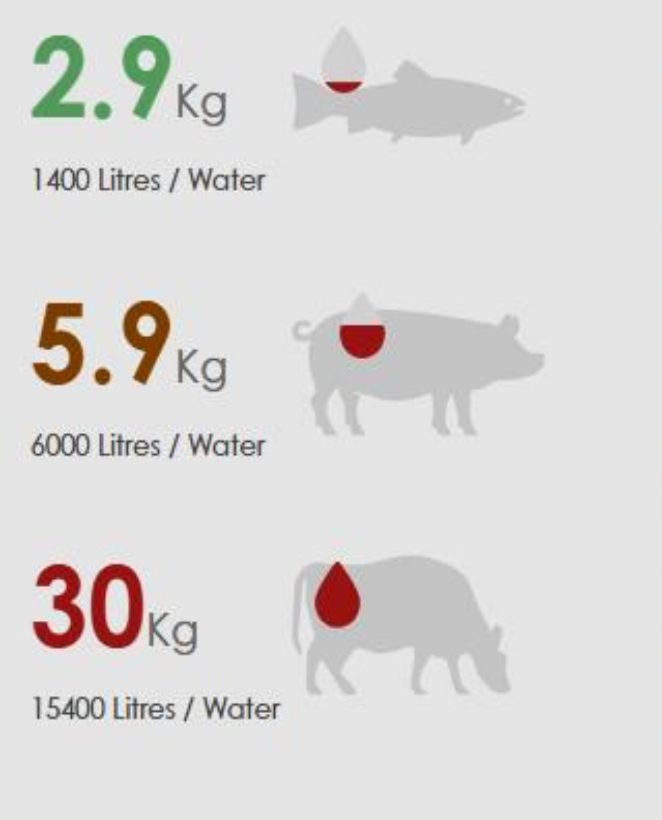
I appreciate both the work and lifestyle of the fish veterinarian: traveling to remote locations, sampling in the field, and following up on results in the lab. I saw first-hand how fish health and veterinary input can inform and improve production decisions. This summer's experience highlighted the comparative nature of veterinary medicine and demonstrated how skills learned in school can be applied across different species and production systems. I am grateful to the John L. Pitts Aquatic Veterinary Scholarship for making this work experience possible.

In Canada, Mowi operates salmon farms on the coast of beautiful British Columbia and Vancouver Island, where over 300 people produce about 23,000 tonnes of sustainable farm-raised Atlantic salmon each year. Mowi salmon are four-star certified to the Global Aquaculture Alliance Best Aquaculture Practices.

Images from https://mowi.com/

STUDENT REPORTS

Carbon footprint of food production







Not only is the carbon footprint of farm-raised salmon lower, but its edible yield is higher (68%) as compared to chicken (46%), pork (52%) or lamb (38%). For Mowi, high edible yields combined with 100% re-use of by-products (i.e., offcuts and trimmings) means that nearly every single gram of salmon is used.

Approximately 70% of our planet is covered by water, yet only around 2% of the world's food supply comes from the ocean. With wild-capture fisheries under increasing pressure, it is important that aquaculture bridges this gap, assuming an increasingly greater role in providing food security for the planet. Mowi believes that by farming the ocean, we can sustainably produce healthy, nutritious and affordable food for society at large.

We pursue an integrated sustainability strategy aligned with the United Nation's Sustainable Development Goals (SDGs). In this strategy, long-term targets have been established for all of our guiding principles.

https://mowi.com/caw/sustainability/

COMMITTEE REPORTS



B-1096: Raising the Standard: Innovation and Certification in Aquatic Animal Welfare

Date: October 29, 2025
Time: 02:00 PM UTC
Presenter: Catalina Lopez Salazar, MVZ, CertAqV
Credits: 1.0 hour

Optional: If you later wish to gain CEPD credits by completing the KSA then fees will become applicable (note: you will be invited to take part in and pay for the KSA after the webinar has finished).

Speaker Bio:
Catalina Lopez is the Director of the Aquatic Animal Alliance, a coalition of over 178 organizations in more than 70 countries working to improve the welfare of aquatic animals worldwide, through engagement with industry, government and global policy bodies. Catalina is a Veterinarian from Colombia, a Certified Aquatic Veterinarian through the World Aquatic Veterinary Medical Association, and currently resides in Mexico City.

Register for the Live Webinar:
https://www.wavma.org/Webinars/b1096-raising-the-standard-innovation-and-certification-in-aquatic-animal-welfare-90635

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

TAASA
Tilapia Aquaculture Association of South Africa

Webinar:
Tilapia nutrition and feed management
Date: 16 OCTOBER 2025 @4:30 pm SAST

"Connecting veterinarians, farmers, students, and industry"
CPD Accreditation in Progress
https://aquaculture.org.za/

Ryan Weaver is the Technical Support and Sales Manager at Specialised Aquatic Feeds, a leading aquafeed manufacturer in South Africa. With over 20 years of experience in commercial aquaculture and aquatic feed, he offers practical insights into on-farm feed management from quality assessment to application for optimal performance. In this webinar, Ryan will share expert guidance on tilapia feed formulation, good feeding management practices, and optimising production efficiencies for your tilapia production system.

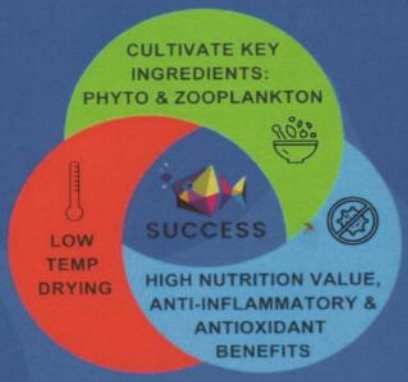


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- Sold live or gently dried for use in dry food blends



DRY BASE INGREDIENTS

- Black Soldier Fly Larvae
- Antarctic Krill
- Atlantic Kelp
- Menhaden Fish Meal
- Algae Biomass
- Copepods, Artemia
- Astaxanthin, Garlic

No Wheat, Corn, Soy



GENTLE MIXING LOW TEMPERATURE DRYING

- Our gentle process and low temperature drying help preserve the natural nutrients, enzymes, amino acids, carotenoids



PRODUCT LINE

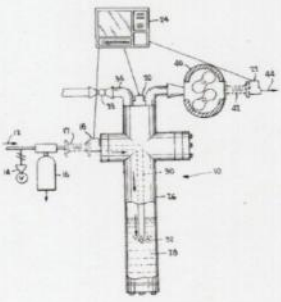
- Crumble: Herbivore, Omnivore, Carnivore (various sizes)
- Fry Powders
- Coral Powders
- Vibrant Sticks
- BluEco Sticks
- Live Feed



Product available in bulk buckets, bag-in-box, retail packs
We provide custom blends & private label

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- Patented Algae Grow Technology: CO_2 Absorption System
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COLLEAGUE'S CONNECTION

Fritz Aquatics

Fritz Aquatics is a division of Fritz Industries, which was founded in 1956 by C. Fredrick "Fritz" Weisend. In the early years, Fritz Industries emerged as a research leader in the development of products based on applied chemistry and unique manufacturing processes, leading to the establishment of the pet products division in the early 1970s.

Today, the specialty division manufactures hundreds of pet products with an emphasis on the aquatics market. Fritz Aquatics is known for innovated products such as Fritz-Zyme® 7 & 9, Turbo Start®, Fritz Guard®, RPM Reef Pro Mix, and many other products. The Fritz Aquatics line is marketed to major distributors and pet retailers throughout the U.S. and internationally.

Fritz Aquatics products are used by zoos, public aquarium exhibits, aquaculture professionals and home aquarium hobbyists. Fritz aquarium products have been trusted by hobbyists and professionals for over 40 years, and they are one of the leading water quality product manufacturers in America. In addition to the thriving hobbyist market, Fritz Aquatics also manufactures products for large aquatic facilities, zoos and the largest public aquariums in the world.

Fritz Aquatics
500 North Sam Houston Rd., Bldg B
Mesquite, TX USA 75149

sales@fritzaquatics.com
Toll-Free 800-955-1323
https://fritzaquatics.com/



C. Fredrick "Fritz" Weisend



Bacterial cultures used for starting the Nitrification process in the Biofilter are a major component of the Fritz Aquatic line of aquarium products.

Photographs by Nick Saint-Erne.

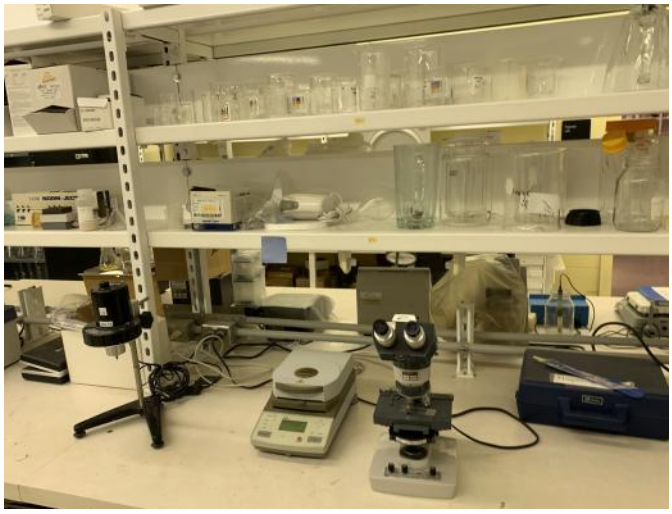


Cultures of bacteria used in Fritz water conditioning products.

The isolated nitrifying bacteria are then produced in large batches.



COLLEAGUE'S CONNECTION



Laboratory Equipment used to test water quality products.



Bottling equipment at Fritz Aquatics in Mesquite, Texas.

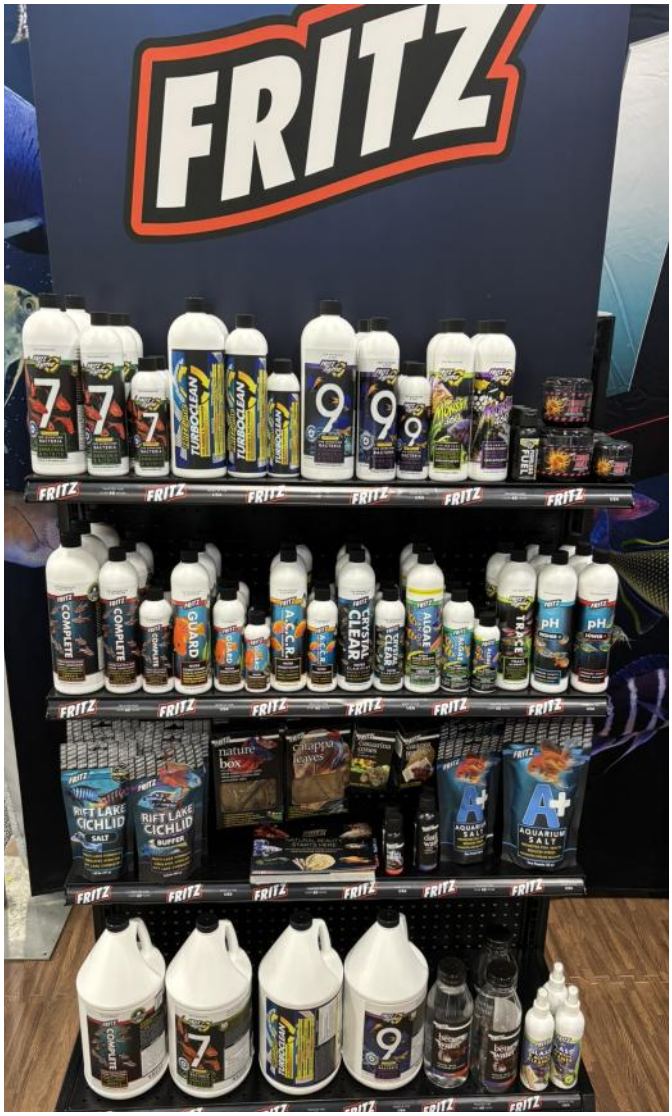


Above: Mike Noce from Fritz is talking to Kapil Mandrekar from Project Piaba at SuperZoo, Las Vegas, NV August 2025.

Below: the Fritz Booth at SuperZoo.



Fritz products on display at SuperZoo 2025.



RESEACH REPORT

Advancing One Health and One Welfare in Latin American aquaculture: The role of veterinarians in integrating fish welfare into sustainability practices

By Catalina Lopez Salazar DVM, CertAqV and Fernando Mardones, DVM, PhD

Abstract

Aquaculture has become a pivotal industry in Latin America, significantly contributing to the global seafood supply. However, the rapid expansion of aquaculture has often prioritized economic and environmental aspects of sustainability, frequently overlooking animal welfare and social considerations. This oversight can lead to compromised aquatic animal health and welfare, increased disease prevalence, higher mortality rates, and diminished product quality, ultimately affecting the industry's sustainability. This article emphasizes the necessity of integrating aquatic animal welfare through the One Health and One Welfare lens, highlighting the interconnectedness of animal health, human health, and environmental integrity. By adopting welfare-centric practices, the Latin American aquaculture sector can enhance productivity, ensure ethical standards, promote ecological balance, and ensure sustainability and opportunities to access markets in the Global North where higher welfare requirements have been established.

Introduction

Aquaculture is the fastest-growing food production sector globally, with Latin America and the Caribbean (LAC) countries accounting for 4.3 million tonnes of aquaculture production, which is around 3.3 percent of global total production in 2022[1]. Aquaculture in LAC grew faster than global averages during this period, with an average cumulative annual growth rate (CAGR) of 5% between 2000 and 2022[2]. The LAC region is the second largest aquaculture producer in the world, significantly behind Asia. At present, a small number of countries dominate aquaculture in LAC, with Chile (salmonids and mussels) and Ecuador (shrimp) accounting for 53 percent of the total aquaculture production, both ranking among the top ten aquaculture countries in the world[3].

While the expansion of aquaculture in LAC contributes to meeting the rising global demand for aquatic food products, it also poses significant challenges concerning sustainability (including social, environmental and economical dimensions) and ethical production practices. These challenges are exacerbated by a relatively weak regulatory framework that insufficiently addresses the industry's complexities[4,5,6], including its implications for animal welfare, environmental integrity, public health, and socio-economic impacts on local communities[7].

Traditionally, sustainability in aquaculture has focused on environmental and economic dimensions, particularly in regions focused on economic growth priorities and food security, while the welfare aspects of farmed aquatic animals are often neglected. This limited perspective can lead to irreversible and adverse outcomes, including heightened disease outbreaks, environmental degradation, and public health concerns[8].

The One Health[9] and One Welfare[10] frameworks offer holistic approaches that recognize the interdependence of animal welfare, human well-being, and environmental integrity. Integrating aquatic animal welfare into these frameworks is essential for the long-term viability of the aquaculture industry in Latin America. Additionally, the aquaculture industry is urged globally to align with the Sustainable Development Goals of the United Nations[11], aiming for an urgent inclusion of neglected dimensions such as animal welfare and social considerations to ensure the global framework goals are met by 2030[12].

One Health and One Welfare: Complementary frameworks for sustainability

The One Health framework recognizes the interconnectedness of human, animal, and environmental health, emphasizing collaborative, transdisciplinary approaches to address complex health challenges such as zoonotic diseases, antimicrobial resistance, and ecosystem degradation[13]. Similarly, the One Welfare framework expands this concept by integrating animal welfare as a central component, acknowledging that the well-being of animals is intrinsically linked to human well-being and environmental sustainability[14].

These frameworks are complementary, as One Health provides a broad perspective on health systems and disease dynamics, while One Welfare addresses the ethical, social, and emotional[15,16] dimensions of human-animal interactions. For example, improving the welfare of farmed aquatic animals not only reduces stress and disease in animals but also enhances food safety and environmental outcomes, aligning with the goals of both frameworks[17]. By integrating One Health and One Welfare, stakeholders can develop more holistic and sustainable solutions to global challenges, ensuring the health and well-being of humans, animals, and ecosystems alike.

The Interconnectedness of fish welfare, environmental health, and human well-being

Public awareness of aquatic animal welfare has grown, largely driven by advocacy from animal interest groups[18]. Recently, non-profit organizations such as Eurogroup for Animals[19], Crustacean Compassion[20], Aquatic Life Institute[21] among others have launched campaigns focused on improving the welfare of aquatic species, particularly seafood animals. Although initial public concern was limited — partly due to the lack of emotional connection to crustaceans and fish — research into their cognitive abilities

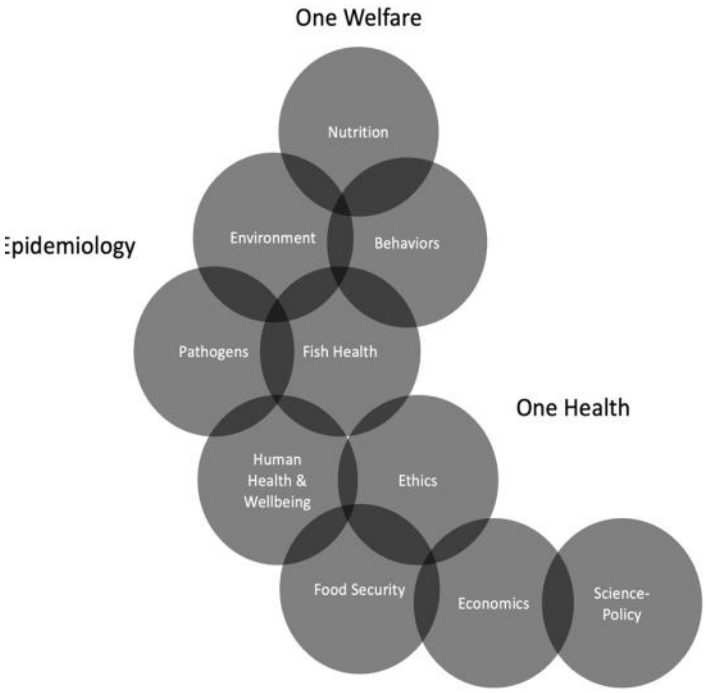


Figure 1. Conceptual framework illustrating the intersecting dimensions and categories that link epidemiology, One Health, and One Welfare.

has brought aquatic species into ethical and welfare discussions[22]. In crustaceans, studies on nociception and stress responses have sparked debate about their sentience, though scientific consensus remains elusive, there is recent strong evidence to support it[23,24,25].

Aquatic Animal welfare (AAW) is intrinsically linked to environmental sustainability and human health[26]. Poor welfare practices, such as high stocking densities or inadequate water quality management, can stress animals, making them more susceptible to diseases. This susceptibility often leads to increased antibiotic usage, contributing to the global issue of antimicrobial resistance (AMR). Approximately 80% of antimicrobials used in aquaculture enter the environment with their activity intact, where they inadvertently select for bacteria whose resistance arises from mutations or, more importantly, from mobile genetic elements containing multiple resistance determinants transmissible to other bacteria. Such selection alters the biodiversity of aquatic environments and the natural microbiome of fish and shellfish[27].

Moreover, stressed and diseased aquatic animals can negatively impact surrounding ecosystems. Waste products from aquaculture operations often lead to eutrophication, harming local biodiversity and water quality[28]. These environmental changes can negatively affect communities that rely on these ecosystems for their livelihoods, thereby linking aquatic animal welfare to human socio-economic well-being.

Outweighing economic benefits vs. sustainability

The aquaculture industry often highlights job creation and economic growth as key benefits when promoting aquaculture projects. However, local communities are often not fully informed about the potential environmental, social, and economic challenges associated with aquaculture operations. These challenges may include water pollution, habitat degradation, introduction of non-native species, and socio-economic disruptions such as conflicts over resource use and shifts in traditional livelihoods. The lack of comprehensive impact assessments and transparent communication can lead to unintended negative consequences for both the environment and the affected populations. The concept of obtaining a social license to operate (i.e., the affected communities' level of acceptance of an industry or company) is a key element to include in policies related to aquaculture[29].

Scientific research has extensively documented these concerns. For example, studies have underscored the critical role of social acceptance in the development of aquaculture, noting that local communities frequently lack sufficient information about the long-term environmental and socio-economic risks associated with these practices. Inclusive stakeholder engagement and transparent governance are essential to addressing these challenges, as they help mitigate conflicts and foster sustainable aquaculture growth[30]. Similarly, Brugère *et al*. (2019) highlight the need for participatory approaches in aquaculture planning, emphasizing that the involvement of local communities in decision-making processes can enhance trust, improve project outcomes, and ensure that development aligns with both ecological and social priorities[31].

Consequences of neglecting aquatic animal welfare in aquaculture

Introducing policy and industry interventions that neglect to include the animal welfare dimension as a priority will inevitably lead to poor outcomes, undermining the sustainability and ethical integrity of aquaculture systems. Animal welfare is a critical component of the One Welfare model, and its exclusion from decision-making processes can result in increased stress, disease, and mortality among farmed species, as well as negative environmental and socio-economic consequences, including:

Increased disease outbreaks: Poor welfare conditions, such as overcrowding and inadequate water quality, can stress fish and weaken their immune systems, making them more susceptible to diseases. This can lead to frequent and severe disease outbreaks, resulting in high mortality rates and significant economic losses for producers[32]. Such outbreaks can spread rapidly even between countries, such as the trans-national spread of the Tilapia Lake Virus (TiLV), now present in Mexico, Colombia, Ecuador, and Peru in Latin America[33].

Environmental degradation: Intensive aquaculture operations that overlook welfare considerations often result in environmental harm. For example, excessive waste from poorly managed fish farms can lead to eutrophication in coastal waters, triggering harmful algal blooms such as the "red tide," which depletes oxygen levels and causes mass die-offs of marine life, severely disrupting local fisheries[34].

Antimicrobial resistance (AMR): To combat diseases arising from poor welfare conditions, aquaculture operations may resort to the excessive use of antibiotics. This practice contributes to the development of antimicrobial-resistant bacteria, posing significant risks to both animal and human health[35].

Economic Losses: Neglecting fish welfare can result in suboptimal growth rates, reduced feed conversion efficiency, and elevated mortality, all of which have detrimental effects on the economic viability of aquaculture operations. A study conducted in Brazil estimated that the direct and indirect economic losses associated with diseases in freshwater farmed fish amount to approximately USD 84 million annually, highlighting the significant financial burden of inadequate welfare management[36].

Case Study: Environmental impacts of the salmon industry in Chile

Over the last few decades, salmon farming in Chile has exploded and it is the country's largest food and agricultural export and the second largest total export sector after copper. In 2024, exports totaled 782 thousand metric tons worth 6.37 billion USD (Aduana, 2025)[37]. Chilean salmon production grew an average of 10.4 percent between 2016 and 2020 and totaled 1.1 million metric tons (MMT) in 2020[38] (Figure 2).

However, this intensive expansion of the industry has led to several environmental challenges, including eutrophication, antibiotic overuse, and biodiversity loss. The accumulation of organic waste from salmon farms has been directly linked to eutrophication in coastal waters causing dead zones and biodiversity loss[39]. Antimicrobial treatments are increasingly frequent, however their effectiveness is increasingly variable, while climate stressors amplify disease risks. Over-reliance on antibiotic and antiparasitic medications heightens the likelihood that resistance will emerge and spread within farms and into surrounding environments, potentially serving as reservoirs of AMR genes, facilitating human and animal exposure. Consequences include preventable fish losses, welfare concerns, and mounting public and regulatory scrutiny.

Another major issue is the escape of farmed salmon, with millions of individuals entering the wild. These escapees compete with native species for resources disrupting local ecosystems, ultimately leading to a decline in biodiversity[40].

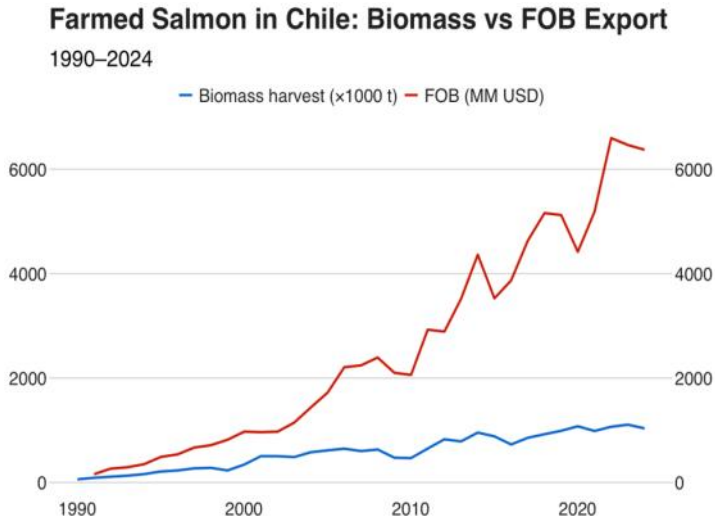


Figure 2. Trends in farmed salmon production in Chile, 1990–2024. Harvested biomass (×1000 t, left axis) and FOB export value (MM USD, right axis).

Other examples in Latin America

Similar issues have been observed in other Latin American countries, where rapid aquaculture expansion, often driven by economic incentives, has led to significant environmental and welfare concerns.

Ecuador*:* Shrimp farming in Ecuador has evolved substantially since its rapid expansion, which initially caused widespread destruction of mangroves, which are critical ecosystems for coastal protection, carbon sequestration, and biodiversity. The elimination of wild larvae capture in 2000 reduced bycatch of juvenile fish and invertebrates, previously estimated at >5 billion post-larvae per month. Following the White Spot Syndrome Virus (WSSV) outbreak, genetic improvement programs enabled the production of fast-growing and disease-resistant larvae routinely challenged with major pathogens such as WSSV, Taura Syndrome Virus, and Acute Hepatopancreatic Necrosis Disease/Early Mortality Syndrome[41]. Advances in farm management—including the replacement of hand feeding with feed trays, reduced water exchange through aeration systems, and the use of microbial agents or probiotics—have further improved efficiency and pond health[42]. Lower stocking densities (15 PL/m²) are compensated by larger shrimp harvested in 90–122 days, and recent assessments report average yields of 7.03 ± 0.93 t/ha/year, with resource use of 76,817 ± 6330 m³ water/t of shrimp and 0.65 ± 0.02 t of fishmeal and fish oil[43]. Despite these advances, concerns remain: shrimp farms in Ecuador hold ~50% lower ecosystem carbon stocks (81.9 mg C /ha) compared to undisturbed mangroves[44], underscoring the need to reconcile production gains with mangrove conservation and shrimp welfare.

***Brazil**:* Tilapia farming in Brazil has been associated with the introduction of this non-native species into local water bodies, leading to competition with native fish species, alterations in local ecosystems, and potential loss of biodiversity. Furthermore, the use of cages in fish production causes enormous limnological damage, as it is an intensive production system that uses high stocking densities and demands high quantities of feed. As a result, fish feed, feces, and excretes get released into neighboring aquatic habitats and even become partly deposited in the sediment[45].

Integrating fish welfare into One Health and One Welfare frameworks

To effectively mitigate these challenges, a fundamental shift is required at all levels of decision-making within the Latin American aquaculture industry. Integrating fish welfare into the One Health and One Welfare frameworks necessitates a multi-tiered approach involving policymakers, industry leaders, producers, researchers, consumers and farm workers.

1. **Including One Health and One Welfare in policy interventions:** Integrating the principles of One Health and One Welfare into policy interventions is essential for addressing the complex and interconnected challenges facing aquaculture and other animal-based industries. These frameworks recognize that the health and well-being of humans, animals, and ecosystems are deeply intertwined, and they provide a holistic approach to sustainable development.
2. **Development and implementation of welfare indicators**: Establishing reliable and practical welfare indicators specific to local species, contexts, and farming systems is essential[46].
3. **Training and education**: Enhancing the knowledge and skills of aquaculture professionals through training programs focused on welfare practices can lead to better management and operational decisions.
4. **Improved farm management practices**: Implementing mandatory practices such as maintaining optimal water quality, appropriate stocking densities, and environmental enrichment can reduce stress and improve fish welfare. Specific ranges should be maintained in order to ensure welfare of aquatic animals, and plans on how to apply timely corrections if any range deviates from normal must be developed. Establishing clear, ongoing, and welfare-focused training programs for staff involved with farm operations and animal handling can have a positive impact on improving welfare.
5. **Responsible use of therapeutics**: Reducing reliance on antibiotics by improving husbandry practices and using biotechnological advances such as vaccines and probiotics can help prevent disease outbreaks without contributing to antimicrobial resistance[47].

The Role of Veterinarians for One Welfare in aquaculture

Veterinarians are uniquely positioned to bridge the gap between industry practices, scientific advancements, and regulatory frameworks to ensure the sustainable expansion of aquaculture within the One Health and One Welfare frameworks.

Animal health and disease management

Veterinarians are essential in preventing, diagnosing, and managing infectious and non-infectious diseases in aquaculture. Disease outbreaks, such as infectious salmon anemia virus (ISAV) in Chile[48] and AHPND in shrimp farming[49], have had devastating economic and ecological consequences. Implementing biosecurity measures, vaccination and prevention programs, and antimicrobial stewardship are critical veterinary responsibilities that align with One Welfare principles.

Animal welfare and ethical practices

The development and implementation of species-specific and life-stage welfare indicators, specifically tailored to regional production systems, is a crucial role of the Veterinary profession. Welfare challenges such as high stocking densities, inadequate water quality, and ineffective slaughter methods directly impact fish health and productivity. Veterinarians must advocate for evidence-based welfare interventions that can include, but are not limited to, maintaining water quality parameters[50] within species-specific thresholds, regulating stocking densities to minimize stress and aggression[51], implementing humane stunning techniques before slaughter to reduce suffering and improve product quality[52], and promoting environmental enrichment strategies to enhance behavioral well-being.

Environmental and ecosystem health

Aquaculture operations impact surrounding ecosystems through nutrient runoff, antibiotic overuse, and fish escapes. Veterinarians contribute to mitigating these effects by advising on sustainable feeding strategies to reduce eutrophication risks and supporting responsible antibiotic use to prevent antimicrobial resistance[53]. Other crucial roles involves monitoring farmed fish escapees and their impact on wild populations[54] and collaborating with environmental agencies to develop policies that align aquaculture with ecosystem preservation.

Public health and food safety

Veterinarians play a pivotal role in ensuring aquaculture products are safe for human consumption. Foodborne pathogens, antimicrobial resistance, and biotoxin contamination (e.g., harmful algal blooms) pose significant public health risks. Veterinary oversight helps maintain food safety standards by implementing surveillance programs for zoonotic pathogens,

educating producers on proper antibiotic use and withdrawal periods, and supporting certification schemes that promote responsible aquaculture practices and accountability procedures for farmers.

Capacity building and policy advocacy

Veterinarians also play an important role as educators and policy advisors, with the potential of helping shape aquaculture legislation in Latin America. Strengthening regulatory frameworks to enforce welfare standards, disease management protocols, species-specific welfare frameworks, and environmental protection are essential. Additionally, training aquaculture professionals in welfare-friendly practices ensures long-term industry sustainability[55].

Conclusion

Fish welfare is an essential yet often neglected component of sustainable aquaculture. The failure to integrate welfare considerations into industry practices has led to significant environmental and public health challenges in Latin America. However, by adopting welfare-centric approaches aligned with the One Health and One Welfare frameworks, the region can foster a more ethical, sustainable, and productive aquaculture industry. Addressing issues such as stocking density, water quality, stunning before slaughter, and environmental enrichment can improve fish health, reduce environmental impacts, and enhance economic viability. Future research and policy efforts should focus on advancing welfare science, promoting regulatory frameworks, and encouraging industry-wide adoption of best practices.

To achieve these goals, stakeholders in Latin America must take concerted action. Policymakers should prioritize the development and enforcement of regulatory frameworks that incorporate fish welfare standards, drawing on international guidelines such as those from the World Organisation for Animal Health (WOAH). Industry leaders must invest in training programs to educate workers on best practices for fish handling, health management, welfare indicators and environmental stewardship. Researchers and academics should focus on advancing welfare science, particularly in understudied areas such as species-specific stress physiology, behavioral needs, and the long-term impacts of aquaculture on ecosystems.

Veterinarians play a critical role in bridging these efforts, providing expertise in animal health, welfare, and sustainable production systems. Collaborative initiatives, such as public-private partnerships and regional networks, can facilitate knowledge sharing and capacity building. For instance, the establishment of a Latin American Aquaculture Welfare Alliance could bring together stakeholders to develop region-specific guidelines, monitor progress and accountability, and promote innovation. Additionally, consumer awareness campaigns can drive demand for ethically produced seafood, incentivizing an industry-wide adoption of welfare-centric practices.

Crucially, One Welfare is a truly transdisciplinary endeavor, requiring the integration of disciplines such as veterinary medicine, environmental sciences, social sciences, economics, ethics, and policy to holistically address societal needs. By embedding fish welfare within this interconnected framework, Latin America can respond to complex challenges at the intersection of animal well-being, environmental sustainability, and public health.

This holistic approach not only aligns with global trends toward ethical and sustainable food production but also supports the achievement of the United Nations Sustainable Development Goals for 2030[56]. By advancing regionally relevant welfare science, promoting regulatory frameworks, and encouraging industry-wide adoption of best practices, Latin America has the potential to position itself as a global leader in responsible aquaculture.

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RESEACH REPORT

Etomidate as an Effective Alternative Method of Euthanizing Adult Zebrafish (*Danio rerio*)

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Abstract

The goals of this study were to investigate the efficacy of two different concentrations of etomidate in euthanizing zebrafish, and to determine whether the density of fish affects euthanasia quality and timing. The zebrafish (n=10 fish/group) were immersed in either 6 mg/L (Eto-6) or 10 mg/L (Eto-10) etomidate. Additionally, 5 zebrafish were immersed in 6 mg/L of etomidate to assess density differences. Tanks were video recorded and scored by two blinded observers. The parameters monitored included: 1) loss of righting reflex (LORR); 2) undulation cessation; 3) cessation of operculation (COO); and 4) loss of startle reflex.

After the 30-minute immersion, fish were transferred to recovery tanks and monitored once every 5 min for 60 min. No aversive behaviors were noted during tank immersion, and no fish regained the aforementioned parameters after transfer to recovery tanks. The time to undulation cessation, COO, and loss of startle reflex was significantly shorter in the group euthanized at Eto-10 as compared to Eto-6. The time to LORR and undulation cessation was significantly shorter in the group euthanized at a lower density of 5 fish/L. We conclude that either 6 or 10 mg/L of etomidate effectively euthanizes adult zebrafish whether there were 5 fish per liter or 10 per liter of water.

Abbreviations

Cessation of operculation (COO), etomidate 6 mg/L (Eto-6), etomidate 10 mg/L (Eto-10), hydrochloride (HCL), interquartile range (IQR), loss of righting reflex (LORR), tribromethanol (TBE), tricaine methanesulfonate (MS-222).

Introduction

Zebrafish (*Danio rerio*) are one of the most commonly used research animals, with an estimated 3,250 institutes in 100 countries using over 5 million zebrafish annually.[1] These numbers are expected to grow with gene editing technology advances such as CRISPR/cas9. With this vast number of fish euthanized daily all over the world, there remains a significant need to improve the standard euthanasia methods. For euthanasia to be deemed humane, certain conditions must be met.[2] These include ensuring minimal pain and distress for the animal, inducing rapid unconsciousness with minimal restraint leading to irreversible death, and ensuring reliable central nervous system depression. Moreover, the process should be reproducible, simple, safe, and avoid emotional strain for the operator. It should also be economically viable and tailored to factors such as species, strain, age, number, and health of the animal. Additionally, within research settings, it should not compromise post-mortem analysis.[2,3]

Currently, there is no United States Food and Drug Administration (US FDA) approved drug for the euthanasia of fish.[2] The only US FDA approved anesthetic agent for fish and the current standard for euthanizing zebrafish over 15 days old is tricaine methanesulfonate (MS-222) anesthetic overdose.[2] MS-222 is a powder requiring a fume-hood for preparation due to potential human health hazards including skin, eye, and respiratory irritation and long-term occupational exposure is associated with retinal toxicity.[4] To minimize these health hazards, MS-222 must be prepared while wearing proper PPE such as gloves and goggles.[5] MS-222 is also highly acidic, which can be irritating to the fish and requires the addition of a buffer solution, such as sodium bicarbonate, to increase the pH. When not buffered, MS-222 causes aversion in which 100% of fish display rapid opercular movements and 39% exhibit piping behavior (gulping of air at the water surface).[6] Even when properly prepared many researchers report their fish experiencing aversion to MS-222.[7,8]

As alternatives to MS-222, other anesthetic agents have been evaluated for potential use in zebrafish euthanasia including 2,2,2 tribromethanol (TBE), benzocaine, lidocaine hydrochloride (HCL), clove oil, metomidate, propofol, and etomidate.[8-12] Aside from anesthetic compounds, rapid chilling is an acceptable euthanasia method in the United States, but in European nations it has been considered questionably humane, with it only being legally permitted as of the 2024 Directive.[1,3,13] Additionally, electroshock is a widely accepted euthanasia method in aquaculture, but is currently not logistically viable in laboratory animal medicine.

Aversion can be difficult to assess in fish and often relies on signs of distress that can be hard to observe in routine husbandry practices, such as piping at the surface, twitching, erratic movement, and rapid opercular movement.[2,14-16] Other methods for measuring aversion may include behavioral tests or measurements of stress hormones such as cortisol. Unfortunately, etomidate is known to inhibit the synthesis of cortisol and it cannot be used as a measurement of distress.[17] Therefore, in this study, changes in behavior were used as a measurement of aversion.

One group used behavioral preference tests in adult zebrafish and found etomidate to be one of two anesthetic agents, along with TBE, to be the least aversive when using hydrochloric acid as a control com-

pared to other agents such as benzocaine/lidocaine HCL and clove oil.[7] Lidocaine HCL and benzocaine are acidic compounds, which potentiates their ability to be aversive to fish without a buffering compound similarly to MS-222.[12] Etomidate has a negligible effect on water pH and may contribute to less aversion in fish.[18]

Etomidate is a non-barbiturate hypnotic compound commonly used as an induction agent in mammalian anesthesia. Etomidate acts as an allosteric agonist on the γ-aminobutyric acid inhibitory neurotransmitter.[19] Etomidate's binding site is located in the transmembrane site between the beta and alpha GABAA subunits. This specific binding site is associated with a Cl^- ionopore and works by increasing the duration of time the Cl^- ionopore is open and therefore increases GABA's effect. An advantage for its use in mammalian anesthesia is its minimal cardiovascular and respiratory system effects. Additionally, etomidate is quick acting, although it does not provide any analgesia.[20] Etomidate is primarily metabolized by the liver and has no active metabolites. Etomidate can also be easily stored and is readily available due to common use in human medicine. In essence, etomidate provides a viable alternative to euthanize adult zebrafish because it is simple to use, stable, has minimal reports of aversion in fish, and has wide human safety margins.

In this study, etomidate's euthanasia efficacy was compared at two concentrations (6 mg/L and 10 mg/L), as well as a single concentration (6 mg/L) used to compare two separate densities of fish (5 fish/L or 10 fish/L). The concentrations were chosen based on previous literature that found 100% mortality for fish euthanized at only 3 mg/L within 20 min, as well as a report on successful euthanasia using 6 mg/L in which fish were removed from the agent after 2 min of cessation of operculation.[18,20] Finding the lowest effective dose can minimize the time an animal undergoes euthanasia, it can be more economical as you decrease the anesthetic agent required, and can leave less residue in the tissue.[20] It was hypothesized that 10 mg/L etomidate would result in a shorter time to LORR, undulation cessation, COO, and loss of startle reflex than 6 mg/L. It was also hypothesized that fish euthanized at a density of 5 fish/L would have shorter times to LORR, undulation cessation, COO, and loss of startle reflex than 10 fish/L.

Ethical Review

This study was designed with the 3Rs in mind to test the efficacy and assess euthanasia quality using different concentrations of etomidate and fish densities. In accordance with the goals of the 3Rs, all the fish used on this study were already slated for euthanasia after their previous unrelated experiments had been completed. All procedures were approved by Stanford University's IACUC, and Stanford is an AAALAC-accredited institution.

Materials and Methods

Animals and Husbandry

Twenty-five mixed sex adult wild-type AB zebrafish from a single batch of embryos (Sinhuber Aquatic Research Laboratory, Corvallis, OR) were used for this study. Zebrafish racks in this facility undergo regular PCR screening for infectious agents (*Aeromonas hydrophila, Edwardsiella ictaluri, Flavobacterium columnare, Mycobacterium* spp., *Ichthyophthirius multifiliis, Pleistophora hyphessobryconis, Pseudocapillaria tomentosa, Piscinodinium pillulare, Pseudoloma neurophilia,* and *Saprolegnia brachydanis*) and no potentially pathogenic organisms were detected on the racks at the time of the experiment. All fish used appeared healthy and behaved appropriately.

Zebrafish were group housed based on the Stanford IACUC guidelines at a stocking density of 5 to 10 fish/L on a single recirculating aquaculture system rack (Aquaneering, San Diego, CA) in a housing room with a 14:10 hour light:dark cycle. The system rack was fitted with a heater, 50 µm prefilter, 25 µm mechanical filter, fluidized bed biologic filter, carbon filter, and an Ultraviolet lamp providing a minimum output of 100,000 $mW/s/cm^2$. A 10% water volume change was performed daily with calcite-filtered reverse osmosis water. Water temperature and chemistry parameters were maintained within standard ranges established as species-appropriate (25 to 29°C, pH 6.5 to 8.5, dissolved oxygen > 6 mg/L, conductivity 500 to 2,000 µS, ammonia < 0.02 mg/L, nitrite < 0.5 mg/L, and nitrate < 50 mg/L). Fish were fed a diet of in-house hatched *Artemia* (E-Z Egg, Brine Shrimp Direct, Odgen, UT) and commercially available powdered feed (GemmaMicro 300, Skretting USA, Tooele, UT) twice daily.

Experimental Design

Zebrafish were randomly netted from their home tanks and randomly assigned to 1 of 3 treatment groups: Eto-6 or Eto-10 immersed at a density of 10 fish/L, or 5 fish/L in Eto-6. The group of Eto-6 at a density of 10 fish/L was used for concentration and density comparisons.

Each fish was netted and then placed in a 1-L clear, polycarbonate tank (Tecniplast USA, Inc., West Chester, PA) containing the original tank system water. The pH of the tank water prepared with etomidate ranged from 7.1-7.3, measured using a pH meter (Hanna Instruments, Inc. HI98129 Meter) both before and after the addition of the etomidate, and therefore remained in tolerable pH zone for zebrafish.[21]

Methods

Fish were placed in tanks with other fish from their same home tanks. After transferring the fish to the tank by net, etomidate was added through a syringe and disbursed as evenly as possible to obtain the desired concentration. Video of the tanks were recorded using an iPhone 14 Pro (Apple Inc., Cupertino, CA) for later analysis.

A table tap was performed roughly every 5 min to assess the startle reflex. After 30 min of immersion, each fish was removed from the tank and placed in a fresh system-water tank for an additional 60 min. Fish were then monitored for signs of life (righting, operculation, body movement, and response to tap) every 5 min.

The current AVMA Euthanasia Guidelines describe useful indicators of death or successful euthanasia in fish to include loss of movement, loss of reactivity to any stimulus, and respiratory arrest (cessation of operculation) for a minimum of 30 min. Heart rate was not used as a parameter due to the fact that the heart can continue to contract even after brain death or removal from the bodies of fish. Therefore, successful euthanasia was defined as reaching irreversible stage IV anesthesia for at least 60 min after transfer from the euthanasia tank to fresh system-water tank, which included respiratory arrest, loss of movement, loss of reactivity for beyond 30 min.[2,22]

Data Criteria

Fish video footage was observed by two blinded observers experienced with zebrafish euthanasia. Time to LORR, undulation cessation, COO, and loss of startle reflex were recorded by each observer. LORR was defined as the inability to remain upright. Undulation cessation was defined as complete loss of purposeful movement forward. COO was defined as loss of opercular movement or buccal pumping. Loss of startle reflex was defined as no reaction or movement to the table being tapped every 5 min. Times were then averaged between the two observers and compared between groups. Displays of aversive behaviors were also recorded, if seen. Aversive behaviors were decided based on previous literature describing signs of distress in fish such as piping at the surface, twitching, erratic movement, and rapid opercular movement.[14-16]

Statistical Analysis

Times until LORR, undulation cessation, COO, and loss of startle reflex were analyzed by using the Mann–Whitney *U* test. Data are expressed as median ± interquartile range (IQR). A *P* value less than 0.05 was considered significant. Analysis was performed by using R Core Development Team, 2015.

Results

Concentration

The median times to LORR, undulation cessation, COO, and loss of startle reflex are summarized along with the IQR in a box and whisker graph (Figure 1). There was no significant difference in time to LORR between the Eto-6 and Eto-10 groups, with a median of 24.0 (IQR, 21.3 to 26.5) sec in the Eto-6 group and 24.0 (IQR, 23.0 to 26.5) sec in the Eto-10 group. The time to undulation cessation was significantly shorter in the Eto-10 group with a median time of 30.0 (IQR, 27.0 to 32.3) sec compared to the Eto-6 group with a median time of 60.5 (IQR, 45.5 to 62.0) sec (P= 0.028). The time to COO was also significantly shorter in the Eto-10 group with a median of 99.0 (IQR, 92.5 to 101.8) sec compared to the Eto-6 group with a median of 112.0 (IQR, 106.2 to 114.0) sec (P= 0.005). The time to loss of startle reflex was also significantly shorter in the Eto-10 group, with a median of 360.0 (IQR, 360.0 to 465.0) sec compared to the Eto-6 group with a median time of 720 (IQR, 480 to 720) sec (P=0.038).

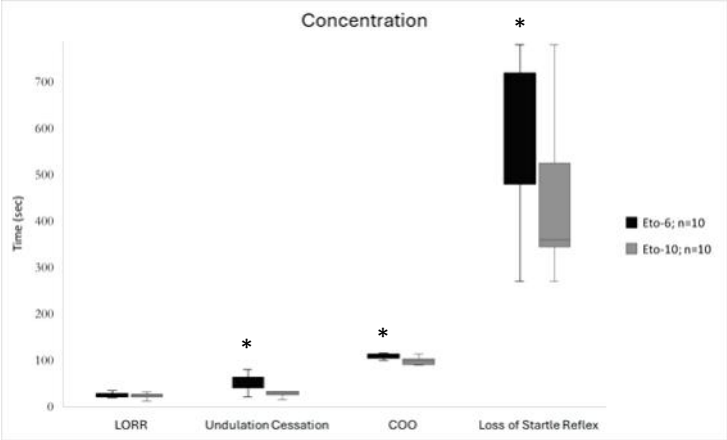


Figure 1. Comparison of 6 vs. 10 mg/L Etomidate.
The time to loss of righting reflex (LORR), undulation cessation, cessation of operculation (COO), and loss of startle reflex (sec) in adult zebrafish after immersion in 6 (Eto-6) or 10 (Eto-10) mg/L etomidate. Medians with interquartile ranges are indicated. Statistical significance was assessed by Mann-Whitney U test.

** value is significantly different from the other group (P < 0.05).*

Density

The median times to LORR, undulation cessation, COO, and loss of startle reflex are summarized along with the IQR in a box and whisker graph (Figure 2). The time to LORR was significantly shorter in the 5 fish/L group with a median time of 17.0 (IQR, 15.0 to 19.0) sec compared to the 10 fish/L group with a median time of 24 (IQR, 23.3 to 26.5) sec (P=0.02). The time to undulation cessation was also significantly shorter in the 5 fish/L group with a median time of 30.0 (IQR, 25.0 to 32.0) sec compared to the 10 fish/L group with a median time of 60.5 (IQR, 45.5 to 62.0) sec (P=0.037). There was no significant difference in time to COO in the 5 fish/L group compared with 10 fish/L group with a median time of 106.0 (IQR, 89.0 to 109.0) sec in the 5 fish/L group and 112.0 (IQR, 106.2 to 114.0) sec in the 10 fish/L group. Additionally, there was no significant difference in time to loss of startle reflex in the 5 fish/L group with a median time of 540.0 (IQR, 540.0 to 840.0) compared to the 10 fish/L group with a median time of 720.0 (IQR, 480.0 to 720.0) sec.

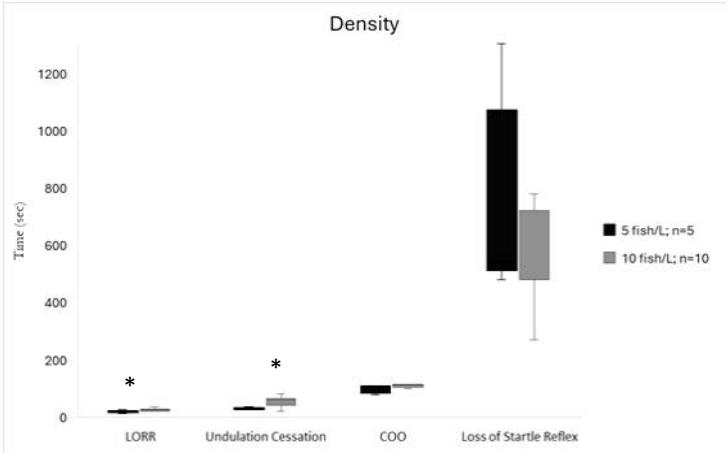


Figure 2. Comparison of 5 vs. 10 fish/L.
The time to loss of righting reflex (LORR), undulation cessation, cessation of operculation (COO), and loss of startle reflex (sec) in adult zebrafish after immersion in 6 (Eto-6) mg/L etomidate at densities of 5 fish/L and and 10 fish/L. Medians with interquartile ranges are indicated.
Statistical significance was assessed by Mann-Whitney U test.

** value is significantly different from the other group (P < 0.05).*

Results of this study indicate that 6 and 10 mg/L etomidate effectively euthanized adult zebrafish with the higher concentration resulting in shorter times to undulation cessation, COO, and loss of startle reflex. Additionally, both densities of 5 and 10 fish/L resulted in effective euthanasia of adult zebrafish with the smaller density resulting in shorter times to LORR and undulation cessation. Immersion for 30 min at both concentrations and immersion densities effectively euthanizing adult zebrafish based on the AVMA's indicators of death (respiratory arrest for at least 30 min, loss of movement, and loss of response to stimuli). The fish showed no signs of aversion (piping at the surface, twitching, erratic movement, or rapid opercular movement) and no recovery after 60 min in fresh tank water.

When comparing concentrations of etomidate, the higher concentration, 10 mg/L, resulted in shorter times to undulation cessation (median times; 30 sec *vs.* 60.5 sec), COO (median times; 99 sec *vs.* 112 sec), and loss of startle reflex (median times; 360 sec *vs.* 720 sec) than 6 mg/L. The startle reflex was lost at a much later time than any other parameter measured across all treatment groups. Ferreira *et al.* similarly found that euthanizing adult zebrafish with 6 mg/L etomidate led to a quick LORR. However, this group did not monitor for loss of startle reflex, but rather loss of response to painful stimuli, which they found occurred at about 15 min, which was later than the other euthanasia methods being evaluated (propofol/lidocaine, clove oil and rapid chilling).[20] The startle reflex differs from response to noxious stimuli as the reflex is due to involuntary muscle contraction in response to sensory stimuli and can remain when the animal is unconscious.[23] The response to noxious stimuli includes a conscious perception and reaction to the stimuli which was not assessed in this study.[24]

Another study that evaluated etomidate at a much higher concentration (50 mg/L) saw shorter times to LORR and COO than either of the concentrations evaluated here along with a prolonged startle reflex that lasted beyond the 600 seconds in which they evaluated the fish. They also noted some fish would lose the startle reflex but regain it at a later time-point, similarly to what was observed here.[12] The only times recorded in this study were the final times the startle reflex was lost. The prolonged startle reflex, along with intermittent body twitching that was observed after about 20 min in all etomidate euthanasia groups, may result from glutamate accumulation. Myoclonic or involuntary muscle movements are a common side effect of etomidate in mammalian patients, and although the mechanism for these movements remains unclear, there has been recent evidence in Sprague-Dawley rats that it is associated with neocortical glutamate accumulation.[25]

There were no differences between any of the groups in the level of twitching observed and all twitching had stopped by 30 min, which met the defined euthanasia criteria described previously. The question then remains whether the fish are fundamentally brain dead before that time point and experiencing post-mortem muscle contractions. Future work utilizing an EEG would be beneficial to assess this question. The prolonged twitching and reflexive movements emphasize the importance of an adjunct secondary method of euthanasia, as recommended by the AVMA Euthanasia Guidelines to confirm proper brain death in fish.

Animal density was also assessed as a potential factor impacting the anesthetic agent's euthanasia efficacy. It was hypothesized, based on clinical experience, the agent would become less efficacious at a higher fish density (10 fish/L) and ultimately result in longer times to loss of the aforementioned parameters. Consideration was also made for zebrafish housing density guidelines based on a facility's IACUC guidelines. Euthanizing zebrafish at higher densities than their current housing density may cause unwanted stress. The Guide recommends housing zebrafish at 5 fish/L.[26] However, there are many institutions that consider a higher density, up to 20 fish/L, as an acceptable housing density.[27,28]

One study determined a zebrafish housing density of up to 12 fish/L had no negative impact on reproductive performance.[29] Primary factors determining an appropriate housing density include food access, water quality, pathogens, and mating opportunities; all of which would not play a role in very brief housing for euthanasia.[30] With that said, there can still be aggression between conspecifics that were not housed in the same tanks and animals should not be euthanized with fish from separate tanks. While there were no behavioral differences in the fish euthanized at a density of 5

fish/L compared with 10 fish/L, the times to LORR (median times; 17 sec *vs.* 24 sec) and undulation cessation (median times; 30 sec *vs.* 60.5 sec) were significantly shorter in fish euthanized at 5 fish/L, respectively. This aligned with the hypothesis that fish euthanized at a lower density would have a shorter time to euthanasia. However, there were no significant differences in the times to COO (median times; 106 sec and 112 sec) and loss of startle reflex (median times; 540 sec and 720 sec), respectively.

It should also be considered that animals euthanized at a higher density could have been more stressed and thus the time to effect of the anesthetic agent and euthanasia may have been prolonged. This concept is well known in human medicine, as patients with higher baseline anxiety have increased intraoperative anesthetic requirements.[31] The veterinary field is also emphasizing this role of stress on anesthetic induction, as cats with reduced stress from improved transport and handling techniques had shorter times to sedation and required lower doses of propofol than cats with higher stress.[32] Regardless of densities, all fish were euthanized effectively after immersion for 30 min.

A few limiting factors in this study were the small sample size (n=5 *vs.* n=10), lack of duplicate groups, no comparison based on sex, and no post-mortem tissue or histological evaluation. Previous work has noted no gross or histologic changes associated with etomidate in fish.[18] Another variable that was not assessed in this study was the time the fish were exposed to etomidate. All fish were left in the euthanasia solution for exactly 30 min. This is a standard time frame for adult zebrafish euthanasia, as the AVMA now recommends fish euthanized by MS-222 remain in the solution for 30 min past cessation of operculation.[2] To highlight the importance of immersion time, Amend *et al*. found adult zebrafish euthanized with etomidate at 3 mg/L for 2 min resulted in 0% mortality but a 100% mortality when exposed for 20 min at the same concentration. This group also found that zebrafish immersed at 15 mg/L had a 95% mortality when exposed for just 2 min.[18] This variation emphasizes the need to evaluate a variety of concentrations in combination with a variety of exposure times in finding the quickest and least aversive euthanasia method using an anesthetic overdose.

Conclusions

This study evaluated two separate etomidate concentrations and two separate fish densities to euthanize adult zebrafish. Fish euthanized in 10 mg/L etomidate had shorter times to undulation cessation, COO, and loss of startle reflex than fish euthanized in 6 mg/L. Fish euthanized at 5 fish/L had shorter times to LORR and undulation cessation than fish euthanized at 10 fish/L. We conclude either 6 or 10 mg/L etomidate is efficacious at euthanizing adult zebrafish when immersed for at least 30 minutes. Although no zebrafish recovered, an adjunct method of euthanasia should still be performed to confirm brain death. It is also concluded that fish may be euthanized at 5 or 10 fish/L, but 5 fish/L may be less stressful and provide quicker immobilization times. Further studies may address alternative concentrations, immersion times, densities, life stages, as well as histological impact on tissues. The data provides more information on an alternative anesthetic agent overdose as an adult zebrafish euthanasia method providing quick immobilization without signs of aversive behavior.

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Data access: Data may be available upon request. Please contact corresponding author.

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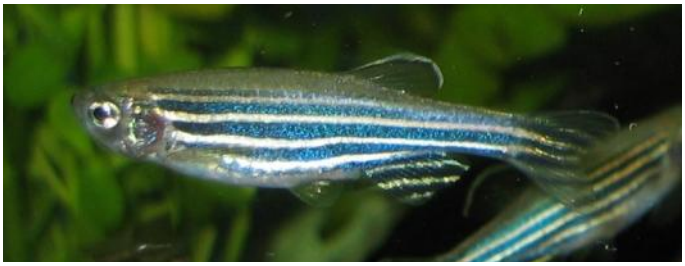
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A female zebrafish (Danio rerio)
From Wikip[edia

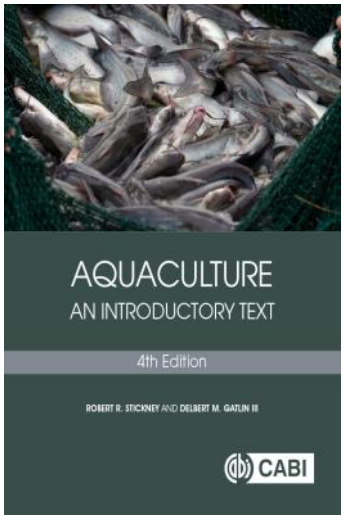


LITERATURE REVIEW

CABI Aquaculture Books

CABI publishes a number of books in aquaculture, fish welfare, and fisheries that may be of interest to WAVMA members. These books can be viewed here: https://www.cabidigitallibrary.org/action/showPublications?pubType=book&ConceptID=780213&sortBy=TitleSort&startPage=

These include 15 recently acquired titles that are new to CABI and published as eBooks for the first time. You can find out more about the acquisition here. Previously published in print by 5m Books, the titles are available digitally and as a collection for the first time on CABI Digital Library. Publication in eBook format makes them accessible to a wider audience, both for individual purchase and for libraries.

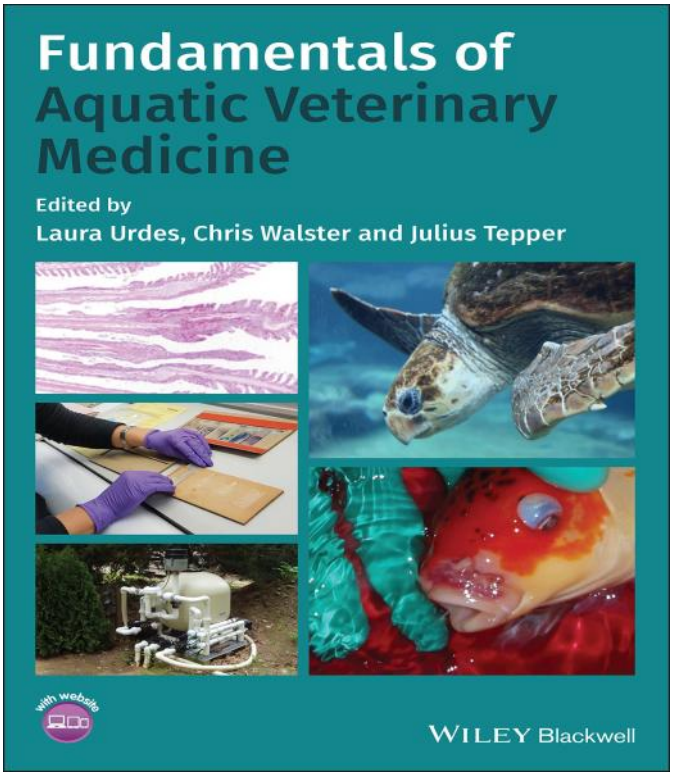




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In addition to the books focused on aquaculture here CABI also publishes information on One Health, which CABI is quite heavily involved in. There is an open access journal, CABI One Health and One Health Knowledge Bank – take a look and see if anything is of interest.

CABI
Nosworthy Way,
Wallingford, Oxfordshire, OX10 8DE, UK



Fundamentals of Aquatic Veterinary Medicine provides systematic, highly practical guidance on the treatment of aquatic mammals, amphibians, fish, and invertebrates in veterinary practice. Mapping to each of the nine core areas of the WAVMA Certified Aquatic Veterinarian (CertAqV) Program, this comprehensive clinical reference covers taxonomy, anatomy and physiology of aquatic species, water quality and life support systems, diagnostics, treatment, and prevention of aquatic diseases, and more. Designed to help readers acquire and demonstrate the necessary knowledge, skills, and experience to be competent in aquatic veterinary medicine, this authoritative guide:

- Focuses on "Day One" competencies outlined by the World Organization for Animal Health (OIE)
- Covers pathobiology and epidemiology of aquatic diseases, public health, zoonotic diseases, and seafood safety
- Provides up-to-date information on relevant legislation, regulations, and policies

Fundamentals of Aquatic Veterinary Medicine is a must-have reference and review guide for veterinary students and practitioners interested in practicing aquatic veterinary medicine, as well as for aquatic veterinarians looking to become WAVMA certified or wanting to acquire OIE "Day One" competency.

Available from:
https://www.wiley.com/en-us/Fundamentals+of+Aquatic+Veterinary+Medicine-p-9781119612704

LITERATURE REVIEW

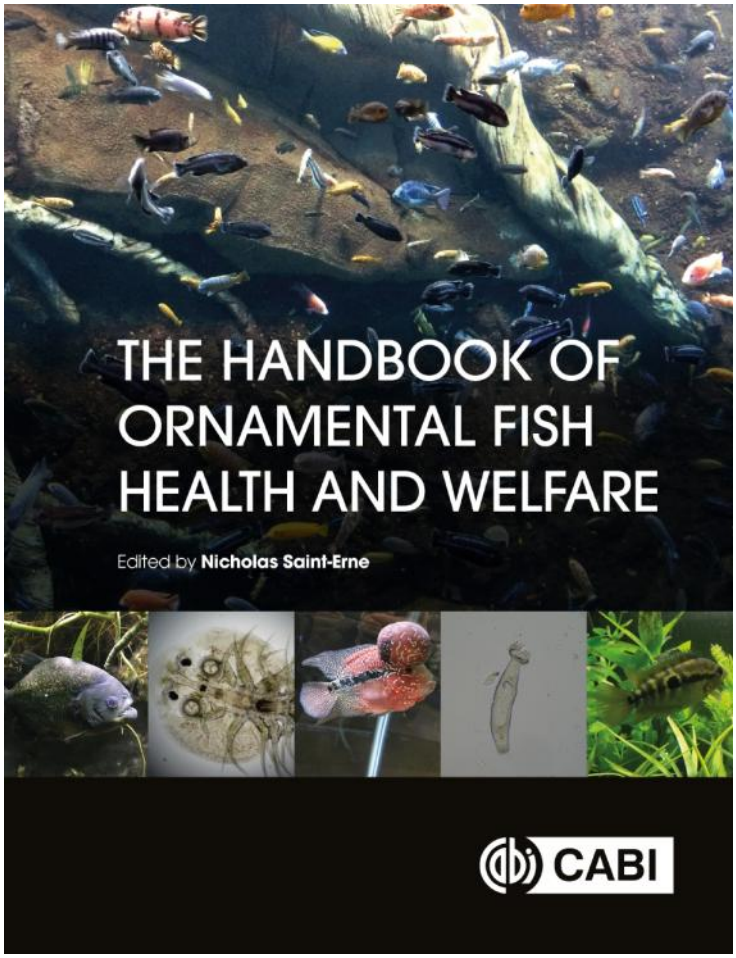
***The Handbook of Ornamental Fish Health and Welfare* (2024)**

Edited by **Nicholas Saint-Erne**, DVM, CertAqV
Certified Aquatic Veterinarian
WAVMA Distinguished Fellow

This book forms a complete resource covering ornamental fish health and welfare from a recognized expert on the topic. Beginning with an overview of the tropical fish industry and aquarium keeping, it covers all the key elements of care, including water-quality testing and maintenance, filtration systems, nutrition, husbandry, handling and transportation of fish, disease diagnosis, treatments and medications, and disease prevention. It also reviews areas of wider interest, such as biosecurity and zoonoses.

Chapters include:
1 A Brief History of Keeping Fish in Aquariums
2 Overview of the Ornamental Fish Industry
3 Fish Taxonomy, Anatomy, and Physiology
4 Aquarium Care
5 Water Quality
6 Filtration Systems
7 Fish Pond Care
8 Fish Nutrition
9 Equipping the Veterinary Hospital to Treat Fish Patients
10 Clinical Procedures
11 Diagnostic Tests
12 Fish Hematology and Biochemistry
13 Transporting Samples for Laboratory Analysis
14 Advanced Diagnostic Techniques
15 Sedation, Anesthesia, and Euthanasia
16 Surgery
17 Infectious Diseases
18 Protozoan Parasites
19 Metazoan Parasites
20 Zoonotic Diseases from Fish
21 Non-infectious Diseases
22 Fish Facility Husbandry and Biosecurity
23 Administering Medications to Ornamental Fish
24 Ornamental Fish Welfare
25 Welfare of Fish in Public Aquariums
26 Quarantine Protocol
Recommended Reading
Glossary
Index

The chapter authors are all WAVMA members and Certified Aquatic Veterinarians, and include:
Azureen Erdman, DVM, CertAqV
Sharmie Johnson, DVM, CertAqV
Wildlife World Zoo & Aquarium
Robert Martinez, DVM, CertAqV
Aquatic Veterinary Consulting, PLLC.



Lily Parkinson, DVM, DACZM, DACVECC, CertAqV. Brookfield Zoo
Nicholas Saint-Erne, DVM, CertAqV
WAVMA Distinguished Fellow
Chris Walster, BVMS, MVPH, CertAqV
WAVMA Distinguished Fellow

The book can be read through to gain a complete overview of the care and welfare of ornamental aquarium and pond fish, or it can be used to easily look up specific information about a topic of interest. With extensive photographs, plus references allowing readers to study areas of interest in more detail, this book makes an invaluable teaching and reference handbook. It is a vital source of information for veterinarians, scientists using fish in their labs, students, ornamental fish breeders, retail pet store workers, and aquarium keepers looking for trusted advice about how to properly care for their ornamental freshwater fish.

Available through the CABI website:

https://www.cabidigitallibrary.org/doi/book/10.1079/9781789246032.0000

LITERATURE REVIEW





Carps

David Hoole, Dieter Steinhagen, Verena Jung-Schroers, Mikolaj Adamek

9781836990000 | 480 pages | 2025

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Tilapia

Aquaculture, Biology and Health Management

Edited by **Kim Thompson, Craig A. Shoemaker and David C Little**

9781800629387 | 880 pages | 2025

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The Handbook of Ornamental Fish Health and Welfare

Edited by **Nick Saint-Erne**

9781789246018 | 368 pages | 2024

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Small Fry

Mark Everard

9781836991670 | 208 pages | 2025

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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.

WAVMA Resources for CertAqV and CertAqVN/T
www.wavma.org/WebCEPD
Resource: one hour Webinars on various topics
Cost: Available for free to WAVMA Members.
KSE Credit: Stated for each webinar. To gain the CEPD certificate you need to complete a short quiz.
Evidence: Submission of Certificate with KSE record.

www.wavma.org/video-library
Resource: Video recordings deemed of good quality but not part of WebCEPD
Cost: Free to WAVMA members
KSE Credit: Variable,
Comments: One of WAVMA's primary aims is to promote aquatic veterinary medicine. There are other resources WAVMA provides such as The Aquatic veterinarian, member listservs, e-news and blog.

Aquadocs
www.aquadocspodcast.com
Resource: Various discussion topics
Cost: Free
KSE Credit: Dependent on time and topic
Evidence: None. Discuss with mentor
Comments: Lots of information on various topics.



Aquaculture Conferences & Exhibitions

LACQUA 2025
Puerto Varas, Chile
October 6-9, 2025
www.was.org

World Aquaculture 2025 India
Nov 10, 2025 - Nov 13, 2025
Hyderabad International Convention Center - Novotel, India

XVII International Symposium on Aquaculture Nutrition
Nov 19, 2025 - Nov 21, 2025
XVII International Symposium on Aquaculture Nutrition
Location: Virtual Zoom

The 17th International Symposium on Aquaculture Nutrition (SINA) will take place virtually from November 19-21, 2025. This scientific event is organized by the Mexican Association of Specialists in Aquaculture Nutrition (AENA) and people who is part of various national education and research institutions. The symposium will feature keynote presentations by national and international experts, highlighting the latest advancements in aquaculture nutrition. The event aims to foster collaboration between industry, government, academia, students, and those interested in the latest global research.
Key topics include: Nutritional requirements, Digestibility, Live feed, Alternative proteins, Nutrition of emerging species, Nutrigenomics, Functional additives, Feeding strategies, Eco-efficient feeds, Special producer session.
Presentations will be by direct invitation to leading researchers and producers.
For more information, visit www.cibnor.gob.mx/eventos-cibnor or contact sina2025@cibnor.mx.

Aquaculture America 2026
Feb 16, 2026 - Feb 19, 2026
Paris Hotel and Convention Center,
Las Vegas, Nevada

World Aquaculture Singapore 2026
Jun 2, 2026 - Jun 5, 2026
Location: Singapore

WSAVA Congress
October 13-15, 2026
Warsaw, Poland
https://wsava.org/congress/

Fish Vet Masterclass

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A Masterclass that teaches you all aspects of fish veterinary medicine.

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The Fish Vet Masterclass is created by qualified fish veterinarian and pathologist, Dr Richmond Loh, with over 20 years of experience. This course is easy to follow and will teach you how to diagnose and treat fish disease to the highest standards of fish veterinary medicine.

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- Fish Disease investigative process - 8 Lessons.
- Microscopes and Microscopy - 3 Lessons.
- Diet and Nutrition - 7 Lessons
- Water quality - 19 Lessons
- Viral Diseases of Fish - 6 Lessons
- Bacterial Diseases of Fish - 4 Lessons
- Algal Diseases of Fish - 3 Lessons
- Fungal and Oomycete Diseases of fish - 4 Lessons
- Protozoal Parasites of Fish - 10 Lessons
- Trematode (Fluke) Worm Infestations in Fish - 3 Lessons
- Nematode (round worm) Infestations in Fish - 2 Lessons
- Other Disease conditions - 14 Lessons
- Formulary of Fish Medications - 7 Lessons
- Biosecurity - 2 Lessons
- Welfare and Euthanasia - 4 Lessons
- Anaesthesia and Surgery - 5 Lessons
- Euthanasia - 1 Lesson
- Laboratory Testing - 2 Lessons
- Case Studies - 5 lessons
- VIP Access for FVMC Facebook group for direct questions with Dr Loh

Certificate upon achieving a passing exam score



AQUATIC VETERINARY CE & PD

Recently uploaded WAVMA WebCEPD Webinars:

B-1089 “Fish ER Medicine”,
by Dr Robert Martinez (USA).

B-1090 “Biotechnological strategies to avoid antibiotic use in managing bacterial infections in farmed freshwater fish”
by Dr Paola Barato (Colombia)

B.-1091 “Cetacean stranding response”
by Dr Natalie Arrow (UK).

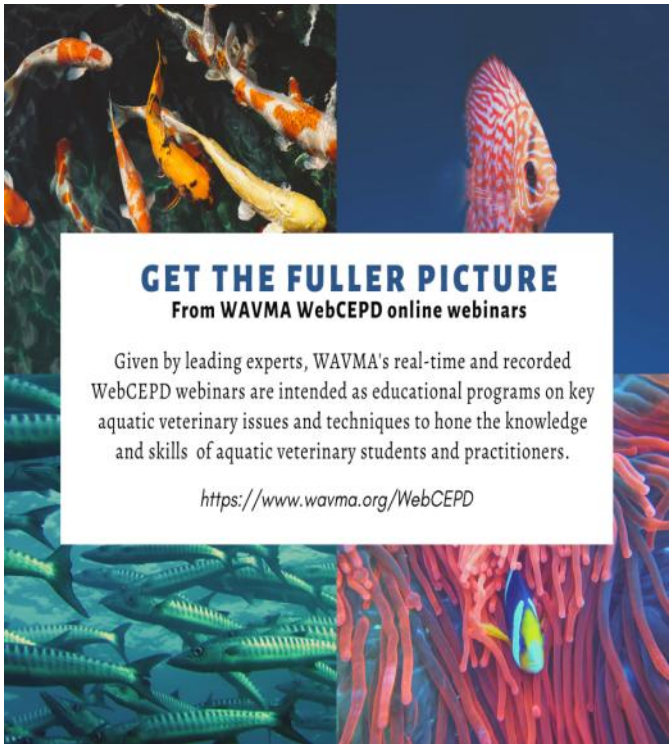
B-1092: Aquaculture Biosecurity
Presenter: Myron Kebus, M.S., DVM

B-1093: From Concepts to Practices: Introducing Tilapia Welfare Assessment Tools
Presenter: Mr Wasseem Emam, Dr Sara Barrento, Mr Murilo Quintiliano

B-1094: Unmasking the Ordinary: Challenging cases in Aquatic Pathology (joint WAVMA+TAVA webCEPD)
Presenter: Weerapong “Mac” Laovechprasit (DVM, PhD)

B-1095: Stranding Response in Remote Areas: Managing Dog-Attack Wounds in Sea Turtles
Presenter: Maribel Escobedo Mondragón M.MVZ

See these webinars and more at:
https://www.wavma.org/WebCEPD



AAFV Conference 2025
October 12-16, 2025
Riverhead, NY

The conference is being held at the Long Island Aquarium:
https://www.longislandaquarium.com/

While we’re putting the finishing touches on our 2025 Conference schedule, you can start planning now by booking your hotel! Stay tuned for updates—we promise 2025 will be even bigger and better!
The American Association of Fish Veterinarians (AAFV; fishvets.org)
https://fishvets.org/aafv-conference/

2026 AQUAVET® I & II

The College of Veterinary Medicine at Cornell University is pleased to announce the 2026 AQUAVET® I & II Programs. They are aquatic veterinary medicine educational programs (introductory and advanced) that will be presented in Bristol, RI. Veterinary students can receive credits for the course and graduate veterinarians can receive CE credits. Specific information can be found at www.aquavet.org.

AQUAVET ® I: An Introduction to Aquatic Veterinary Medicine is a 4-week course (25 May - 21 June 2026) intended primarily for veterinary students.
AQUAVET ® II: Comparative Pathology of Aquatic Animals is a 2-week course (25 May - 7 June 2026) that is oriented toward the pathology of diseases of aquatic invertebrates and fish that are used in biomedical research, public aquaria and aquaculture.
Applications are due by January 15, 2026.

AQUATIC VETERINARY CE & PD



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