

WORKSHOP REPORT

Focus on Aquatic Veterinary Education

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The increasing demand of sustainably farmed fish and shellfish is stimulating fast-growing sectors in the global aquaculture. Worldwide there is an increasing demand for professional services and research related to a broad range of aquatic animal species. Aquatic veterinarians and para-veterinarians play a key role to provide diagnostic services, to design therapeutic solutions and recommendations towards prevention and disease management. Professional specialised support on aquatic animal health is also needed in zoo attractions, for ornamental aquatic pets, to help with wildlife species management, to support the exponential use of aquatic species in biomedical product development, and from basic to applied research. Traditional academic tracks include the acquisition of basic knowledge and skills on pet and farm animal health and medicine. However, despite some specific background on aquatic animal health is sometimes included in curricula (Iatridou et al. 2018), the focus of their training contents is mostly on terrestrial species. The World Aquatic Veterinary Medical Association (WAVMA) together with the European College of Aquatic Animal Health (ECAAH) support the global development of a veterinary task force with expertise in a wide range of aquatic animals and medical specialties. The European Association of Fish Pathologists (EAFP), more broadly focusing on aquatic animal health, involves any fish and shellfish related specialty and professional category.

WAVMA and ECAAH, with the support of the EAFP, jointly organized and promoted a workshop dedicated to the international efforts made to promote the aquatic veterinary education. This event was also envisaged as a continuation of the workshop organised in 2021 during the virtual EAFP 20th International Conference on Diseases of Fish and Shellfish (Scarfe et al. 2021). The Aquatic Veterinary Education workshop featured five talks on 14th September 2023 during the virtual EAFP 21st International Conference on Diseases of Fish and Shellfish held in Aberdeen, Scotland. The event was followed by a virtual discussion session held through Zoom on 21st September 2023.

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Highly specialised training programs for veterinarians devoted to aquatic animal health: progress since the EAFP 2021 Aquatic Veterinary Education Special Session

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Providing veterinarians and para-veterinarians with opportunities to achieve a specific skill set, to support recognition of a high-level professional qualification, was discussed during the previous EAFP meeting in 2021 in a special session focusing on aquatic veterinary education (Scarfe et al. 2021). The relevance of education in aquatic animal resources, and particularly on aquaculture, was discussed during the 2022 European Aquaculture Society (EAS) congress in Rimini, Italy (Padrós et al. 2023). However, it became apparent that despite achieving some reasonable success in promoting specific aquatic animal health training programs to veterinary practitioners, the wider stakeholder audience, both at undergraduate and post-graduate level, has only limited awareness about these training opportunities. The ECAAH was recently started by the European Board of Veterinary Specialisation (EBVS). The residency training programs started in 2020, and currently offers four programs through eleven main and satellite training centres distributed in four countries and alternative supervised training tracks. Upon completion of all the requirements, residents become EBVS[®] Specialists in Aquatic Animal Health. ECAAH worked with EBVS to achieve standardization of residency programs under the 8th level of European Qualification Framework. ECAAH residents are frequently combining aquatic animal health specialty training events with the academic PhD, or with professional employment in government agencies or companies. Such expertise diversification helps stakeholders to become aware of this highly trained workforce, leading to a formal credential recognition by the national health services. ECAAH has increased efforts to communicate the existence of the aquatic animal health specialty educational programs, targeting audiences both at national and international conferences (e.g., SIPI (Società Italiana di Patologia Ittica), EAS, and EAFP) and through intensifying collaborations with WAVMA and EAFP. It is expected that a continued interaction with private feeding companies, aquaculture producers, diagnostic services, or veterinary practices, could actively contribute to generate an increased employability of specialized veterinarians. This can contribute to the improvement of the continuous education process itself, offering new opportunities for hosting residents within their respective stakeholder sectors, as part of their specializing training track. The number of residents is increasing, and the first group of residents completed their examination by the end of 2023. Therefore, from an educational point of view, the progress is satisfactory thanks to the developed synergies, however, stakeholder awareness still needs further improvements.

The ECAAH has been working to increase collaboration opportunities with WAVMA, starting with the organization of joint WebCEPD webinars, and is planning to develop other future training short courses and webinars in cooperation with other partners. In this view, goals to be achieved (i.e., by the EAFP 2025 international conference) are to make aquatic animal health educational programs and specialists more visible to the public and industrial stakeholders. Making specialty programs and recognised specialists' more visible, such as through the Federation of European Aquaculture Producers (FEAP), Aquaculture Advisory Council (AAC) and other entities, and with a joined effort between the ECAAH, WAVMA, and EAFP, could act as a powerful interface between stakeholders and educational organizations. The final objective is to provide benefits to the industry, through increased specialist involvement, life-long learning, and to increase job opportunities in this sector.

Fostering international opportunities towards aquatic animal medical competence certification

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Nowadays veterinarians and other experts are needed to guarantee continuous improvement in the fast-growing aquaculture sectors, involving not only the seafood production and post-production industry but also zoo attractions, ornamental aquatic pets, up to biomedical research and wildlife management. WAVMA has become a reference non-profit association involved in facilitating global opportunities for the development of a veterinary task force with applied expertise in a wide range of aquatic animals and specialties. Through the Credential Committee WAVMA offers the only day one competence certification programs that are recognized worldwide: the well-established Certified Aquatic Veterinarian (CertAqV), and the recently started Certified Aquatic Veterinary Nurse/Technician (CertAqVNT). In 2019 the Education and Students Committee (ESC) was established to help students and dispense complementary training in aquatic animal health worldwide. As all WAVMA committees, the ESC is composed of volunteers, thus it is reorganized each year based on people available to contribute. Since 2023 ESC has been organized into three subcommittees, each chaired by a dedicated WAVMA member. WAVMA Student Chapters are established at veterinary universities to stimulate extracurricular learning activities and to promote student networking with professionals. The Education Resources subcommittee exposes students to training opportunities, thus they can better appreciate the roles of an aquatic veterinarian in aquatic animal wellbeing, within the framework of the UN Sustainable Development Goals and One Health. The WebCEPD subcommittee coordinates the Continuing Education and Professional Development (CEPD) program, almost monthly offering virtual lectures given by experts and often in partnership with other

professional associations. Continuous Education (CE) credits can be obtained after completing a post-webinar knowledge and skills assessment (KSA). Thanks to the quality of the lectures delivered, by experts covering a wide range of aquatic topics, the successful WebCEPD program became a hallmark of WAVMA. The WebCEPD program is also providing great opportunities for establishing collaborations with other associations. Joint webinars have been organized in partnership with the EAFP (Zrnčić, Toffan, and Gorgoglione 2020) or ECAAH, and other national associations, such with the Chilean (MEVEA) and Thai (TAVA) associations of aquatic veterinarians. The Education Support subcommittee manages small funding schemes, both for Student Chapters (Mini Grant) and for individuals (John Pitts Aquatic Veterinary Education Awards), enabling awardees to gain expertise with any aquatic specialty. Funds for these fellowships are provided by WAVMA and through generous donations, with calls for application opened up to twice a year and assigned after a review process completed by subcommittee members. Together with other initiatives, all these activities contribute to make WAVMA a global reference for the support of professionals approaching aquatic species and new aquatics' specialties. The success of the WAVMA training opportunities and the numerous applicants continuously seeking for the WAVMA certifications indicate as new generations of veterinarians and para-veterinarians are becoming more attracted to the fields of the aquatic animal health.

Continuing education, specialization, and worldwide certification of professional veterinarians in aquaculture

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The offer of post-graduate training for veterinarians and non-veterinarians focusing on aquaculture is becoming abundant in some countries, including with Masters, PhD, or other specific training programs available at leading veterinary and agronomic universities. Several associations, such as the EAFP, the American Fishery Society (AFS), the World Aquaculture Society (WAS), or WAVMA between others, organize high quality meetings, virtual lecture series, and workshops to foster knowledge updating and networking opportunities among scientists. Despite many short training opportunities are becoming available to professionals, these often lack an official recognition. While academic titles can be valuable, they might not fully prepare individuals with the practical experience required in real-world situations within their specialized fields. It is often challenging for international organizations and companies to recruit individuals with the required hands-on expertise. In 2010, the World Organization for Animal Health (WOAH), formerly known as OIE, supported the creation of the World Veterinary Education in Production Animal Health (WVEPAH). This

new organization was assigned the mission to build a new workforce of international experts in strategic food production sectors, including poultry, swine farming, as well as in aquaculture. WVEPAH established new training programs for veterinarians, so they could master multiple specialties in their food production fields, and thus could be trusted to manage severe crises and for auditing farms with international standards. Thereafter these highly skilled professionals can become trainers for national and local training programs. The diploma will be issued by WOAHA after an assessment of candidates' credentials and examination administered by the University of Montréal, Canada. So far, the experience with the certification program in aviculture has been successful to train new experts and is being followed as model for further specialties, including in aquaculture and in swine production. Since 2023, the new WVEPAH's aquaculture branch is partnering with WAVMA towards the establishment of a new "Professional Certificate in Animal Health: Aquaculture Production" (PCHAP), which will be composed by a general (first year) and specializing (second year) hybrid modules. The new training program is expected to start during the Summer of 2024 with lectures accessible online, and with the first general module course to be held in Padova, Italy during the Autumn. In the effort to establish the new PCHAP, WVEPAH is looking for new cooperations with leading institutions in aquaculture sectors.

A new era for Aquatic Veterinary Education: MicroMOOC Courses

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The virtual continuing education provide valuable learning opportunities on cutting-edge technologies and allows to maintain an up-to-date knowledge in specialty fields. MicroMOOCs (Massive Open Online Courses) recently became increasingly important in higher education, thanks to their ability to provide flexible and widely accessible learning opportunities for students and professionals worldwide. With the increasing global need for aquatic veterinarian services, traditional educational methods face challenges in providing accessible, timely, and comprehensive learning experiences. MicroMOOCs are instead suitable to enhance the aquatic veterinary education, providing compact, targeted, and high-quality educational modules that can be easily accessed remotely by trainers and trainees. We evaluated the effectiveness of MicroMOOCs and assessed their potential in aquatic veterinary education, including toward several competence certification programs. When designing these training programs, advantages and limitations of this approach should be kept into consideration, evaluating the pedagogical models and make sure that scientifically proven and updated

contents are delivered. The WAVMA ESC actively works to dispense complementary training to aquatic students, veterinarians, and para-veterinarians around the world. We analysed the example of the successful WAVMA WebCEPD webinar series, in which lectures are given by invited professionals from various fields of expertise. Live webinars can be attended upon free registration and the recordings remain available through the WAVMA website. After watching the webinar participants can obtain Continuous Education (CE) credits by answering to a short knowledge and skills assessment (KSA). Virtual learning opportunities have become important tools in higher education thanks to their ability to provide flexible and accessible learning opportunities, and to democratize education. MicroMOOCs offer a promising opportunity to revolutionize the veterinary education and we do recommend further exploration of this model to meet the evolving needs of the aquaculture industry.

Offering fresh aquatic veterinary training to students in Michigan

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Veterinary students often receive little or no training concerning the health and medicine of aquatic species. Many North American veterinary universities often focus their training programs on traditional companion pets and agriculture animal species. Alternative professional veterinary careers are becoming more appealing under the One Health perspective, due to an increasing demand for professional services in industrial aquaculture, seafood production and product inspection, ornamental aquatic pets care, wildlife management, and biomedical research. In 2020, the 3-week elective Clerkship in Aquatic Animal Medicine (PDI 636) was reinvented to provide Michigan State University veterinary students with fundamental knowledge on core subjects, to orientate them towards clinical reasoning to integrate aquatics into their career practices. The course started in the spring of 2021 and is offered once a year during the Spring semester. During the morning students are introduced to the topic of each day through specialized lectures, given either by the course coordinator (Dr. Gorgoglione) or by local and international guest lectures. During the afternoon students get involved in practical learning through individual, in pair, or group assignments designed to foster adaptive learning while focusing on assigned topics. Students can practice writing skills with assignments about summarizing scientific articles and webinars (Gerras et al. 2021), or using scientific English to prepare presentations, abstracts, and diagnostic reports upon solving case studies ([Fig. 1.A](#)). Through the entire course each student retrieves biological, production, and health information about one assigned fish species, delivering a final presentation focused on that selected species. Through all these activities each student gains points that contribute to their final course grade, together with points given upon attendance and active participation. Laboratory activities



Figure 1. Michigan State University students and instructors during the activities of the Aquatic Animal Medicine clerkship (PDI 636) in the Spring of 2023. A) MSU veterinary students discussing virtually case studies with Gillian Taylor, DVM from University of Pretoria, South Africa; B) Prof. Christopher Vandergoot explaining fish immobilization technique to veterinary students at MSU; C) Group picture with the aquarium curator, Paul Shuert, DVM, concluding the study visit to Belle Isle Aquarium in Detroit, MI; D) MSU veterinary students discussing with Antonio Comas, DVM during the study visit to Preuss Pets in Lansing, MI.

train students in fish anatomy, necropsy techniques with internal organs sampling, anaesthesia and biopsy procedures completed by microscopy evaluation of any specimen collected ([Fig. 1.B](#)). Several excursions allow students to visit public aquaria (e.g. Belle Isle Aquarium, Detroit, MI; [Fig. 1.C](#)), research lab, fish hatchery, and a large local aquatic pet shop involved in aquatic ornamental species breeding (Preuss Pets, Lansing, MI; [Fig. 1.D](#)).

Starting during the Spring of 2023, an entire week of this course was organized in a virtual partnership with the University of Pretoria, South Africa (in coordination with Gillian Taylor, DVM). This new partnership provides veterinary students from both universities with additional learning opportunities and is set to continue. The clerkship is highly appreciated by students and course collaborators. The broad diversity of lecturers and students, experiences, traits, and backgrounds are valuable in providing a positive learning environment, rich with many perspectives. Despite the direction within veterinary medicine that each student will pursue, the

updated and specialized knowledge provided by this unique course serves as a valuable source of information to orientate young veterinarians in their alternative career decisions.

Discussion

The discussion during the event was focused on a series of open questions, including: Do veterinary medicine degrees sufficiently cover topics on aquatic animals and aquatic animal medicine? / Capacity building: what is needed to educate and practically train good experts in aquatic animal health? / Is there room for new specific aquatic animal health-focused degrees? / What are the industry needs and expectations? / What are the professional profiles currently required by diverse stakeholders involved in the aquaculture industry? / What are the selection criteria for hiring experts in aquatics' health? / How the different stakeholders involved in aquatic health education and professional training could joint efforts and improve cooperations? / What are the limitations in the continuous life-long training and specializations in aquatic animal health?

Due to the complexity of the topics approached, these questions were only partially discussed during the session at the 21st EAFP international conference in Aberdeen, thus were further discussed during a complementary virtual session organised one week later. Although, getting answers to these questions will provide discussion topics for further meetings aimed at generating actionable strategies to improve the aquatic veterinary education worldwide.

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