



The



quatic

eterinarian

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WHO ARE WE

MISSION

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

OBJECTIVES

- A. To serve aquatic veterinary medicine practitioners by developing programs to support and promote our members, and the aquatic species and industries that they serve;
- B. To be an advocate for, develop guidance on, and promote the advancement of aquatic animal medicine within the veterinary profession and with associated industries, governments, non-governmental entities and members of the public;
- C. To develop and implement aquatic veterinary education programs, certifications and publications, including a credentialing process to recognize day-one competency in aquatic animal medicine;
- D. To foster and strengthen greater interactions among: aquatic veterinarians, related disciplines, veterinary allied and supportive groups and industries, governments and animal owners.

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

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

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Cover Photo:

Dr. Julius Tepper’s koi pond
 at his home in
 Long Island, New York.

Photo by Nick Saint-Erne, DVM.

See story about Dr. Tepper
 in the Colleague’s Connection
 on pages 18-21.



Get The Fuller Picture From WAVMA WebCEPD Online Webinars

WAVMA’s WebCEPD Program - Webinars for Global Aquatic Veterinary Education

Given by leading experts, WAVMA’s real-time and recorded WebCEPD webinars are intended as educational programs on key aquatic veterinary issues and techniques to hone the knowledge and skills of aquatic veterinary students and practitioners.

<https://www.wavma.org/WebCEPD>

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>.

Editor’s Note

The Coronavirus Pandemic is still upon us! This current plague has caused cancelation of most veterinary conferences for 2020, as well as other group activities such as sporting events, theaters, movies, and music concerts. While many people in these latter businesses are having a hard time making ends meet, my veterinary practice, as well as the practices of other veterinarians I have spoken to, is overwhelmingly busy. I don’t know why that is, but I am thankful to be working and keeping busy helping people with their animals’ health. Let’s hope things get better soon and we all stay healthy!

Since the WSAVA / WAVMA Conference in Poland scheduled for this year has been postponed until 2021, we are having an online virtual WAVMA Conference and Annual General Meeting on November 7, 2020 (see pages 9 and 42). This was arranged by the WAVMA Executive Board and the Meetings Committee (see page 11), chaired by Dr. Julius Tepper, who is also the subject of our Colleague’s Connection article on pages 18-23. In addition to being a Certified Aquatic Veterinarian, Julius is also an avid Bonsai grower.

We also have three submissions by WAVMA members; a research article (pages 24-29) and two case reports (pages 30-35). Please continue to send in your articles, news items, and case reports for publication to help our journal grow. It important for us to share our knowledge with future aquatic veterinarians. Deadline for submissions for the next issue is December 15, 2020. Stay healthy!

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

*Bonsai tree at Max Koi Farm in Singapore.
 Photo by Nick Saint-Erne, DVM
 September 26, 2018*



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>.



The Aquatic Veterinarian

**The Quarterly Magazine of the
 World Aquatic Veterinary Medical Association**

**Consider promoting your products, services
 or programs to aquatic veterinarians,
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 paraveterinary professionals
 throughout the world**

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WAVMA Members

Free 1/8 page (business card size) advertisement
 Contact TAVeditor@wavma.org for information on advertising and payment options.

President's Report

Hello WAVMA Members,

I want to explain the changes that will be implemented soon regarding your WAVMA membership. We will be making a change to the WAVMA membership year at the time we roll out our new website, which we are expecting to occur in the coming weeks.

Our current membership year is based on a calendar year (January-December); because of this, members who join part way through the year do not enjoy the same length of benefits as members who join in January. To help address this inequity, the WAVMA Executive Board has voted to change the membership year to a rolling 12-month system.

Briefly, this means that your membership will be due for renewal 12 months after you pay your dues. For example, if you pay your dues 1 February 2021 your next renewal date will be 1 February 2022. Likewise, if you pay your dues 15 July 2021 your renewal deadline will be 15 July 2022.

To help make this transition as smooth as possible for all members, and to ensure members receive maximum benefit, your renewal dates will be the following once this change is implemented:

- **If you paid your dues between 1 October 2019 and 31 December 2019:**
 - Your next renewal deadline will remain as 1 January 2021
 - After that, your subsequent renewal deadline will be 12 months from your last renewal payment.
- **If you paid your dues during 2020 or later:**
 - Your next renewal deadline will be 12 months from your last dues payment

We hope this new system will make it easier for members to know their WAVMA renewal deadline. In addition, this new process will be much simpler and less expensive to manage, allowing more time and money to be directed toward WAVMA programs and services.



Please let me know if you have any questions regarding this transition or your membership. Thank you for your continued support of WAVMA. Looking forward to another great year— so renew your membership in WAVMA!

Jena Questen, DVM, CertAqV
2020 WAVMA President
President@WAVMA.org



Secretary's Report

Whatever country a person is in, I have no doubts that everyone alive today will remember 2020 for the impact that the COVID-19 pandemic had on their lives. Anyone who tracks the progression of the pandemic (see WHO Coronavirus Disease (COVID-19) Dashboard), will know the virus is now in every country, and on every continent (except Antarctica). As of the end of September 2020, more than 34,500,000 confirmed cases of COVID-19 have resulted in more than 1,000,000 deaths – suggesting that 1 in ~34 people who get infected, especially those with pre-existing medical conditions, die!

While some countries haven't seem to have grasped the principles (or advice of epidemiologists) on how to prevent the spread of highly contagious diseases, others (like New Zealand, Taiwan and some Scandinavian countries) have almost gotten back to pre-COVID days. After an early slump in veterinary practice, those that quickly adopted staff-protection, curb-side patient drop-off/pick-up, and "telehealth" or "telemedicine" practices, quickly got back to a "new normal." For many countries, it will be well into 2021 (perhaps later) for them to halt the spread of COVID-19, through vaccinating at least 65-70% of their population (developing the so-called "herd immunity").

Despite these disruptions, the WAVMA Executive Board and Committees have continued to have virtual meetings to ensure that WAVMA programs continue moving forward. Some of the more important decisions made in the pasts three months include:

- Approved additional veterinarians that completed all requirements to be recognized as Certified Aquatic Veterinarians and can utilize the CertAqV honorific to indicate their competency;
- Received nominations for 2021 Board Officers and Directors (web-based voting will open shortly, and the results will be announced during the November 7 AGM);
- Planning how to participate and schedule aquatic veterinary sessions for virtual or in-person conferences in 2021 and 2022 in a number of countries.

The Aquatic Veterinarian is meant to be read as a 2-page spread (like a paper magazine!). To view it this way on your computer, open the pdf document using Adobe Acrobat or Adobe Reader, then go to the menu bar at the top of the computer screen and click on View, then Page Display, then Two Page View. That will allow you to scroll through the issue seeing the cover page by itself first, followed by two pages side by side for the rest of the issue. Doing this, you will be able to see the Centerfold picture in all its ginormous glory!



- Modernized the "look" and functions of the WAVMA website and membership database that will be live shortly;
- Finalized plans for a WAVMA 2020 Annual General Meeting on November 7, that will include presentations by leading aquatic veterinarians (for which participants can earn CE credits), from students about what they have done to get experience in aquatic veterinary medicine, and ending up with updates from Board members about WAVMA progress and programs;
- Upgraded the WAVMA webinar system to allow up to 500 individuals to participate, and has plans for a few more 2020 WebCEPD webinars so members can earn continuing education and professional development credit from attending;
- Made six 2020 Pitt's Awards to support veterinary students or new graduates in activities that allow them to get more experience in aquatic veterinary medicine;
- Approved new Student Chapters at the University of Pennsylvania, University of California, School of Veterinary Medicine and the University of Edinburgh, Royal (Dick) School of Veterinary Studies;

We encourage members to provide feedback to the Executive Board on any of these, or other issues you feel the Board might like to consider.

A. David Scarfe PhD, DVM, MRSSAf, CertAqV
WAVMA Secretary
Secretary@wavma.org

Treasurer's Report**New Members—Third Quarter 2020**

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

Veterinarians

Zackarias Gardenfors
Camilo Bulla
Cristina Cardetti
Jessica Keen
Jennifer Schori
Kenya Crawford
Sarah Murphy
Scott Hammer
Thirumurugan Rajarathanam
Alexandra Troiano
Chelsea Anderson
Wren Abbott
Toby Lowry

Veterinarian—New Graduate

Morag Clinton
Jan Clyden Tenorio

Vet Graduate Student, Intern or Residents

Metin Olemin
Ahmed Elkesh
Nurhan Ayikol
Lakshmi Sastry

Vet Student Members (enrolled in Vet Curriculum)

Isabelle van Klaveren
Sari Stein
Victoria Fairman
Nichole Thomas
Emily Flaherty
Heather Gosnell
Chloe Hoerner
Chloe Childress
Dylan Wilson
Onur Dincer
Natalia Hofmann
Alanna Goldy
Ashley Myers
Kailyn Thomas
Isabella Grainger
Simran Bajwa
Allison Williams
Mason Lichliter
Hanna Millar
Ryan Leder
Kelsey Hank
Alexandra Watkins
Ewan Allan
Rebekah Handran
Madelaine Steevens
Lydia Gerrard
Kaitlyn Trail

Jessica Navarro
Katrina Tsang
Shan Wei Ngan
Charles Stewart-Bates
Hyo Jin Jeon
Marie Crowe
Annie Kim
Olivia Norman
Michelle MacPherson
Sydney Tejml
Olivia Roberts
Kathryn Bradley
Emma Norris
Ariana Abreu Salvatore
Fiona Sykes
Kristina Liang
Lyann Yeung
Elizabeth Martinez
Lindsay Martin
Kristen Deignan
Justin Hoffman
Lauren Kisley
Jordan Bujold
Anne Szcotka
Laura Martinelli
Hannah Hipkiss
Brianna Laing
Ana Griefen

Affiliate Members (Non-veterinarian)

Michael Sandel
Diane Elliott

Welcome to WAVMA!

Nick Saint-Erne, DVM CertAqV

WAVMA Treasurer
Treasurer@WAVMA.org

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>

WAVMA Elections

The positions of President-Elect, Secretary, Treasurer, and the four Regional Directors are up for election each year. We rely on our veterinarian members to run for positions on the Executive Board to help keep the organization moving forward. The Executive Board meets monthly via web conferencing and we have had board members from all around the world. It doesn't matter where you live—only that you are willing to help out! The Nominees for the 2021 Executive Board will be released soon on the new WAVA.org website. Watch for details there. For more information, contact our Administrator, Chris Walster: Administrators@WAVMA.org.

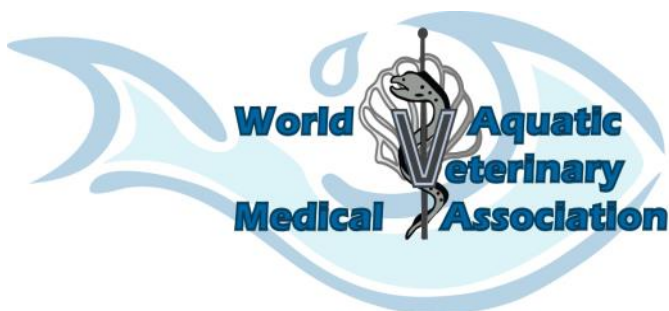
Join A WAVMA Committee

All of the great programs and features you get from WAVMA membership are provided by volunteers. We are always looking for more helpers, whether veterinarians, veterinary students or veterinary nurses, to join us on the committees. If you are not interested in running for office, but would like to provide your input and guide the future of WAVMA, join one of our committees (no previous experience necessary!). See a list of our committees on page 10. Contact our Secretary or the committee chair for more information about the committee and the dates of the next meeting (also done via web conference). All are Welcome!

Join a WAVMA Committee today!

Executive Board Responsibilities

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



WAVMA Fellows Council Report

A new process of nomination and selection of WAVMA Distinguished Fellows was proposed to the Executive Board by the Fellows Council. Calls for nominations for WAVMA Distinguished Fellows will be launched every year in October and close at the end of April. Any member can nominate another member, and self-nominations are accepted. The current Fellows will review the nominations and propose candidates for Fellowship. Selected candidate(s) become Fellows after approval by the Executive Board.

Calls for 2021 nominations are now open. All members are invited to nominate a colleague to be considered as a future WAVMA Fellow. Self-nominations will also be accepted, but all nominations must be submitted by using the form available from [the WAVMA website](#), by 30th of April 2021.

The nomination form should highlight, in up to 250 words, the nominee's contributions to aquatic veterinary medicine in any of the following areas:

- Academia / Industry
- The advancement of clinical practice of aquatic veterinary medicine
- Significant contributions to WAVMA and its mission
- Any other area considered relevant by the nominator

Eligibility to become a WAVMA Fellow includes:

- Being a WAVMA Member in good standing
- An acknowledgement from the nominee that they are prepared to contribute to the Fellowship Advisory Council.

The Fellowship Advisory Council will review the nominations received and submit the names annually to the Executive Board for consideration as a Fellow.

Laura Urdes

Chair of the Fellows Advisory Council

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 SCHOLARSHIPS, PLEASE MAKE
 A DONATION TODAY
 TO THE SCHOLARSHIP FUND!
[WWW.WAVMA.ORG/
 SCHOLARSHIPS](http://WWW.WAVMA.ORG/SCHOLARSHIPS).**

WAVMA 2020 Annual General Meeting

Saturday 7th November 2020, 12:00 to 17:30 UTC

www.wavma.org/agm

The WAVMA Annual General Meeting – WAVMA Members Only 16:30-17:30 UTC

Will be held after the WAVMA Conference presentations are over
(See page 42 for the WAVMA Conference Presentations).

Executive Board Presentations

Officers Reports:

- **Jena Questen, President**
 - Welcome and General Comments
 - Summary of 2020 WAVMA activities
- **Devon Dublin, Past President**
 - Progress to Date and Future Directions
- **Stephen Reichley, President-Elect**
 - Vision for 2021
- **Nick Saint-Erne, Treasurer**
 - Financial update
- **Dave Scarfe, Secretary**
 - Communications update

Directors Reports: Perspectives from the region

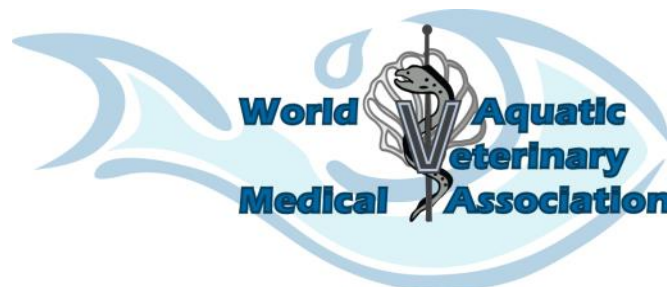
- **Nelly Isyagi**, Director for Africa and Middle East
- **Claudia Venegas**, Director for Americas
- **Stephen Pyecroft**, Director for Asia/Pacific
- **Dusan Palic**, Director for Europe

Fellows Advisory Committee:

- **Laura Urdes**, Chair
 - 2020 WAVMA Fellow Announcement

Jena Questen 2021 Executive Board Summary

- Group Photo
 - All attendees turn cameras on for a screenshot
- **Virtual Town Hall**
 - Questions and Answers led by Jena Questen



PRIVILEGES & BENEFITS OF WAVMA MEMBERSHIP

Aquatic Veterinary e-Learning

Supporting WAVMA's WebCEPD, PubCEPD
 CertAqV & Clinical Cases Programs.

- Enjoy on-line *e-Learning* programs & courses to advance your knowledge & skills
- Get continuing education credit through *WebCEPD, PubCEPD & Clinical Corner*
- Discover core knowledge, skills & experience needed to become a WAVMA Certified Aquatic Veterinarian (*CertAqV*)
- Receive *discounted* subscriptions to publications & meetings
- Utilize WAVMA's *picture & video libraries* for your own presentations
- Join *listservs* to discuss clinical cases & other issues
- Mentor & be mentored to expand your and other's aquatic veterinary skills
- Publish your articles in WAVMA's quarterly journal: *The Aquatic Veterinarian*
- Find world-wide externships, internships, residencies & jobs in all aquatic vet areas
- Access *Member Directories* & have your Clinic/Hospital listed on-line
- Benefit from *Educational grants* for vet students & new veterinary graduates
- Form & participate in *veterinary school chapters* throughout the world
- Participate in veterinarian and client surveys
- Help build additional member programs by serving as an Officer, Director or Committee Member

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 SCHOLARSHIPS.](http://WWW.WAVMA.ORG/SCHOLARSHIPS)

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.

Budget and Finance Committee

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

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

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

Communications Committee

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

Chair: David Scarfe, 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: David Scarfe, dscarfe@ameritech.net

Meetings Committee

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

Chair: Julius Tepper, cypcarpio@aol.com

Membership Committee

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

Education & Student Committee

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

Chair: Bartolomeo Gorgoglione, BartGorg@msu.edu

Fellows Advisory Council

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

Our WAVMA Distinguished Fellows are:

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

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

A Fellows' Council meeting took place on 08 August 2020, with six Fellows attending this meeting. The following items were discussed:

Distinguished Fellow Election Protocol - final preparations for review of the nomination form, program description and the invitation to nominate was carried out with the Fellows present at the meeting. To aid with the selection of nominees, the criteria which will be used to assess candidates were reviewed and accepted as guidelines to be used.

The call for 2021 Fellow nominations, ending on 30 April 2021, was launched via WAVMA Members-L and social media. By the set deadline, the call will be promoted further by other means of communication e.g., on the Fellows webpage, the TAV, e-News, WAVMA's Twitter, FB and LinkedIn. The program opening will also be announced at the AGM in November 2020.

Laura Urdes represents the Fellows Advisory Council with the Executive Board. Please contact Laura with questions or suggestions, at laurau_2005@yahoo.com.

Laura Urdes, DVM PgDip PhD CertAqV
 Fellows Advisory Council Chair

Meetings Committee

It is with great pleasure that the Meetings Committee announces our first virtual conference to take place Saturday 7th November 2020, 12:00 to 16:30 UTC. This event, composed of two sessions, is organized by an ad-hoc committee, including Dr Bartolomeo Gorgoglione, Dr Chris Walster, and led by Dr Julius Tepper. The first session is open to the public, upon registration. See page 42 for more information.

Highlights will be talks titled "Current advances in diagnostics and treatments of farmed fish" by Meritxell Diez-Padrisa; "Current advances in diagnostics and treatments of ornamental fish" by Dr. Gregory A. Lewbart; and "What whales and dolphins can tell us about the health of our oceans - an overview of research from the Eastern Cape, South Africa" by Dr. Stephanie Plön.

A delegation from the largest WAVMA Student Chapter, from The Ohio State University, will highlight their activities and the benefits available to WAVMA students. Three short talks will be given by John L. Pitts Aquatic Education Awardees, including Elizabeth St. Germaine, Laura Krogman and Sarah Wright.

Following this program will be the WAVMA Annual General Meeting Discussion, open only to WAVMA Members, from 16:30-17:30 UTC. Please join us for this great meeting!

The Koi Practitioners Working Group is pleased to announce its third annual session (KoiPrax3), that will take place 21 March 2021 in Warsaw, Poland. KoiPrax 3: "Koi Ulcer Disease and Aeromonas species: Current Clinical Presentations, Diagnostic Resources and Treatments." Date: 21 March 2021 Time: 08:00 – 17:35 Place: Room D – Pavilion 4.

This full day meeting will feature speakers that are at the forefront of research on bacterial diseases of koi. Our honored keynote speaker will be Verena Jung-Schroers. Fees: WAVMA members: free of charge – registration required; Non-WAVMA members: 100 EUROS. Please contact me for reservations.

Verena Jung-Schroers is a specialized veterinarian in fish diseases working at the Fish Disease Research Unit of the University of Veterinary Medicine in Hannover, Germany. She is the leader of the ECAAH (European College of Aquatic Animal Health) approved training centre of the Fish Disease Research Unit in Hannover. Verena Jung-Schroers is involved in many research projects of different topics, like microflora and bacteriology, welfare of aquatic animals, and fish and shrimp and virology.

Julius M. Tepper, DVM, CertAqV
 Meetings Committee Chair
dvm2468@gmail.com



WAVMA Member Receives 2020 Veterinarian of the Year Award

During the Washington State Veterinary Medical Association's October 2–4, 2020 Pacific Northwest Veterinary Conference, **Dr. Brian Joseph**, State Veterinarian at the Washington State Dept. of Agriculture, Olympia, WA, received the 2020 Veterinarian of the Year Award.

The award is presented in recognition of an outstanding career in veterinary medicine and contributions made to their practice, stakeholders, and other service directly benefitting their community. Dr. Joseph is an exceptional and compassionate leader with an esteemed career in many facets of veterinary medicine, including aquatic and zoo medicine, agriculture, and as a leader in the U.S. Army Reserve Veterinary Corp. His depth of knowledge combined with his incomparable character has inspired the men and women under his leadership, led to the improved health of animals and the public, and has positively impacted the many communities he's served.

As Washington's "State Veterinarian," he not only works to prevent animal disease and protect food safety, but inspires many within the veterinary community and the public. He is currently an active member of the World Aquatic Veterinary Medical Association's Credentialing Committee that evaluates and certifies veterinarians that have the core (Day-1) knowledge, skills and experience to practice aquatic veterinary medicine.

WAVMA Shop

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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, in the following 9 core subject matter areas:

1. Aquatic Environment and Life Support Systems
2. Taxonomy, Anatomy and Physiology
3. Husbandry and Industries
4. Pathobiology and Epidemiology of Aquatic Animal Diseases
5. Diagnostics and Treatment of Aquatic Animal Diseases
6. Clinical Veterinary Experience and Client Communications
7. Public Health, Zoonotics and Seafood Safety
8. Legislation, Regulations, and Policies
9. Principles of Aquatic Animal Welfare

For CertAqV Program Description [Click here](#) to download, or go to WAVMA.org/CertAqV-Pgm.

Individuals who desire to participate in the WAVMA CertAqV Credentialing Program will first need to register and pay the US\$250 administrative fee. When registering you will select a mentor to assist and guide you through the requirements. After you have registered, you will receive an e-mail on how to download a document to record where you have obtained sufficient KSEs (knowledge, skills and experience/education) in each of the 9 modules or subject areas. You have up to 2 years to complete these.

When your mentor is satisfied you have sufficient KSE credits, he/she will request the WAVMA Credentialing Committee to evaluate these. Once the Committee and the WAVMA Executive Board have evaluated these and are satisfied you meet all requirements, you will be notified and mailed a certificate suitable for framing and display.

Congratulations to the following Veterinarians who have qualified recently to become Certified AqV:

Christa Barrett
 Mariah Beck
 Katharine Haussman
 Robert Martinez
 Sonja Miles
 Norrapat Towanabut

There are an additional 64 members in the process of becoming Certified Aquatic Veterinarians.

A. David Scarfe PhD, DVM, MRSSAf, CertAqV
 WAVMA CertAqV Program Coordinator
 Credentialing Committee Chair
CertAqV-Admin@wavma.org

Certified Aquatic Veterinarians

Jessica Allen	USA
June Ang	Singapore
Nimrod Arad	USA
Farah Gonul Aydin	Turkey
Sarah Balik	USA
Madison Barnes	St. Kitts & Nevis
Christa Barrett	USA
Heather Barron	USA
Giana Bastos-Gomes	Hong Kong
Mariah Beck	USA
Jenice Bell	USA
Heather Bjornebo	USA
James Bogan	USA
Pierre-Marie Boitard	France
Serena Brenner	USA
Erika Brigante	St. Kitts & Nevis
Todd Cecil	USA
Bryony Chetwynd-Glover	UK
Dondrae Coble	USA
Michael Corcoran	USA
Emily Cornwell	USA
Rebecca Crawford	St. Kitts & Nevis
Charles Cummings	USA
Nadav Davidovich	Israel
Darren Docherty	UK
Simon Doherty	UK
Devon Dublin	Japan
Jacqueline Elliott	USA
Ashley Emanuele	USA
Azureen Erdman	USA
Antonella Fabbrissin	Italy
Mohamed Faisal	USA
Erika First	USA
Ari Fustukjian	USA
Christopher Good	USA
Bartolomeo Gorgoglione	USA
Krystan Grant	USA
Miguel Grilo	Portugal
Stephanie Grimmett	UK
Katharina Hagen-Frei	Switzerland
Katharine Haussman	USA
Orachun Hayakijkosol	Australia
Eileen Henderson	USA
Chelsea Hester	USA
Nora Hickey	USA
John Howe	USA
Kerryn Illes	New Zealand
Leslie Jarrell	USA
Jimmy Johnson	USA
Sharmie Johnson	USA
Kasper Jorgensen	Denmark
Brian Joseph	Canada
Parinda Kamchum	Thailand
Fritz Karbe	Germany
Sherri Kasper	USA
Elizabeth Kaufman	Israel
Denyse Khor	Singapore
Amy Kizer	USA
Jessica Koppien-Fox	USA
Jack Kottwitz	USA
Elizabeth Leuchte	UK
Jan Linkenhoker	USA
Eric Littman	USA

Richard Lloyd	UK
Richmond Loh	Australia
Adolf Maas	USA
Raphael Malbrue	USA
David Marancik	Grenada
Victoria Maroun	St. Kitts & Nevis
Robert Martinez	USA
Alexandra Mason	USA
Colin McDermott	USA
Matthijs Metselaar	UK
Sonja Miles	UK
Tim Miller-Morgan	USA
Haitham Mohammed	Egypt
Alissa Mones	USA
Danny Morick	Israel
Ross Neethling	UK
Sally Nofs	USA
Massimo Orioles	Italy
Dušan Palić	Germany
Brian Palmeiro	USA
Christine Parker-Graham	USA
Lily Parkinson	USA
Ayanna Phillips	Trinidad & Tobago
Jena Questen	USA
Eva Quijano Cardé	USA
Atisara Rangsichol	Thailand
Zachary Ready	USA
Aimee Reed	USA
Stephen Reichley	USA
Nuno Ribeiro	Portugal
Patinan Rookkachard	Thailand
Komsin Sahatrakul	Singapore
Nick Saint-Erne	USA
Jessie Sanders	USA
Sasha Saugh	South Africa
David Scarfe	USA
Khalid Shahin	UK
Galit Sharon	Israel
John Shelley	USA
Chris Shirkey	USA
Constance Silbernagel	USA
Melissa Singletary	USA
Esteban Soto	USA
Brittany Stevens	USA
Win Surachetpong	Thailand
Gillian Taylor	South Africa
Julius Tepper	USA
Sharon Tiberio	USA
Norrapat Towanabut	Thailand
Laura Urdes	Romania
Greta Van de Sompel	Belgium
Claudia Venegas	Chile
Zachary Waddington	Canada
Sarah Wahlstrom	USA
Chris Walster	UK
Scott Weber	USA
Marcus Webster	USA
Trista Welsh	USA
Michael Wenninger	USA
Peter Werkman*	Holland
David Wilbur	USA
Howard Wong	Hong Kong
Sarah Wright	USA
Taylor Yaw	USA
Irene Yen	St. Kitts & Nevis

Communications Committee

Social Media Update:

The photo album on the WAVMA Facebook page was updated with images of the multilingual membership brochures. I have boosted this post (created a paid advertisement) to help generate more reach and interaction.

In addition, I have scheduled posts every Sunday for the next 6 Sundays highlighting each different language brochure. As the post with each brochure (ex. French, German, Italian, etc.) is posted on the Facebook page, I will make it an ad targeted for the countries that have the language as an official language.

The process of scheduling a post to the Facebook Page is very quick and easy to do. My typical process is when I come across an article or another topic of interest, I schedule a post on the WAVMA Facebook page. You'll notice in doing so, the page has posted something on almost a daily basis - I have a queue of 13 posts. This constant activity on the WAVMA Facebook page is important to drive page "likes" and "followers" - people who will see future posts and become aware of WAVMA and our activities. This approach to posting, along with some other things I do, has increased our page followers to 8,294. That is 1,671 new followers year-to-date. Here is the link to the WAVMA Facebook page:

<http://www.facebook.com/WAVMA>

If you have any questions or would like to discuss the WAVMA Facebook Page or Facebook Group more please let me know. Also, if you come across something you think should be posted on the WAVMA Facebook Page, please email me the link.

Stephen Reichley

stephen.reichley@gmail.com

First webinar in collaboration between WAVMA and EAFP: 'Main infectious diseases of marine fish' Bull. Eur. Association of Fish Pathol., 40(4) 2020

S. Zrnčić 1, A. Toffan 2, B. Gorgoglione 3

1 Croatian Veterinary Institute, Zagreb, Croatia;

2 Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro, Italy;

3 Michigan State University, East Lansing, MI, USA

On 27th of July 2020 a free webinar entitled "Main infectious diseases of marine fish" was delivered worldwide thanks to a collaborative effort between the EAFP and the World Aquatic Veterinary Medical Association (WAVMA). The 2-hour webinar was given by Dr. Anna Toffan and Dr. Snježana Zrnčić. They offered a comprehensive review of recent knowledge on the most important diseases threatening global marine aquaculture, and bottlenecks for further development of marine aquaculture.

The webinar was organised and moderated by the Chair of the WAVMA Education and Students Committee, Dr. Bartolomeo Gorgoglione with the technical assistance provided by Chris Walster, from the UK, as the WAVMA Administrator. This first joint webinar generated an astonishing audience, with 432 people registered and 230 attending it live. Furthermore, the lectures raised great interest among listeners, with up to 70 questions and comment messages received from attendees from all around the world.

The webinar will remain available through the WAVMA website (www.wavma.org/Webinars/b-1036-main-infectious-diseases-offarmed-marine-fish). We hope that this first EAFP-WAVMA webinar could foster a series of new initiatives in collaboration between the two associations.

Multilingual Membership Brochure Ad Activity: 5 July 2020 – 21 August 2020

Brochure	Reach (number of people who saw ad at least once)	Engagements (reactions, comments, shares, clicks on image)	Cost
All – ad for Album	10,314	3,245	\$10
French	42,210	4,081	\$10
German	1,496	41	\$6
Italian	1,786	48	\$6
Portuguese	13,756	1,883	\$6
Romanian	2,335	116	\$6
Spanish	56,112	874	\$10
TOTAL	128,009	10,288	\$54

Education & Student Committee

The WAVMA ESC has been working during the summer with the support of two sub-committees. I'm happy to announce the establishment of our newest Student Chapter, approved in September, at the Veterinary School of the University of Pennsylvania (see page 16).

ESC is reviewing the current plan for money that could be annually given to student chapters, optimising the process from the request to the money disbursement. We have received concerns from many Student Chapters about issues they are having due to the current pandemic situation. It is our intention to keep supporting them and we hope activities can return to normality soon. Please forward to us any Student Chapter updates.

The ESC sub-committee led by Dominik von La Roche is currently editing a new leaflet with instructions for keeping active WAVMA Student Chapters. The ESC sub-committee on Students and Resources, led by Eva Marie Quijano Cardé, is starting a new initiative, a student panel to connect WAVMA students to allow networking and discussing about externships and other learning opportunities.

During this summer we have restarted the WebCEPD series. Following Diane Elliott's event on 22th June, on 27th July the first joint WAVMA-European Association of Fish Pathologists (EAFP) webinar was held. The 2 hour webinar was given by Dr. Snježana Zrnčić from Croatia and Dr. Anna Toffan from Italy. All these new webinars are now available to be watched for free through the new WAVMA website, but CEPD credits can be achieved following the guidelines provided. Two upcoming WebCEPD webinars are scheduled with the WAVMA AGM on 7 November, by Meritxell Diez-Padrisa and by Dr. Gregory A. Lewbart. These webinars will also remain available on our website and will qualify to grant CEPDs. Once more I would like to invite more WAVMA members to join the Education & Student Committee.

Dr. Bartolomeo Gorgoglione

Chair of Education &
Student Committee

BartGorg@msu.edu



New Advantages for WAVMA Members!

Get new discounted or free learning opportunities through the online educational programs offered by "[The Aquarium Vet](#)"!

All WAVMA members can claim a **15% discount** to attend [The Aquarium Vet E-quarist course](#)[™]. This is the first online course providing aquarist education, suitable for veterinarians and veterinary technicians to increase knowledge in aquatic animal medicine. Each of the first five modules is approved for 15 hours of continuing education credit in jurisdictions that recognize RACE approval (total 75 hours). Please contact [Katrina Campbell](#) to obtain your unique WAVMA member coupon code!

WAVMA Student members get **free registration** to the **Aquarium Vet webinars**. These one-hour live webinars occur every two months in three different time zones and cover an array of topics related to aquatic animal medicine.

Save the date for the next 2020 webinars, on 14th October, and 9th December. WAVMA Students must register in advance. People registered for the Aquarium Vet E-quarist course also have free access to the bi-monthly webinar series.

Please visit [The Aquarium Vet website](#) to learn more about [The Aquarium Vet E-quarist course](#)[™] and for the upcoming webinars.



New WAVMA Student Chapter
University of Pennsylvania
School of Veterinary Medicine

After noticing a lack of aquatic education in our curriculum and a general lack of resources for students that are interested in aquatic veterinary medicine, we decided to start a student chapter of WAVMA. Attending a few marine mammal-related talks last year made it evident that our classmates were interested in learning more about aquatic animals, so we plan to bring those educational opportunities to them from now on! We are excited to learn more about aquatics along with our peers as we host virtual lectures and we can't wait to schedule necropsies, wet labs, and volunteer work when it's safe to do so again. We're excited to be a part of WAVMA!

Thank you,
Josie Thal
WAVMA Chapter President
jet97@vet.upenn.edu
VMD Candidate, University of Pennsylvania
School of Veterinary Medicine



Brianna Laing, Vice President



Lindsay Martin,
Social Chair



Left:
Justin Hoffman,
Treasurer

Right:
Lakshmi Sastry,
Secretary

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](#).

PROGRAMS AVAILABLE TO STUDENT CHAPTERS:

- Assistance in organizing and promoting Chapter programs and activities.
- 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.
- Reduced rate (50% off) WAVMA Full Membership the year after graduation.
- John L. Pitts Aquatic Veterinary Education Awards Program
- Access to WAVMA member-only programs.
- Aquatic veterinary externship and job listings.
- WAVMA promotional flyers, brochures and other materials for distribution to other students.
- Free or discounted registration for WAVMA meetings, conferences or educational webinars.
- Participation in the WAVMA Certified Aquatic Veterinarian (CertAqV) Credentialing 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.



Instructions for Authors and Contributors

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

Colleague's Connection

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

Peer-Reviewed Articles

Original research or review of any aquatic veterinary topic. Articles will be reviewed by 3 veterinarians and comments and changes referred back to the author prior to publication. The text for an article begins with an introductory section and then is organized under the following headings:

- Materials and Methods
- Results
- Discussion (conclusions and clinical relevance)
- References (cited in the text by superscript numbers in order of citation).

Clinical Cases

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

Book Reviews

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

Publication Abstracts

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

News and Views

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

Legislative & Regulatory Issues

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

Meetings and Continuing Education and Professional Development (CE&PD) Opportunities

Description or synopsis of upcoming aquatic veterinary or (veterinarian-relevant) non-veterinary in-person or on-line educational meetings noting the meeting title, dates, location, and contact person or website.

Jobs, Internships, Externships or Residencies

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

Advertising

See advertising rates on page 4.

Please send articles, clinical reports, or news items to the editor by the following submission dates:

- Issue 1 – February 15 (published in March)
- Issue 2 – May 15 (published in June)
- Issue 3 – August 15 (published in September)
- Issue 4 – November 15 (published in December)

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

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

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



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Meet: Dr. Julius Tepper
Certified Aquatic Veterinarian & Bonsai Enthusiast

I suppose I've always had a casual interest in bonsai trees. As a "koi ponder" keeping the Japanese colored carp, Nishikigoi, appreciating the beauty of koi lends itself to also appreciate the beauty of bonsai.



However, it wasn't until I returned to the U.S.A. in 1976, after graduating from vet school in Belgium, that a fortuitous "find" in the garden of my parent's home got me started in the bonsai hobby. I came upon a seedling of a Japanese yew (*Taxus cuspidata*) growing amongst the impatiens. It had probably been dropped as a seed by a bird, being a small, slow-growing shrub often found in rock gardens in the New York area.

I was intrigued with the idea of training it as a bonsai, so I stopped in at a local bonsai grower in my neighborhood. The owner was very helpful and sold me a properly sized bonsai pot for my tree. She also gave me an application form to join the Bonsai Society of Greater New York, which met monthly at her store. Thus began my lifelong journey of care and learning about my bonsai trees.



Here is a 1996 photo of my first Japanese yew bonsai tree at almost 20 years of age.

The first few years saw my yew tree moving into an apartment and eventually to a private home. In the early 1990s, I decided to enter my yew tree into a show the Bonsai Society was holding and was very proud to win second place.

However, I found out that all entries after first place are awarded second place, so there are never any losers! The judge told me the tree was very healthy, but lacked any stylistic qualities. I still had much to learn.

There is a story that a newspaper reporter once interviewed one of the most renowned bonsai artists in Japan. The reporter mockingly asked the artist if he talked to his trees. The artist laughed and replied "of course not, I only listen to them!" After many years of study, I began to listen to my trees.



Photo of Dr. Tepper's Japanese Yew bonsai tree taken on October 21, 2018 by Nick Saint-Erne.

My yew tree now is 44 years old. It has reached a state of great beauty and femininity. It has been trained into the "fukinagashi" style, Japanese for "windswept". Here is a photo from this past week (September 2020).





Above: Dr. Julius Tepper with his Bonsai trees in his back yard; Long Island, New York, USA. Photo by Nick Saint-Erne (10-21-2018)

Here are a few of my other Bonsai trees:



This is a Purple Gem rhododendron in the "naegari" (exposed root) style I grew from a cutting. It is 28 years old. This picture was taken this past spring. After flowering, it was repotted into a new pot.



Here it is repotted in a delicate new pot, reflecting the gentle curves of the Purple Gem rhododendron.



*This is a Sargent juniper (*Juniperus chinensis sargentii*) trained in the "sekijoju" (root-over-rock) style. It is 8 years old.*



*Dr. Tepper's Japanese Red Maple bonsai tree.
 Photo by Nick Saint-Erne*



This is a Satsuki azalea, flowering this spring. It is 22 years old (formal upright style)

I hope to continue caring for my koi pond and Bonsai trees for many more years. I watch them age and mature as if they were my children.



Bonsai is the art of growing a plant, frequently a type of tree, in a container to make it look like a miniature version of a large tree, or even a forest of trees. Bonsai trees are grown in small containers to limit root growth, which in turn keeps the plant small. They are carefully pruned and trimmed to make them reflect the appearance of an ancient tree.

There are several recognized styles of bonsai art:

- Formal Upright (Chokkan) — straight tapered trunk pointing up with laterally spreading branches
- Informal Upright (Tachiki) — gently curving or twisting trunk, with laterally spreading branches
- Upright Broom style (Hokidachi) — straight trunk with branches pointing up, spreading like a broom
- Slanting (Shakan) — the trunk is angled at 30 degrees and branches taper toward the top of the tree
- Windswept (Fukinagashi) — The trunk is angled more than 30 degrees and the branches are on the downward side of the trunk
- Cascade (Kengai) and semi-cascade (Han-Kengai) - short, squat and abruptly tapered trunk, can be straight or curved; branches shaped to grow downward
- Literati (Bunjin) — thin, wiry, curved trunk
- Driftwood (Sharimiki) — dead branches are prominent among the foliage
- Rock Grown (Sekijoju) — the root is spread over a rock, exposing it; the stone is an important element
- Group (Yose Ue), Twin Trunk and multiple trunk — tree is pruned to have multiple trunks in the container
- Raft style (Ikadabuki) — trunk is shaped to grow horizontally



*Photos of Dr. Julius Tepper's Koi pond
and Bonsai trees on this page were taken
October 21, 2018
by Nick Saint-Erne, DVM*





*Another view of Dr. Julius Tepper's Koi Pond.
Photo by Nick Saint-Erne*



Hematologic and plasma biochemical values in nesting hawksbill sea turtles (*Eretmochelys imbricata*) on Holbox Island.

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ABSTRACT

Background: Hematologic and plasma biochemical values are important in the management of endangered species, such as hawksbill sea turtles. However, published studies on blood biochemistry and hematology of hawksbill turtles are limited.

Objectives: Establish hematologic and plasma biochemical baseline values in nesting hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean Region and compare data with other species, and life stages of hawksbill sea turtles.

Methods: Blood samples were collected from 20 healthy nesting hawksbills after oviposition. Heparinized blood was used for RBC, WBC counts, and PCV determination. Plasma biochemical concentrations were measured using an automated biochemical analyzer. The mean, standard deviation, median, and range were determined for each parameter.

Results: Minimum, maximum, and median concentrations were obtained for 20 hematologic and 13 plasma chemistry variables. Variations between this and other hawksbill studies can be attributed to geographical distribution, life stage, and physiological stage. Nesting hawksbills have similar clinicopathological data to other nesting sea turtles and reptiles.

Conclusions: Geographical location and reproductive status cause important variations in the hematological and plasma biochemical results of hawksbills. The reference values obtained in this study may be used as a standard profile in adults, useful for veterinarians involved in sea turtle medicine.

Key words: clinical chemistry, hawksbill sea turtle, hematology, reference values, reptile.

Introduction

In recent years, the interest in establishing hematological and biochemical baseline values in wildlife has increased, and currently there are many veterinary specialists who are involved in sea turtle conservation, wildlife management, and rehabilitation centers.

While blood values in wildlife provide important information about patient and population health, extrinsic and intrinsic variables must also be considered in the interpretation of blood values (Stacy and Innis, 2017). Life stages, sex, nutritional status, health, and environmental conditions influence physiological status and blood parameters in sea turtles. These values are critical for providing health indicators of the wild population, comparing other populations and species, and for use as prognostic indicators in health assessments of stranded turtles (Deem et al., 2009).

Different hematological studies have been performed in sea turtle species (Hamann et al., 2002; Santoro and Meneses, 2007; Casal et al., 2009; Deem et al., 2009; Innis et al., 2009; Caliendo et al., 2010; Goldberg et al., 2013; Lewbart et al., 2014; Flower et al., 2015; Kelly et al., 2015; Pinto et al., 2015; Coleman et al., 2016; Stacy and Innis, 2017), but only a few have provided information regarding baseline values in nesting sea turtles (Casal et al., 2009; Deem et al., 2009; Camacho et al., 2013; Goldberg et al., 2013; Stacy and Innis, 2017). However, hawksbill turtles have been scarcely studied, (Caliendo et al., 2010; Goldberg et al., 2013; Muñoz-Pérez et al., 2017).

Hawksbill sea turtles are globally distributed, with preference to tropical regions rich in coral reefs and sponges (Bjorndal, 1997). This species has global protection under CITES, Appendix I, and IUCN Red List Category of Critically Endangered, due to the decreasing population trend (IUCN, 2020). In Mexico, hawksbill turtles are under federal regulation NOM-ECOL-059-2010 and NOM-162-SEMARNAT 2012, which establishes the specifications for their protection, recovery, and management of wild populations and nesting beaches. However, there is still much to learn in terms of veterinary clinical pathology in this species.

The aim of the present study is to measure plasma biochemical and hematological values in nesting hawksbill sea turtles from Holbox Island, in order to obtain reference values that may be used for future studies, and monitoring health population in nesting hawksbills in the Mexican Caribbean Region.

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Materials and Methods

Between the months of May through June 2018, we collected 20 blood samples of clinically healthy nesting hawksbill sea turtles (*Eretmochelys imbricata*), from the nesting beach of the island Holbox, Quintana Roo, an important hawksbill nesting area in the state. The study site is located along the coast between the coordinates 21°33'42.3"N; 87°20'13.8"W and 21°35'35.8"N; 87°07'11.8"W, and covering a total length of 24 kilometers. Sampling permits and CITES permits were issued by the Secretary for Natural Resources Management in Mexico. Research methods for the Animal Care and Use permit were evaluated and approved by our local institutional Ethical Committee, at the Veterinary Medicine and Zootechnic Faculty (FMVZ), of the National Autonomous University of Mexico (UNAM). To avoid double sampling by recapture, individuals were marked with flipper tags and series numbers were registered by "Pronatura Península de Yucatan A.C."

Whole blood samples of ~5mL were collected from the cervical sinus using plastic syringes (5mL) with single-use needles (21 gauge). To avoid clotting, blood collection tubes (3mL, BD Vacutainer, EUA.) containing lithium heparin (56 USP) were used and 600 µL of blood was collected into a microtainer with polymer gel to separate the plasma from the cells (600 µL, lithium heparin, BD Microtainer PST, USA) (Campbell, 2012). Three blood smears on glass slides were prepared immediately, air-dried, labeled, and stored in a slide box (25 places, Velaquin Scientist, Mexico) until processing at accommodation facilities outside the nesting beach.

Dorsal neck region was previously wiped clean and disinfected (gauze with ethanol 70°G.L. and povidone-iodine 3%) to reduce sample contamination and health risk in the specimens. The samples were collected when the turtles returned to the sea after the egg laying process to minimize any disturbance to the nesting process. A maximum period of 10 minutes was programmed; once the time was up, the procedure was suspended to try to avoid hematological alterations caused by stress (Flower et al., 2015). In addition, a complete visual physical examination was performed, and their size was evaluated based on the curve carapace length and width. None of the nesting turtles used in this study had external lesions, and all showed normal behavior. Samples were kept with coolant gel (-4°C) in ice chests, during field work (4 to 6 hr., each night) and through transportation to the processing site.

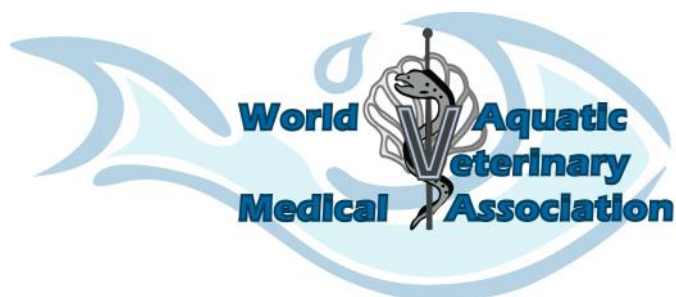
Once in the accommodation facilities, PCV, absolute counts, plasma separation and leukocyte differential were carried out immediately. PCV was determined using microhematocrit capillary tubes (Hematokrit, Kapillaren, Hirschmann Laborgerate, Eberstadt, Germany) centrifuged at 7500g for 5 minutes (PRO-12K vari-

able speed microcentrifuge, Velab, Mexico). Plasma was immediately separated by centrifuge at 2000g for 5 minutes (Minicentrifuge, C Cientif, México) in the microtainers tubes, and stored at -20°C until analysis. These portable centrifuges proved to be useful for field work on these species, since the island does not have a turtle camp with optimal facilities for laboratory equipment, and access to the nesting area is difficult. Total maximum sample size for the study was also limited due to environmental conditions.

Absolute count for RBCs and WBCs were measured with a Neubauer bright-line hemocytometer (0.100 mm x 0.0025 m², Superior, Merienfeld, Germany), using the Natt and Herrick's method (Campbell, 2012). The blood smears were stained according to the manufacturer's instructions with Diff-Quik (Hycel, México), for differential leukocyte count; Giemsa stain (Hycel, México), for hemoparasite analysis; and fixative agent (Methanol, Hycel, México) for storage and future analysis. For differential leukocyte counts, 100 leukocytes were counted (Campbell, 2012). Thrombocytes per liter of blood were estimated according to the same method. Total solids and plasma fibrinogen were measured by refractometry, using the heat precipitation method (Campbell, 2012).

Once fieldwork was finished, the samples were kept in portable coolers with coolant gel (-4°C) in ice chests for 4 hours until reaching the storage facility in the Clinical Pathology Laboratory at the Faculty of Veterinary Medicine and Zootechnic (FMVZ) of the National Autonomous University of Mexico (UNAM).

Plasma biochemical constituents were measured using an automated chemistry analyzer (Dirui CS-T240) and liquid reagent (Sekisui Diagnostics y Randox) according to the manufacturer's instructions. The biochemical analytes were as follows: glucose, uric acid, total cholesterol, triglycerides, total protein, albumin, globulins, albumin:globulin ratio (A/G), aspartate aminotransferase (AST), and glutamate dehydrogenase (GDH). The biochemical analysis included ion concentrations of calcium (Ca), phosphorus (P), sodium (Na), potassium (K), and chlorine (Cl), using a selective ion automated analyzer (Easy Lite Plus, Medica Corporations). The mean, standard deviation, median, and range were determined for each parameter.



Results and Discussion

The obtained values are summarized below in Table 1. No hematologic and biochemical variables were significantly different between individuals. To our knowledge, this is the first study of nesting hawksbill sea turtles in the Mexican Caribbean Region to report hematologic and biochemical values.

*Hawksbill sea turtle
in Saba, Netherlands
Antilles.*

Photo from Wikipedia



Table1.

Hematologic (n=20) and biochemical (n=13) results for nesting hawksbill sea turtles (*Eretmochelys imbricata*).

Analyte (Unit)	Median ± SD	Mean (Minimum–Maximum)
CCL (cm)	86.75 ± 4	86.7 (80-93)
CCW (cm)	81.65 ± 5.2	80.4 (72-90)
Hematocrit (L/L)	0.37 ± 0.05	0.38 (0.29-0.45)
RBCs (x 10 ¹² /L)	0.29 ± 0.1	0.32 (0.23-0.51)
MCV (fL)	1250 ± 291.2	1250.2 (882.4-1793.1)
Thrombocytes (x 10 ⁹ /L)	6.0 ± 1.9	5.7 (3.0-10)
Total Solids (g/L)	44 ± 5.6	44.7 (36-59)
WBCs (x 10 ⁹ /L)	2.6 ± 1.1	2.8 (1.0-5.5)
Heterophils (x 10 ⁹ /L)	1.90 ± 1.0	2.1 (0.85-4.2)
Lymphocytes (x 10 ⁹ /L)	0.49 ± 0.3	0.52 (0.09-1.27)
Monocytes (x 10 ⁹ /L)	0.05 ± 0.1	0.07 (0.0-0.28)
Eosinophils (x 10 ⁹ /L)	0.13 ± 0.1	0.16 (0.05-0.48)
Basophils (x 10 ⁹ /L)	0.0 ± 0.1	0.008 (0.0-0.03)
Fibrinogen (g/L)	1 ± 0.6	1.2 (0.0-2.0)
Glucose (mmol/L)	4.8 ± 0.8	4.7 (3.3-5.5)
Uric acid (µmol/L)	35 ± 20.2	36.3 (6.0-85)
Cholesterol (mmol/L)	4.31 ± 1.16	4.5 (2.7-6.43)
Triglycerides (mmol/L)	4.55 ± 2.4	5.0 (0.9-8.3)
Total protein (g/L)	35 ± 5.4	33.2 (24-41)
Albumin (g/L)	15 ± 2.7	14.6 (10-18)
Globulin (g/L)	20 ± 3.3	18.5 (13-24)
Albumin:Globulin ratio	0.76 ± 0.1	0.8 (0.6-1.1)
AST (U/L)	106 ± 30.7	95.2 (35-133)
GLDH (U/L)	32 ± 15.2	31.1 (6.0-68)
Calcium (mmol/L)	1.79 ± 0.7	1.9 (0.7-3.3)
Phosphorous (mmol/L)	2.08 ± 0.5	2.2 (1.7-3.3)
Sodium (mmol/L)	143 ± 2.7	142.4 (137-145)
Potassium (mmol/L)	4.9 ± 0.9	4.9 (3.4-6.3)
Chlorine (mmol/L)	113±3.9	112(103-118)

CCL, carapace curve length; CCW, carapace curve width; RBCs, red blood cells; MCV, mean corpuscular volume; WBCs, white blood cells; AST, aspartate aminotransferase; GLDH, glutamate dehydrogenase.

No seasonal trend was observed for hematologic values. Leukocyte differentials for the nesting hawksbills in our study fell within the normal range for adult female sea turtles (Stacy and Innis, 2017). We found a slightly higher percentage of WBCs, heterophils, lymphocytes, and eosinophils than in juvenile hawksbills (Caliendo et al., 2010) and slightly lower percentage of WBCs among free-ranging subadult hawksbills (Muñoz et al., 2017), which is normal given the extrinsic and intrinsic variables, such as blood collection and handling.

Plasma biochemical values are similar to those found in other studies of nesting sea turtles (Deem et al., 2006; Casal et al., 2009; Perrault et al. 2012; Goldberg et al., 2013). Levels of triglycerides, cholesterol, and proteins are higher than the reported in other life stage, sex, and species of sea turtles (Bolten and Bjorndal, 1992; Santoro and Meneses, 2007; Deem et al., 2009; Innis et al., 2009; Pinto et al., 2015). These values are likely to be elevated in nesting sea turtles due to increased protein synthesis during breeding and nesting season (Wilkinson, 2004; Goldberg et al., 2013).

It has been previously reported that female sea turtles have higher cholesterol, triglyceride, total proteins, and albumin levels than males; plasma concentrations appeared to increase over reproductive cycles, and their seasonal time frame (increases during the previous nesting stage and during nesting) (Hamann et al., 2002). This hyperproteinemia is estrogen-induced, associated with increased levels of the proteins necessary for yolk production, plasma total protein concentration returns to normal after vitellogenesis (Campbell, 2012).

In comparison with nesting hawksbills from Brazil (Goldberg et al., 2013), values of cholesterol and triglycerides were 1.6 and 2.4 times higher, respectively, than the values found in this study. Total protein, albumin, and glucose levels were found to be high as well, and these differences could be due to the variation of the diet in their geographical location. Analytes such as triglycerides, cholesterol, glucose, AST, blood urea nitrogen (BUN), calcium and phosphorus are related to the nutritional status and diet of sea turtles (Hamann et al., 2002). However, these biochemical parameters values also showed decreasing trends as the nesting season progressed compounded by limited energy reserves or resources and possible fasting in nesting turtles (Honarvar et al., 2011).

We found a slightly lower value of aspartate aminotransferase (AST) as compared to other studies of other species of nesting sea turtles (Deem et al., 2006; Casal et al, 2009; Perrault et al. 2012) and double the values reported by Goldberg et al. (2013) in nesting hawksbills in Brazil. These findings do not have a clinical significance due to the clinical sensitivity and specificity of plasmatic enzymes in sea turtles, which tends to be unspecific. Distribution of AST and ALT activity have been found in multiple tissues (Petrosky et al., 2015), and are not considered to be organ specific. Therefore, an increase in these values must be taken into consideration for the diagnosis of liver or muscle damage (Stacy and Innis, 2017).

Due to the importance of glutamate dehydrogenase (GLDH) as a biomarker of hepatic toxicity, we included the use of it in our study. Because it is not commonly offered by most veterinary laboratories, this is the first study in sea turtles that reports the values of this plasmatic enzyme. The GDLH values obtained in this study were higher than those reported for tortoises (Scope et al., 2013; López et al., 2017). Increased values of GDLH may indicate hepatocellular necrosis in reptiles (Innis and Knotek, 2020), however little is known concerning the interpretation of increased activity and baseline values of GLDH in reptiles. In a study with Hermann's tortoises (*Testudo hermanni*) over two summer seasons for characterization between gender-seasonal plasma chemistry, it was found that the increases in plasmatic enzymes such as GLDH could be related in changes of hepatic metabolism due to physiologic changes rather than hepatic damage as the reason for increasing this enzyme activity (Scope et

al., 2013).

Uric acid and electrolytes values were similar to those reported previously for this species (Wilkinson, 2004; Goldberg et al., 2013). Table 2 summarizes the median and range (minimum and maximum) values of hematologic and biochemical reported values in hawksbill turtles.

Conclusion

Given the variability of geographical location, the lack of information related to clinical pathology in hawksbill sea turtles, and the small size of sample in this study, hematologic values in other regions may be different than results for the adults of this species in this study. However, given the endangered status of hawksbill turtles, this study provides some basis for the baseline data in hawksbill turtles and an interpretation for nesting hematologic and biochemical profile. Plasma enzyme activities and biomarkers studies will be needed to elucidate the true utility of these enzymes for the diagnosis and organ-specific disease for each species of sea turtles. Little is known concerning the interpretation of increased activity and baseline values of GLDH in reptiles, and it would be of benefit for veterinarian laboratories to offer this analyte in order to improve diagnostic capacity.

Acknowledgements

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Table 2. Hematologic and biochemical values for hawksbill sea turtles (*Eretmochelys imbricata*).

Analyte (Units)	Present Study 2020	Caliendo, et al. 2010	Munoz, et al. 2017	Goldberg, et al. 2013
	Median (Minimum-Maximum)			
Sample size	20	150	8	41
Life stage	Nesting	Juvenile	Sub-adults	Nesting
Sex	Female	Unknown	Unknown	Female
Location	Holbox Island, Mexico	Persian Gulf, UAE	Galapagos, Ecuador	Barreira do Inferno, Brazil
Wild or captive	Wildlife	Captivity	Wildlife	Wildlife
CCL (cm)	86.7(80-93)	11.8	56.8 (41-82)	82.2
CCW (cm)	81.65(72-90)			
Hematocrit (L/L)	0.37(0.29-0.45)	0.19(0.10-0.24)		0.40(0.34-0.44)
RBCs (x 10 ¹² /L)	0.29(0.23-0.51)		0.35(0.17-0.48)	
MCV (fL)	1250(882.3-1793.1)			
Thrombocytes (x 10 ⁹ /L)	6(3.0-10)			
Total Solids (g/L)	44(36-59)		43(36-51)	
WBCs (x 10 ⁹ /L)	2.6(1.0-5.5)	2.3(1.3-4)	5.31(1.76-12.76)	
Heterophils (x 10 ⁹ /L)	1.9(0.85-4.2)	1.74(0.5-3.9)		
Lymphocytes (x 10 ⁹ /L)	0.49(0.09-1.27)	0.36(0.1-1.1)		
Monocytes (x 10 ⁹ /L)	0.05(0.0-0.28)	0.05(0.0-0.3)		
Eosinophils (x 10 ⁹ /L)	0.13(0.05-0.48)	0.03(0.01-0.08)		
Basophils (x 10 ⁹ /L)	0.0(0.0-0.03)	0.01(0.0-0.03)		
Fibrinogen (g/L)	1(0.0-2.0)			
Glucose (mmol/L)	4.8(3.3-5.5)	5.1(3.8-8.5)		5.3(4.0-7.1)
Uric acid (µmol/L)	35(6.0-85)	71(30-137)		53(37-77)
Cholesterol (mmol/L)	4.3(2.7-437)			7.1(5.8-10.2)
Triglycerides (mmol/L)	4.5(0.9-8.3)			11(7.8-17.3)
Total protein (g/L)	35(24-41)	26(14-38)	48(40-58)	56(43-67)
Albumin (g/L)	15(10-18)	13(5-20)		21(13-28)
Globulin (g/L)	20(13-24)	15(5-23)		33(27-40)
Albumin:Globulin ratio	0.76(0.6-1.1)			
AST (U/L)	106(35-133)	152(46.5-656.5)	196(117-296)	55(42-69)
GLDH (U/L)	32(6.0-68)			
Calcium (mmol/L)	1.79(0.7-3.3)		1.09(0.94-1.32)	2.9 (2.3-3.65)
Phosphorous (mmol/L)	2.08(1.7-3.3)			3.6 (2.7-4.5)
Sodium (mmol/L)	143(137-145)		157(154-160)	140 (132-145)
Potassium (mmol/L)	4.9(3.4-6.3)		4.2(3.6-4.7)	
Chlorine (mmol/L)	113(103-118)			

CCL, carapace curve length; CCW, carapace curve width; RBCs, red blood cells; MCV, mean corpuscular volume; WBCs, white blood cells; AST, aspartate aminotransferase; GLDH, glutamate dehydrogenase.

All studies have a high variability in geographical location, but the interpretation of hematologic concentrations follows standard principles in reptiles.

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Histopathology and Polymerase Chain Reaction Diagnosis for Lung Phaeohyphomycosis in a Free-Ranging Hawksbill Sea Turtle (*Eretmochelys imbricata*)

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Abstract

An adult female hawksbill sea turtle (*Eretmochelys imbricata*) was stranded, found dead in Puerto Morelos Reef National Park, Quintana Roo, Mexico, and submitted for necropsy. During necropsy, the lungs presented significant pathological alterations, including multifocal to coalescing granulomas. Nodules 0.1-2.0 cm in diameter were observed throughout the pulmonary parenchyma that revealed caseous pale yellowish content when sectioned; histopathological evaluation revealed chronic inflammatory processes with intralesional fungal hyphae consistent with Grocott positive fungal structures. A Polymerase Chain Reaction (PCR) targeting Internal Transcribed Spacer (ITS) regions of fungi revealed *Cladosporium cladosporioides* as the causal agent. Identification of the fungal infection causing phaeohyphomycosis is important for accurate diagnosis, treatment, study of epidemiological impacts, and potential risk factors of these and other fungal diseases in sea turtles.

Key words: *Cladosporium cladosporioides*; phaeohyphomycosis; fungal disease; hawksbill turtle; pulmonary necrotizing granulomas; sea turtle.

Understanding causes of mortality is fundamental for any conservation and protection program; epidemiological study in causes of stranding and mortality provide useful information for identifying diseases, threats, recovery, and sustainability of these species in a given region.¹

Both fungi genera (melanized and non-melanized) have been reported in sea turtles, fungal infection diseases are commonly found in stranded sea turtles as a secondary infection due to chronic debilitation, crowding, cold stunning, trauma, or any other stressor that leads into immunosuppression of the individual, acting as opportunistic pathogens.²⁻⁷ Phaeohyphomycosis is a fungal disease characterized by the presence of pigmented septate hyphae caused by several genera of fungi that contain high levels of melanin within the cell walls, identified as melanized fungi.^{6, 8, 9} The frequency of reporting and diversity of etiologic agents involved have increase with time, especially in immunocompromised and immunocompetent individuals.^{2, 3, 6, 7} These fungi are typically found in the environment and introduced through inhalation or trauma.^{2, 5, 6, 9} The fact that they are common environmental flora poses a diagnostic dilemma in cases where fungus was extracted from external body surface or nonsterile site, e.g., skin, carapace, oral, or cloacal mucosa.⁴

The aim of this report is to describe the morphologic, histopathology, and molecular findings in a female hawksbill sea turtle (*Eretmochelys imbricata*) with a severe granulomatous inflammation in the lungs in order to document the occurrence of fungal infection diseases in free-ranging sea turtles, and monitoring health population of hawksbills (*E. imbricata*) in the Mexican Caribbean Region. To date, and to our knowledge, this is the first case of phaeohyphomycosis due to *Cladosporium cladosporioides* to be reported in hawksbill sea turtles (*E. imbricata*).

During the month of July, 2018 in the stranding patrol across the Northeast Region of Quintana Roo, Mexico, a stranded dead female adult hawksbill turtle was reported by a citizen to the Puerto Morelos Reef National Park rangers. The bloated carcass was found at the surface near Petempich Bay (20°55'43.7"N; 86°50'17.4"W), on the shoreline and retained by sargassum and seagrass. Due to the environmental conditions and logistical restrictions of the area, it was necessary to perform a necropsy in the field.

Sampling permits were issued by the Secretary for Natural Resources Management in Mexico and approved by the Director of Puerto Morelos Reef National Park. Research methods for the Animal Care and Use permit were evaluated and approved by our local Institutional Ethical Committee, at the Veterinary Medicine and Zootechnics Faculty (FMVZ).

Post-mortem inspection revealed that the turtle was debilitated, with a low body condition (2/5), contained a few examples of epibionts of the genus *Balanus sp.* randomly distributed in the dorsal carapace region, detachment of dorsal and ventral scutes from the carapace, absence of the head, and a deep laceration in the left ventral region of which a section of the small intestine was exposed to the environment. The specimen had 75.5 cm of curved carapace length, and 69.8 cm of curved carapace width.

Due to the high degree of decomposition, significant gross lesions were restricted to lung parenchymal nodules of 0.1-2.0 cm in diameter in both lungs (with the left lung the more affected) (Fig.1), with firm consistency, brownish-gray external coloration with a white central circular area.



Figure 1

Figure 1. Pulmonary granuloma (resected parenchyma), left lung, hawksbill sea turtle. Lung parenchymal nodules of 1.7 and 2.0 cm in diameter.

The sectioned surfaces of all nodules revealed caseous content, with a well-defined concentric circular area of white-yellowish coloration. Fragments of the lung parenchyma with nodulation (≤ 5 g) were fixed by immersion in 10% buffered formalin and others (≤ 2 g) were preserved under freezing (-20°C).

Once fieldwork was finished, the samples were kept in portable coolers with coolant gel (-4°C) in ice chests for 4 hours until the storage and analysis in the Clinical Histopathology Laboratory at the Faculty of Veterinary Medicine and Zootechnics (FMVZ) of the National Autonomous University of Mexico (UNAM). In all samples, we followed validation procedures for quality control in our laboratory under the NOM ISO 9001: 2015.

Lung sections analyzed under microscope showed alveoli cells presenting a high state of autolysis. Most of the pulmonary parenchyma was observed compressed by a circular area delimited by a large amount of cellular debris with concentrically arranged amorphous eosinophilic material surrounded by a fibrous connective tissue (Fig. 2a, b). To detect the presence of fungal agents, histological sections were examined by Grocott-Gomori's Methenamine Silver stain, which allowed the observation of few septate fungal Grocott positive structures (Fig. 2c, d).

Such lesions evidenced a chronic inflammatory process due to fungal infection, with a morphological diagnosis of severe focal granulomatous pneumonia and inflammatory reactions associated with intralesional brown pigmentation within the cell walls of the hyphae elements (Grocott positive fungal structures). The paraffin block with formalin fixed tissue was sent to the Molecular Pathology Laboratory of the FMVZ-UNAM, for molecular identification.

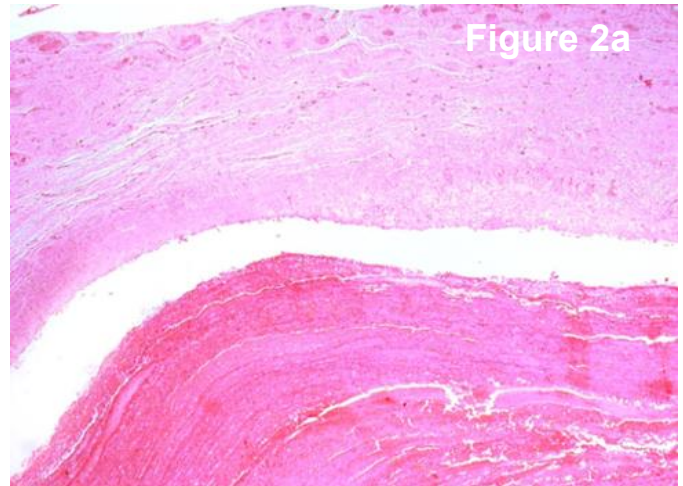


Figure 2a

Figure 2. Pulmonary necrotizing granuloma, lung, hawksbill sea turtle. (a) Necrotizing granuloma, large amount of cellular debris and eosinophilic material surrounded by concentric fibrosis at 100x. Hematoxylin-eosin (HE).

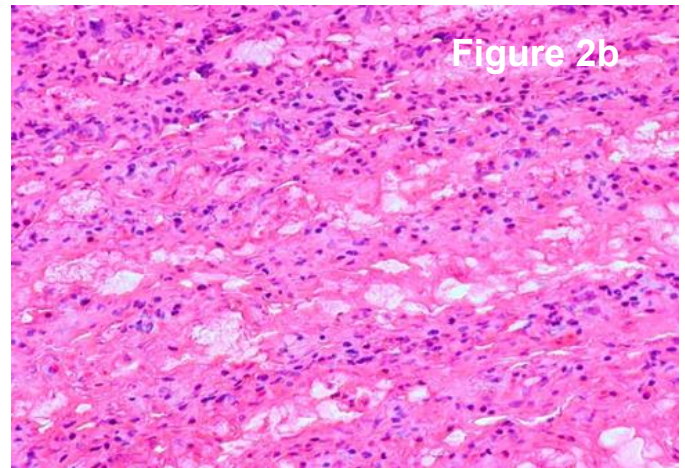


Figure 2b

2(b) Eosinophilic material at 400x. HE.

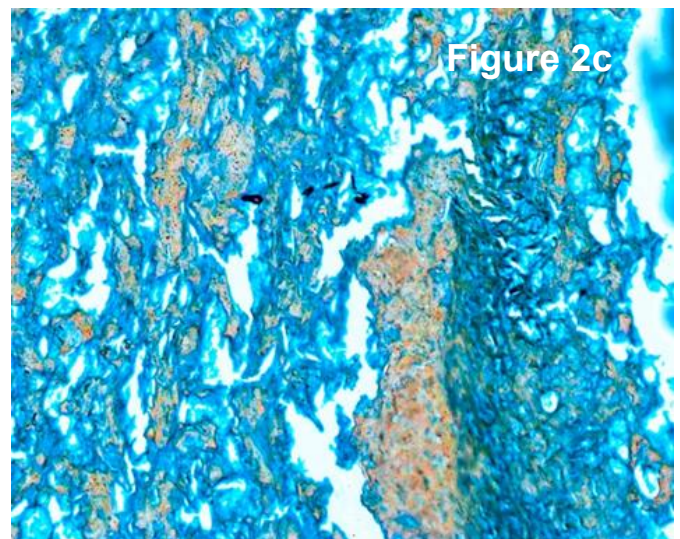
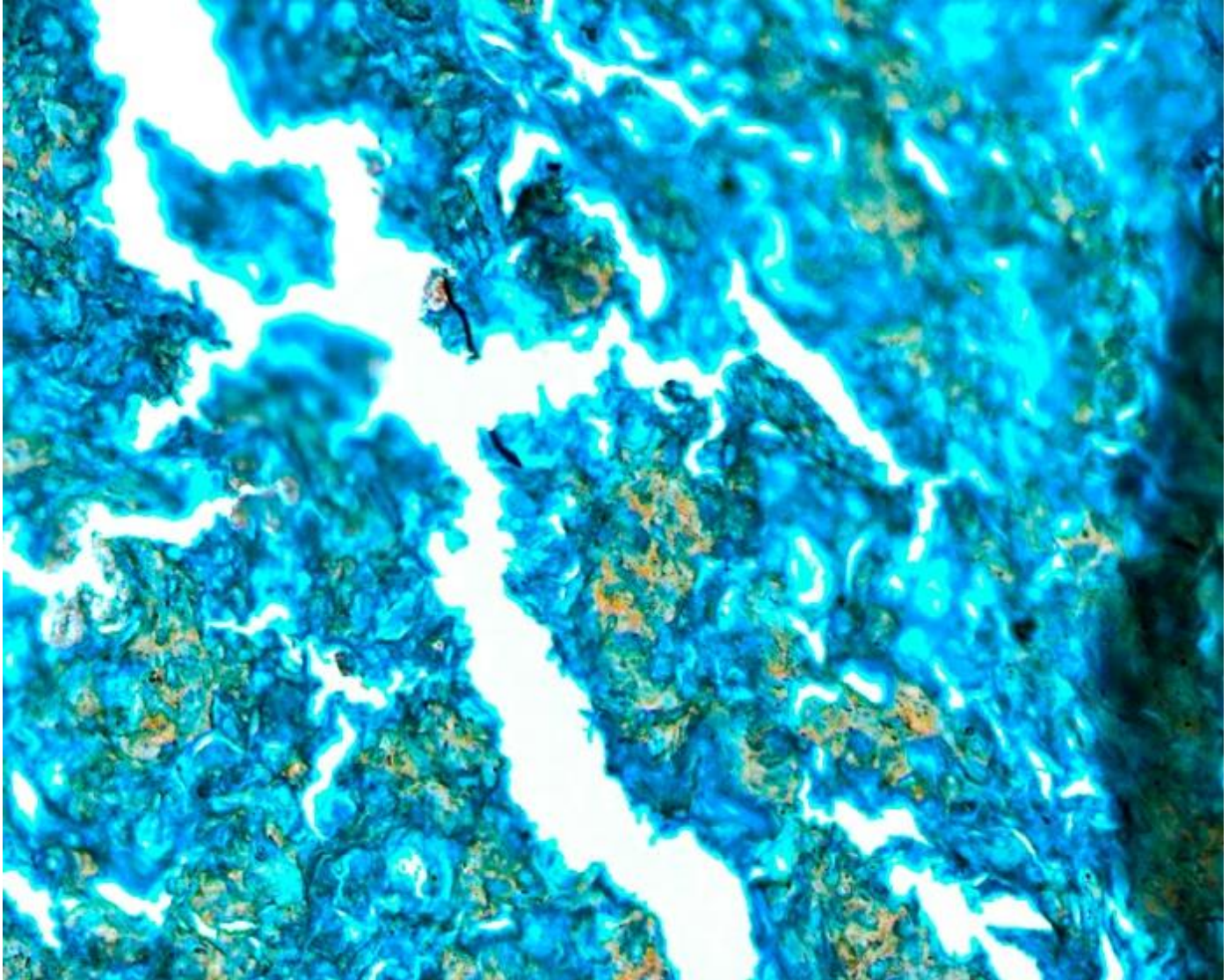


Figure 2c

2(c) Pigmented septate hyphae structures at 400x. Grocott-Gomori's Methenamine Silver (GMS).



2(d) Another section of the granuloma with pigmented septate hyphae structures at 400x. GMS.

Slices were taken from the paraffin block (10µm) containing tissue fragments from the lung with nodulation for DNA extraction. Fungal DNA was extracted from these tissues using the commercial kit DNeasy blood & tissue (QUIAGEN, Netherlands) according to the manufacturer's instructions and protocols. Polymerase Chain Reaction (PCR) was performed in which universal oligonucleotides were used to amplify ribosomal subunits 18S, 5.8S, 28S and the Internal Transcribed Spacer (ITS) regions as the molecular target.

The 551bp fragment was amplified, purified, and sent to the Synthesis and Sequencing Unit of the Biotechnology Institute of UNAM for Basic Local Alignment Search Tool (BLAST) computer program analysis, in order to compare with all microorganism sequences in the database. The fragment was identified as a 90.5% match with *Cladosporium cladosporioides*.

The phaeohyphomycosis fungi species with pathologic relevance reported so far in sea turtles are: *Veronaea sp.*⁷, *Cladosporium sp.*^{6, 7}, *Ochroconis sp.*^{5, 7}, *Cochliobolus sp.*⁷, *Alternata sp.*⁶, *Dreschlera sp.*⁵ The spectrum of these fungi associated diseases in sea turtles has rapidly increased and includes necrotic cutaneous infections, tracheal obstruction, pneumonia, and a generalized infection process, leading to difficult diagnosis and treatment.^{2, 5-7}

This case report demonstrates that free-ranging sea turtles are susceptible to opportunistic pathogens in the environment, which highlights the importance for diagnosis procedures by molecular analysis to detect unusual infectious diseases an accurate identification of fungi. Phaeohyphomycosis laboratory diagnosis is based on morphological characteristics of the agent as observed by direct microscopic examination, histopathology, fungi culture, histochemical, and molecular analysis. Is very important to obtain correlation between morphological characteristics and molecular

findings and/or fungi culture in order to be pathologically relevant. Additional studies in phaeohyphomycosis are required to assess the epidemiological impacts and potential risk factors for sea turtles in the wild and captivity.

Acknowledgements

We would like to acknowledge the Sea Turtle Protection and Conservation Program of the Puerto Morelos Reef National Park, dependent on the National Commission for Protected Natural Areas, with special recognition to the ranger Luis Alberto Ramos for his support during the logistic and performance of the necropsy; as well as to local and national wildlife authorities. To Evan Alexander Hazlett, BES of Yucatec Diving and Conservation for writing, review and translation assistance. We are grateful to the people of Pathology Department of the FMVZ - UNAM for their support with postgraduate students, and analysis of the samples with special recognition to Dr. Laura Romero Romero, Dr. Laury C. Martinez Chavarría, Zazil Vázquez Gallegos, MVZ and biologist Alejandro Usategui-Martin. The first author was supported by the National Quality Postgraduate Program Grants of the National Science and Technology Council (CONACYT).



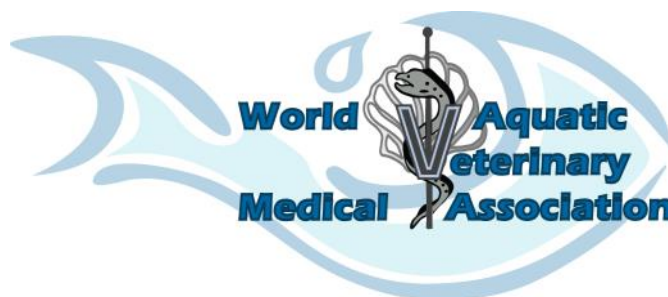
Hawksbill sea turtle (Eretmochelys imbricata)
off the coast of Saba.

Photo by magicOlf - <https://www.flickr.com/photos/magicolf/3248274430/>, CC BY-SA 2.0,
<https://commons.wikimedia.org/w/index.php?curid=26359369>

The hawksbill sea turtle (*Eretmochelys imbricata*) is a critically endangered sea turtle belonging to the family Cheloniidae. It is the only extant species in the genus *Eretmochelys*. The species has a worldwide distribution, with Atlantic and Indo-Pacific subspecies, *E. i. imbricata* and *E. i. bissa*, respectively.

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The Presence of *Ichthyophthirius multifiliis* in Koi (*Cyprinus rubrofuscus*)

By **Alex J. Hall**

Student at The Royal Veterinary College,
University of London

Abstract

Koi are one of the most common freshwater fish kept by home aquarists. On observation, many of the Koi located in this particular pond showed signs of pronounced gilling (rapid respiration). As per the owner, the koi also showed signs of inappetence for over a week. Tissue samples from a euthanized koi were taken from the gills and caudal fin. On closer inspection, microscopy revealed that these koi were infected with *Ichthyophthirius multifiliis*. This is a very common protozoan parasite condition; all freshwater fish are considered to be susceptible to this disease. Though highly contagious, it is relatively easy to treat this condition with appropriate medication.

Introduction

Derived by the selective breeding of the common carp (*Cyprinus carpio*), domesticated carp originated in China ~2000 years ago. These common carp have an “unspectacular” grey-green or brownish color, as well as ordinary fins. Selective breeding for fancy colors started in Japan with the breeding of rare gold colored carp, producing the domesticated koi carp (*Cyprinus rubrofuscus*). As selective breeding continued, more color variations and fin morphologies emerged (Watson, Hill, & Pouder). Koi are commonly kept as pets as they are some of the hardier ornamental fish.

This clinical report describes ornamental koi that became infected with *Ichthyophthirius multifiliis* (Ich), also called “white spot disease.” Ich is the largest known parasitic protozoan found in fish. These round/oval protozoa range from 0.5 to 1.0mm (Ruth Francis-Floyd, 2018). This highly contagious parasite spreads rapidly from one fish to another, and spreads without the need for an intermediate host. This organism is an obligate parasite, meaning it cannot continually sustain its lifecycle without a living host. Often considered a “warm water” disease, Ich outbreaks are often seen with changing water temperatures. These outbreaks are generally observed in spring as the pond water temperature increases. The classic sign for an Ich infection is the presentation of small white spots on the fins and skin (Francis-Floyd & Reed). Although in koi, the white spots on the skin are not always evident. The mortality rate is nearly 100% if left untreated.

Case Presentation

A group of koi were evaluated because of signs of pronounced gilling (rapid opercular movement for res-

piration) and inappetence. Dissolved oxygen (DO) was tested first, as the pronounced gilling could be a sign of low oxygen concentration present in the water. However, the DO concentration was normal. Next, the stocking density of the pond was determined as follows. The koi were located in a roughly ~30,000-gallon pond (~120,000 liters). This pond contained roughly 20 adult koi averaging around 13 pounds (5.9 kilograms) each. This pond had an ideal stocking density of ~1g/1L. This calculation shows that this pond was not overcrowded. This also further proves that the pond has the resources to support the koi.

Next, the overall architecture of the pond was examined. The water appeared to be moving adequately and wasn't stagnant. There was also proper aeration and filtration. It was suggested to the owner that the aeration pumps should be moved to the filtration unit outside of the pond. This would not change the amount of dissolved oxygen in the water; however, it would prevent the microbubbles from re-suspending settleable solids, which could be irritating to the gill tissue.

A koi in poor condition was euthanized using MS-222, or Tricaine mesylate (Tricaine methanesulfonate). Samples of the caudal fin and gill tissue, as well as skin scrapes from the lesions, were collected. On a gross appearance, the gill tissue appeared red and inflamed. On closer inspection with microscopy, Ich parasites were observed in the gill tissue as well as on the epidermis. The presence of these parasites helps explain the inappetence and pronounced gilling.

The koi were treated with Kordon's Rid-Ich, a solution of formalin and zinc-free chloride salt of malachite green. These koi are expected to recover as the infestation wasn't too severe.

Discussion and Conclusions

Ich infestations are of significant clinical importance because they are highly contagious and display a severely high mortality rate if left untreated. The high rate of infestation is due to the fact that a single Ich parasite can multiply into many hundreds over the course of one generation. This makes early detection and constant surveillance critically important. Although Ich has a direct obligate life cycle, there are three distinct stages of the parasite. First, a free-swimming, ciliated theront attaches to the host and invades the host's outer layers of epithelium, and becomes the feeding trophont stage. This invasion under the epithelium protects the trophont from chemical treatment. The trophont feeds on the host's tissues until it reaches a mature state. Once the trophont is mature, it leaves the host and becomes a tomont. This tomont then secretes a gelatinous cyst that allows it to stick to its surroundings, such as rocks or plants. The tomont, once attached, starts rapidly dividing, making hundreds of tomites within a single cyst. This gelatinous capsule prevents the tomites from being affected by chemical treatments. Within the cysts, these tomites mature to become the-

ronts, then the theronts leave the cyst and become free swimming in search for a host. The theronts are unprotected and therefore highly susceptible to chemical treatments. These theronts must find a living host within 24-48 hours for the life cycle to continue. Therefore, if the theronts are killed, the cyclic infection ceases. As of now, the only treatments for Ich are designed to target this unprotected motile stage (Francis-Floyd, 2018).

Ich can be suspected by the appearance of small white lesions across the fish's epithelium. However, to be confirmed, Ich parasites in the infected tissue must be observed with microscopy. If an Ich infestation is present, the mature trophonts should be visible in the tissue sample. These trophonts are round and dark in color, ranging from 0.5 to 1mm in diameter. During this stage, the trophonts have a C-shaped macronucleus, which can help identifying the parasite.

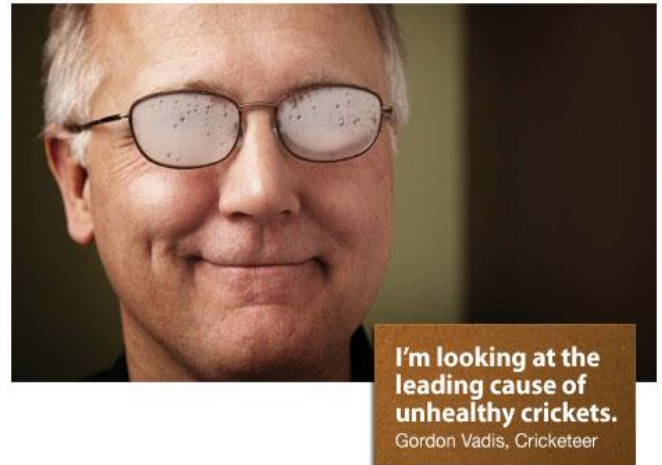
As stated, the chemical treatments only treat the free swimming theronts. This means that repeated treatments in succession are needed. These repeated treatments prevent the subsequent generations from infecting the fish. The outbreak becomes controlled as the mature trophonts drop off and produce theronts that cannot survive the chemical treatment. There is a direct relation between the temperature of the water and the speed of the parasite's life cycle. At warmer temperatures (75-79F), the life cycle is completed in 3 to 6 days. At this temperature, chemical treatment should be applied daily to prevent reinfection. If the water temperature is cooler (~60F), treatments should be 3 to 5 days apart. There should be a minimum of 5 successive treatments. The fish should continue treatments until the mortality rate from the fish reaches 0% (Francis-Floyd & Reed).

Acknowledgements

I would like to thank Julius M. Tepper, DVM, CertAqV for his guidance.

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

Stuck on You: Aquatic Glue

Hi All,

I have been asked by a Marron (large freshwater crayfish) researcher to advise them on a suitable substance/sealant to use to seal a hole in the hard exoskeleton and soft exoskeleton under the tail. Identification tags will be placed in the tail and as such a small hole will need to be made in the hard exoskeleton.

Does any one have any experience sealant substances on the shells/exoskeletons of crustaceans and if so, which product would you recommend? Epoxy resins are sometimes used to fix cracks in turtle shells and I was wondering if anyone has tried this on crustaceans before! Thanks for your help, it is much appreciated!

Dr. Jo Bannister, BSc.BVMS, BSc.Ans (Hons)
 Perth, Western Australia
jo.bannister@bigpond.com

As a herp vet, I will tell you that you have to be very careful with epoxy. I do not advise that it be used in contact with the soft tissues. Instead, I recommend that you use a fast setting dental acrylic. It's much safer and has lower reactivity with the tissues and immune system. I know that it's also preferable in drilled molluscs.

Adolf Maas
DrMaas@zoovet.us

Just how big of a hole are you talking about? I've used cyanoacrylate in a blue crayfish attacked by a pet turtle. The exoskeleton where it will be applied has to be dried completely, which I think can be stressful to the crustacean, but then once dried, it seemed to work for the pinch/crack that I was trying to repair with it.

Jack Kottwitz
jack_kottwitz@hotmail.com

Does anyone have a favorite underwater adhesive for post-surgical fish? The fish are research fish getting implants. Thank you!

Kerry Ann Collins, DVM
 41 Main St., Richmond, ME 04357
 Email: KCollins@kennebecbio.com
www.kennebecriverbiosciences.com

Hi Kerry,

As I recall (it's been awhile, so defer to others with more recent experience), simple interrupted monofilament (non-absorbable) sutures in two layers worked pretty well to close holes made by implants. Depending on species, cyanoacrylate can cause substantial dermatitis and/or tissue necrosis in fish; but my experience was that it also just doesn't hold up too well in water to begin with...

I know Dr. Evelyn Sawyer was working on thrombin/fibrin-based field bandages derived from salmon blood; if I remember it was originally for vascular applications but the concept might have advanced to the point of some utility for other uses as well.

Regards,

Dr. Peter L. Merrill
wetvet@comcast.net

Scale Protrusion in a Koi

Hello WAVMA Members,

I am interested into your opinion about a koi case: The fish is a Nisai Ki Matsuba, showing every year skin symptoms of a little bit of increased mucus, and slight reddening of the skin. The owner is treating the fish with salt baths and told me that this is the remedy for some weeks before the symptoms show up again (approximately 3-4x per year).

Besides the reddening of the skin, I recognized that the scales of the fish are altered, the apical end is not round, they are shorter than normal (red arrows), and a little bit protruding, also in the period when the other symptoms are not present.



I decided to treat the fish with an antibiotic medications and the reddening and excess mucus cleared up, but the scale deformation of course did not, and the slight protrusion of the scale is also still present, which could lead to a failure in the first immune barrier (mucus, skin, scales). The picture quality is maybe not good enough to see the protrusions (black arrow).



Finding something similar in the literature has failed, so I can't really tell if the altered scales are a genetic problem or a late symptom of an early Cyprinid Herpesvirus 1 infection, or another causative agent. Without knowing the etiology, I don't feel confident to decide how to proceed when the symptoms show up again and again. What is your opinion, have you had a similar problem before?
 Kind regards!

Manuel Künzel (Vet)
 Germany

Great case Manuel.

It seems unlikely that the abnormal scales per se would create chronic lesions, as we see gross variations in the scale covering in doitsu (scale-less or reduced number of scales) koi varieties without pathology.

The history is suggestive of chronic low-grade fluke infestation. Is it possible this has been missed deep in these open scale pockets? Possibly a biopsy of the skin in this area would make sense.

Julius M. Tepper, DVM, CertAqV
 Fellow, World Aquatic Veterinary Medical Assn.

Hi Julius Tepper,

Good idea, I will try that if the inflammation starts again. I will also try to do a bacterial swab deep in the pocket, but I am not a fan of bacterial swabs of the skin.



Illustration of the scale in the dermis of the koi skin, covered by a layer of epidermis, showing the inflamed area (red dots) under the edge of the scale.

In doitsu koi, you have variations in scale distribution and morphology, that is true. But, I can't remember, having a doitsu in my hands that has apical protruding scales (see picture) that form artificial pockets.

I forgot to tell you that I already did excessive skin scraping with negative results for ectoparasites. But you are right, digging a bit in the artificial pocket is a good idea, I will use a Dental technician instrument to reach it (see pic).

Thank you!

Manuel Künzel (Vet)
 Germany



Koi Scales

Scales in koi are calcified flexible cycloid plates, consisting of collagen fibers, albuminoid materials, and hydroxyapatite crystals. Growth rings are added frequently as the fish grows, and are not an indicator of age. The scales come from the dermis layer of the skin and are covered with a thin layer of epidermis. The dermis consists of fibrous connective tissue, blood vessels, nerves, osteogenic cells for scale production, the scales, and chromatophores (pigment cells).

Koi do not have scales on the head. There are usually 37-39 scales in the row along the body at the lateral line, and 6 rows of scales above that and 6 below. The scales over the lateral line have holes through them to allow vibrations to pass through to the neuromast receptors. There is a total of about 800-900 scales on the body of a koi.

Doitsu koi are a variety of koi with no scales or a reduced number of scales. The name comes from the Japanese word for "Deutsche," which means German, and refers to scaleless carp introduced from Germany that were cross bred with koi in 1904 to produce koi with fewer than normal scales. Doitsu koi have only two rows of scales along the dorsum, and may also have a row of enlarged scales along the lateral line.

From *Advanced Koi Care* (2nd edition) 2010,
 by Nicholas Saint-Erne, DVM CertAqV

Abstracts from Scientific Literature—Koi Genetics:**The complete mitochondrial genome of the Oujiang color carp, *Cyprinus carpio* var. color (Cypriniformes, Cyprinidae)**

Baosen Wang, Peifeng Ji, Jian Wang, Jinsheng Sun, Chenghui Wang, Peng Xu, Xiaowen Sun
Mitochondrial DNA 2013 Feb;24(1):19-21.
Epub 2012 Aug 24. PMID: 22920435
DOI: 10.3109/19401736.2012.710230

Abstract

The complete mitochondrial genome of Oujiang color carp was determined to be 16,581 bp in length accurately using the next generation sequencing technology and bioinformatics tools. The complete mitochondrial genome of Oujiang color carp shows typical circular molecule structure of vertebrate's mitochondrial genome, which consists of 13 protein-coding genes, 22 tRNA genes, 2 rRNA genes, and 1 control region. The whole genome base composition was estimated to be 31.89% A, 27.53% C, 15.76% G, and 24.82% T, with A/T bias of 56.71%. The complete mitochondrial genome of Oujiang color carp provides the basis for genetic breeding and conservation studies.

The complete mitochondrial genome of the Japanese ornamental koi carp (*Cyprinus carpio*) and its implication for the history of koi.

Mabuchi, Kohji; Song, Hayeun
Mitochondrial DNA 2014 Feb;25(1):35-6.
DOI: 10.3109/19401736.2013.779261.
Epub 2013 Apr 22.

Abstract

Complete mitochondrial genome (mitogenome) sequences were determined for two individuals of Japanese ornamental koi carp. Interestingly, the obtained mitogenomes (16,581 bp) were both completely identical to the recently reported mitogenome of Oujiang color carp from China. Control region (CR) sequences in DNA database demonstrated that more than half (65%) of the koi carp individuals so far reported had partial or complete CR sequences identical to those from Oujiang color carp. These results might suggest that the Japanese koi carp has been originated from Chinese Oujiang color carp, contrary to the belief in Japan that the koi carps have been developed directly from carp stocks in Japan. In any case, the present results emphasize the importance of analyzing Oujiang color carp when studying the origin of koi carp.

Complete mitochondrial genomes of domesticated and wild common carp (*Cyprinus carpio* L.)

Mingxue Lin 1, Jixing Zou 2, Chenghui Wang 1
Mitochondrial DNA: A DNA Mapp Seq Anal. 2016;27(1):50-1.
Epub 2014 Jan 17. PMID: 24438270
DOI: 10.3109/19401736.2013.869690

Abstract

Glass red common carp (*Cyprinus carpio* var. *wananensis*) were occasionally found among wild common carp (*Cyprinus carpio*) 50 years ago. In this paper, we determined the complete sequences of Glass red common carp and wild common carp mitogenomes. Both mitogenomes exhibited the same length of 16,581 bp, order in 13 protein-coding genes, 22 tRNA genes, 2 rRNA genes and 1 control region. The sequence similarity between them reached 99.62% and 100% in 21 tRNA genes, excluding tRNA(Ser) and 2 protein-coding genes (ATP8 and ND4L), respectively. The two mitogenomes will be useful in elucidating the evolutionary relationship of the common carp.

Keywords: Common carp; mitogenome; similarity.

The structural basis for enhanced silver reflectance in Koi fish scale and skin

Dvir Gur, Ben Leshem, Dan Oron, Steve Weiner, Lia Addadi
J Am Chem Soc. 2014 Dec 10;136(49):17236-42.
Epub 2014 Nov 26. PMID: 25393507
DOI: 10.1021/ja509340c

Abstract

Fish have evolved biogenic multilayer reflectors composed of stacks of intracellular anhydrous guanine crystals separated by cytoplasm, to produce the silvery luster of their skin and scales. Here we compare two different variants of the Japanese Koi fish; one of them with enhanced reflectivity. Our aim is to determine how biology modulates reflectivity, and from this to obtain a mechanistic understanding of the structure and properties governing the intensity of silver reflectance. We measured the reflectance of individual scales with a custom-made microscope, and then for each individual scale we characterized the structure of the guanine crystal/cytoplasm layers using high-resolution cryo-SEM. The measured reflectance and the structural-geometrical parameters were used to calculate the reflectance of each scale, and the results were compared to the experimental measurements. We show that enhanced reflectivity is obtained with the same basic guanine crystal/cytoplasm stacks, but the structural arrangement between the stack, inside the stacks, and relative to the scale surface is varied when reflectivity is enhanced. Finally, we propose a model that incorporates the basic building block parameters, the crystal orientation inside the tissue, and the resulting reflectance and explains the mechanistic basis for reflectance enhancement.

**2020 Aquatic Animal Welfare (Virtual) Conference
 November 2-6, 2020**

Registration is Free (Note: presentations will be recorded, for those unable to join the live presentations)

This conference is organised by the Humane League UK that works to end the abuse of animals raised for food. We are laser-focused in our approach and push for institutional change, pressuring big food companies to end the worst abuse in their supply chains alongside working on political advocacy and encouraging individuals to switch to a plant-based diet.

The virtual Aquatic Animal Welfare Conference 2020 is an international conference aimed at updating advocates on the latest science and campaigns from around the world on aquatic animal welfare. It will cover wild-caught fishes, farmed fishes, octopus and crustaceans. Through presentations, panels, regional strategy workshops, and networking opportunities, advocates can come together to learn, exchange ideas, develop new networks and establish plans for potential future collaborations. This conference is open to those within the animal protection and environmental movement and scientists in the field. The conference is happening at a critical time to push fishes, crustaceans and octopus up the agenda in the animal protection movement.

In an attempt to make this a truly international conference we have speakers spanning the globe. And we are seeking participants from around the world as well. We hope that you will be able to join us for sessions in real-time where possible. While the conference is advertised in GMT, the recordings will be made available to those that can't make the talks due to time zone differences and you will have the opportunity to submit further questions to the presenters afterwards, allowing interaction even if you are unable to attend in real-time.

Agenda (all times are GMT):

Monday, November 2 - FISH BEHAVIOUR

8:50 am - 9:00 am Vicky Bond: Introduction
 9:00 am - 9:50 am Prof. Culum Brown: Pain and Emotion in Fishes – Fish Welfare Implications for Fisheries and Aquaculture
 10:00 am - 10:50 am Dr. Lynne Sneddon: Are fishes and crustaceans sentient?
 11:30 am - 12:20 pm Dr. João Saraiva: Fish ethology and impact on fish farming
 1.30 pm - 2:20 pm Dr. Becca Franks: How do we know what fish want?
 2:30 pm - 3:00 pm NETWORKING/ Icebreaker app - getting to know fellow conference attendees
 4:00 pm - 4:50 pm PANEL: Current attitudes towards fish welfare

Tuesday, November 3 - FISH FARMING

8:00 am - 8:50 am Tse Yip Fai (謝業輝): Fish farming in China
 9:00 am - 9:50 am Shreya Paropkari: Research on aquaculture
 10:30 am - 11:20 am Dr. Lars H. Stien: Salmon farming disease and welfare
 11:30 am - 12:20 pm Dr. Maria Filipa: How to ensure good welfare practises in the aquaculture industry
 1:30 pm - 2:20 pm Dr. Hans van de Vis: How to measure welfare on-farm
 2:30 pm - 3:20 pm Dr. Pablo Arechavala-López: Environmental Enrichment And Fish Welfare In Aquaculture
 4:00 pm - 4:50 pm Dr. Sunil Kadri: Managing fish welfare in intensive aquaculture: current practices and future possibilities
 5:00 pm - 5:50 pm PANEL: Economic barriers to fish welfare

Wednesday, November 4 - FISH SLAUGHTER

9:30 am - 9:50 am NETWORKING: Icebreaker app - getting to know conference attendees
 10:00 am - 10:50 am Jade Spence: Improving slaughter of fish, decapods and cephalopods in practice
 11:00 am - 11:50 am Dr. Hans van de Vis: Wild fish slaughter - capture, loading, storage and slaughter
 12:45 pm - 1:35 pm Meda Simanavičiūtė: Banning the sale of live fish - outreach successes and struggles
 3:00 pm - 3:50 pm Ann Broadhurst: Recent progress in the welfare of crabs, lobsters, and other decapods, in the food industry
 4:00 pm - 4:50 pm Dr. Elena Lara: Octopus farming
 5:30 pm - 6:20 pm Saulius Simcikis: Should we try to reduce the scale of baitfish farming and fish stocking?

Thursday, November 5- AQUACULTURE IMPACTS & LEGISLATION

8.30 am - 9.20 am PANEL: Working with communities of the global majority for intersectional change
 9:30 am - 10:20 am Juliette Alemany: Projects in South and Southeast Asia to improve environmental and social practices in aquaculture
 11:00 am - 11:50 am Dr. Krzysztof Wojtas: Fish meal and fish oil
 12:00 pm - 12:50 pm Susanna Lybæk: Cleaner fish in the salmon industry and alternatives for treating lice
 2:00 pm - 2:50 pm Jay Shooster: Advancing Fish Welfare Though False Advertising Lawsuits
 3:00 pm - 3:50 pm Edie Bowles: How fish are treated under UK law
 4:30 pm - 5:20 pm Kathy Hessler: The Push for Legislative Reform
 5:30 pm - 6:00 pm NETWORKING: Icebreaker app - getting to know fellow conference attendees

CONTINUED ON NEXT PAGE

2020 Aquatic Animal Welfare (Virtual) Conference

November 2-6, 2020
 CONTINUED

Friday, November 6 - CAMPAIGNING & POLICY

8:00 am - 9:00 am STRATEGY MEET UP: For groups in Asian, European, African & Oceania time zones (all welcome though regardless of time zone!)

9:30 am - 9:55 am Koushik Raghavan: State of affairs of aquaculture in India

10:00 am - 10:25 am Amandine Sanvisens: Advocate work in France

11:00 am - 11:25 am Stefan-Andreas Johnigk: Fish work in Germany

11:30 am - 11:55 am Haven King-Nobels: Welfare for the 89%: Helping fish in Asian Aquaculture

12:00 pm - 12:25 pm Doug Waley: Lobbying the EU Commission

1:30 pm - 1:55 pm Dr. Walter Sanchez-Saurez & Lauri Torgerson-White: Can we achieve positive welfare for farmed fishes?

2:00 pm - 2:25 pm William Bench: Stronger Together: Aquatic Life Institute & The Aquatic Animal Alliance

2:30 pm - 2:55 pm Jen Lamy: The Promise of Alternative Seafood

5:00 pm - 6:00 pm STRATEGY MEET UP: For groups in North and South American time zones (all welcome though regardless of time zone!)

6:00 pm - 6:10 pm Round up and Closing

For more information about the Conference and to register: <https://sites.google.com/thehumaneleague.org/fishconference2020/home>

Note: Details, including links to sessions, will be sent out via Eventbrite to the email address you signed up with, closer to the event date.

For more information about the Humane League: <https://thehumaneleague.org/>

2021 AQUAVET® I & II & III Courses

The College of Veterinary Medicine at Cornell University is pleased to announce the 2021 AQUAVET® I, II & III course offerings. They are aquatic veterinary medicine education programs that currently consist of two courses that will be presented at Roger Williams University in Bristol, RI in June 2021 and one on Aquarium Medicine held in three venues.

AQUAVET® I:

An Introduction to Aquatic Veterinary Medicine is a 4-week course (30 May - 26 June 2021) intended primarily for veterinary students.

AQUAVET® II:

Comparative Pathology of Aquatic Animals is a 2-week course (30 May - 12 June 2021) that is oriented toward the pathology of diseases of aquatic invertebrates and fish that are used in biomedical research, encountered in display aquaria and are of importance in commercial aquaculture.

AQUAVET® Summer Research Fellow (one offered) is an 8-week research program, usually studying fish disease at a lab at Cornell University. There is no tuition and this student will receive a stipend of \$3,800 after completing the 8 weeks.

AQUAVET® III:

Clinical Aspects of Captive Aquatic Animal Medicine is a 5-week course (following AQUAVET® I - 27 June to 1 August 2021) and is limited to a small number of students. The venues include GA Aquarium, U of GA and Dolphinaris, Cancún, México.

Veterinary students can receive credits for the courses and graduate veterinarians can receive CE credits. More detailed information and applications for admission (due by January 15, 2021) are available on the web site www.aquavet.org.

The Aquatic Veterinarian is meant to be read as a 2-page spread (like a paper magazine!). To view it this way on your computer, open the pdf document using Adobe Acrobat or Adobe Reader, then go to the menu bar at the top of the computer screen and click on View, then Page Display, then Two Page View. That will allow you to scroll thorough the issue seeing the cover page by itself first, followed by two pages side by side for the rest of the issue. Doing this, you will be able to see the Centerfold picture in all its ginormous glory!



The Atlantic Salmon Conservation Foundation is proud to announce our upcoming series of webinars. To register, please follow the link below each webinar title. Participation in the series is free and audio access is available through your computer.

La Fondation pour la conservation du saumon atlantique est fière d'annoncer notre prochaine série de webinaires. Pour vous inscrire, suivez le lien sous chaque titre. La participation à cette série de Webinaires est gratuite et l'accès audio est disponible grâce à votre ordinateur.

2020-2021 ASCF Webinar Schedule | Horaire des webinaires de FCSA 2020 à 2021

Please note: Presentations will be in either English (EN) or French (FR), but where possible, the question and answer period will be bilingual.

Veillez noter que les webinaires seront en anglais (EN) ou en français (FR), mais dans la mesure du possible la période de question et réponse sera bilingue.

23 Sep (EN) – Myron King (MUN) – Assessing the impact of instream barriers and climate change on wild Atlantic Salmon

<https://attendee.gotowebinar.com/register/6822993425075156749>

7 Oct (FR) – Marc Trudel (MPO) – Effets de facteurs de stress multiples sur la survie en mer du saumon atlantique

<https://attendee.gotowebinar.com/register/1194496645489164044>

21 Oct (EN) – Brian Hayden (UNB) - Locked in time – can salmon scales help us understand marine mortality

<https://attendee.gotowebinar.com/register/8012958575955957260>

4 Nov (EN) – Antóin O'Sullivan (UNB) - Hydrological interconnectedness of landscapes, forests and rivers

<https://attendee.gotowebinar.com/register/6300833153981358863>

2 Dec (FR) – Carole Anne Gillis (GMRC) & Valérie Delisle-Gagnon (OBVMR) – Caractérisation et protection des aires de drainage des refuges thermiques de la rivière Matapédia

<https://attendee.gotowebinar.com/register/8328789992453321484>

6 Jan (EN) – Sam Andrews (UNB) – A review of Atlantic Salmon smolt consumption by Striped Bass

<https://attendee.gotowebinar.com/register/3765430808606893584>

22 Jan (FR) – Marie-Camille St-Amour (OBVNEBSL) & Rébecca Gagnon (OBVMR) – Projet de partenariat avec le Club quad Avignon Ouest pour la caractérisation des ponceaux à potentiel faunique

<https://attendee.gotowebinar.com/register/8864928355146819343>

3 Feb (EN) - Karelle Gilbert (UL) & Sylvian Jutras (UL) - Water and forest road networks in Quebec: issues and solutions

<https://attendee.gotowebinar.com/register/3345762613468739343>

17 Fev (FR) - André St-Hilaire (INRS) – La caractérisation et la sensibilité thermique des rivières à saumon

<https://attendee.gotowebinar.com/register/2353160899308784908>

3 Mar (EN) - Ben Whalen (KWRC) – Riparian Restoration Tool Box: A how to manual for watershed practitioners

<https://attendee.gotowebinar.com/register/7279197292405329167>



**MEETINGS OF INTEREST TO
AQUATIC VETERINARIANS**

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

Many Veterinary Conferences being held in 2020 have been canceled or postponed. Please check websites to ensure conferences are still being held before making travel plans.

2020 WSAVA Congress has been postponed!

Future WSAVA Conferences:

45th WSAVA World Congress

Dates: 21-24 March 2021

Warsaw, Poland

[Visit the website here](#)

46th WSAVA World Congress

Dates: 13-16 November 2021

Hyderabad, India

[Visit the website here](#)

47th WSAVA World Congress

Dates: 29-31 October 2022

Lima, Peru

See: [WSAVA](#)

The 2016 WAVMA Virtual Conference Presentations

The presentations (18 webinars) from the 2016 WAVMA Virtual Conference were recorded but due to various issues have never been placed on the WAVMA website to date. They will form part of over 110 webinar recordings which will be available to members once we get the new website up and running. Exactly when that will be is still a bit up in the air, but hopefully in the next few months. A lot of detail still needs to be worked through.

CEPD credit was available if you watched the original webinars live and will be available when they go up on the WAVMA website.

Chris Walster
Website Administrator

VMX – Veterinary Meeting and Expo

Dates: January 16-20, 2021

Location: Orlando, Florida

Venue: Orange County Convention Center

Host: NAVC

Formerly the NAVC Conference, VMX is the world's leading veterinary conference bringing together veterinary professionals across the country and around the world for 5 days of education, hands-on learning, exhibits and entertainment.

Expect to hear from the brightest professionals in the veterinary industry and explore all the veterinary CE topics you're interested in, while enjoying a winter break in sunny Orlando.

Registration is Launching Soon for VMX 2021:

<https://navc.com/best-veterinary-conferences/>

WAVMA 2020 Annual General Meeting

Saturday 7th November 2020, 12:00 to 17:30 UTC

www.wavma.org/agm

12:00-12:15 UTC: Introduction by Julius Tepper, WAVMA Meetings Committee Chair, and Jena Questen, WAVMA President.

12:15-13:15 UTC: Keynote talk 1: "Current advances in diagnostics and treatments of farmed fish" by Dr. Meritxell Diez-Padrisa, Production Director, Mowi Scotland Ltd., Fort William, Scotland.

13:20-13:35 UTC: John L. Pitts Aquatic Veterinary Education Awards Program Awardee talk 1: "Attending AQUAVET@ III in 2019" by Elizabeth St. Germaine, Western University of Health Sciences, College of Veterinary Medicine, Pomona, CA, USA.

13:35-13:50 UTC: Pitts Aquatic Veterinary Education Awards Program Awardee talk 2: "6-week clinical externship at the University of Florida's Tropical Aquaculture Lab" by Dr. Laura Krogman, Spokane, WA, USA.

13:50-14:05 UTC: Pitts Awardee talk 3: "Making Waves in Aquatic Veterinary Medicine as a Senior Veterinary Student." by Dr. Sarah Wright, Aurora, IL, USA.

14:10-15:10 UTC: Keynote talk 2: "Current advances in diagnostics and treatments of ornamental fish" by Dr. Gregory A. Lewbart, North Carolina State University, College of Veterinary Medicine, Raleigh, NC, USA.

15:15-15:45 UTC: Guest talk 1: "Ohio State University WAVMA Student Chapter" by OSU WAVMA Student Chapter: Cheryl Theile, Charlene Morotti & Raphael Malbrue, Columbus, OH, USA.

15:45-16:15 UTC: Guest talk 2: "What whales and dolphins can tell us about the health of our oceans- an overview of research from the Eastern Cape, South Africa" by Dr. Stephanie Plön, Bayworld Centre for Research and Education, Port Elizabeth, South Africa.

16:15-16:20 UTC: Conclusion by Julius Tepper. The Annual General Meeting will follow the Lectures.

WAVMA's WebCEPD Program -
 Webinars for Global Aquatic Veterinary Education

Given by leading experts, WAVMA's real-time and recorded WebCEPD webinars are intended as educational programs on key aquatic veterinary issues and techniques to hone the knowledge and skills of aquatic veterinary students and practitioners. Currently, there are 37 recorded videos available to watch on the WAVMA.org website.

Earning CEPD Credit for Recorded Webinars

Recorded webinars can be viewed at no charge. However, to earn veterinary continuing education & professional development (CEPD) credit, you will need to complete a short knowledge & skills assessment (KSA) or quiz to ensure you have met the learning objectives. On successful completion you will receive a CEPD certificate (useful for re-licensure/registration to practice veterinary medicine, and credit towards becoming a WAVMA Certified Aquatic Veterinarian). Accessing the KSA and receiving a CEPD will cost US\$5.00 for WAVMA Student Members, \$15.00 for all other WAVMA Members, and \$25.00 for those who are not WAVMA members - click on "more info" for the recording and for KSA/CEPD information.

<https://www.wavma.org/WebCEPD>

Our most recent CEPD video:

[B-1035: Skin Deep: Microscopic Anatomy of Normal Finfish Integument](#)

Presenter:



Dr. Diane Elliott

Date Recorded:
 June 22, 2020

Duration: 1.0 hour

Career level:
 Veterinarians,
 Veterinary Scientists,
 Veterinary Students

CEPD Credits: 1.0

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

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

QUICK LINKS TO WAVMA PROGRAMS & SERVICES:

(Press control then click on item using computer mouse)

- [Online Member Directory](#)
- [Certified Aquatic Veterinarian Program \(CertAqV\)](#)
- [WebCEPD](#)
- [The Aquatic Veterinarian Journal](#)
- [Aquatic Veterinary Jobs Listing](#)
- [WAVMA Student Chapters](#)
- [Veterinary Student Externship Listing](#)

A variety of items (mugs, t-shirts, hoodies, bags, etc.) are available for purchase through WAVMA's Zazzle 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 Administrators](#).

WAVMA Decal



Decal to affix to your automobile or practice window to promote WAVMA Membership

Price*: \$8 WAVMA member

Price*: \$5 WAVMA student

Price*: \$10 Non member

<https://www.wavma.org/Shop>

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>.

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