

# WOAH Collaborative Centre Reports Activities 2022

## Activities in 2022

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### Centre Information

<b>Title of WOA Collaborating Centre</b>	WOAH Collaborating Centre for Emerging Aquatic Animal Diseases
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<b>Name Director of Institute (Responsible Official):</b>	Dr Rachel Hartnell
<b>Name (including Title and Position) of Head of the Collaborating Centre (WOAH Contact Point):</b>	Dr Grant Stentiford
<b>Name of the writer:</b>	Kelly Bateman

### TOR1 AND 2: SERVICES PROVIDED

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by WOA

Disease Control	
Title of activity	Scope
	The FHI is responsible for the delivery and enforcement of

Provision of dedicated Fish Health Inspectorate (FHI) to fulfil statutory responsibilities regarding aquatic animal health.	aquatic animal health legislation in England and Wales.
Epidemiology, surveillance, risk assessment	
Title of activity	Scope
Provision of aquatic animal health epidemiological surveillance service	Provision of advice for aquatic animal health policy, risk assessment and modelling: design and assessment of surveillance plans.
Training, capacity building	
Title of activity	Scope
Provision of training in sampling and histological analysis of fish and crustacean diseases.	Training in sampling techniques for fish and crustacean tissues and histological/molecular analysis
Training, capacity building	
Title of activity	Scope
Provision of materials for the "Introduction to histopathology in fish and crustacean diseases"	Training workshop run by the European Union Reference Laboratory for fish and crustacean diseases.
Training, capacity building	
Title of activity	Scope
Contribution to Regional seminar for the WOAHA Central Asia Workshop on Aquatic Animal Health, held in Bishkek, Kyrgyzstan, 20-21 July 2022	Presentation (online) providing an overview of the WOAHA Collaborating Centre covering how to engage with the centre and brief summary of some relevant research.
Zoonoses	
Title of activity	Scope
National Reference Laboratory for Anisakis.	Maintain capacity and knowledge base for zoonotic nematode parasites. Provide advice to industry, government and other stakeholders as required.
Wildlife	
Title of activity	Scope
Monitoring of health and disease of wild fish, crustaceans and	Samples of fish, crustacean and mollusc tissues were assessed for disease and samples collected for reference materials.

molluscs	
Aquatic animal diseases	
Title of activity	Scope
International Database on Aquatic Animal Diseases (IDAAD)	Complete review of the disease data, accessions added and updated as required.
Aquatic animal diseases	
Title of activity	Scope
WOAH experts available for Koi Herpesvirus (KHV) and Spring Viraemia of Carp (SVC).	Provision of expert advice on these disease conditions, their diagnostics, host range, pathogenicity and characterisation, including pathogen testing when required.
Aquatic animal diseases	
Title of activity	Scope
Investigation into health of Edible crab stocks ( <i>Cancer pagurus</i> )	Provision of advice and reference materials. Assistance in histological analysis of tissues to colleagues at the European Union Reference Laboratory for Mollusc Diseases.
Aquatic animal diseases	
Title of activity	Scope
Analysis of Blue crab ( <i>Callinectes sapidus</i> ) tissues from USA	Assistance in histological and ultrastructural analysis of blue crab tissues infected with an unknown microeukaryote parasite.
Aquatic animal diseases	
Title of activity	Scope
Collaboration on shrimp health and microbiome studies with ICAR India (associate partner laboratory to WOAHC)	FCDO-OCPP collaborative project between Cefas and ICAR (India) using 'omics methods, molecular diagnostics, and histopathology to elucidate a syndromic disease of shrimp: white gut syndrome. Analyses have shown involvement of EHP and a diversity of viral lineages. A publication is currently in preparation.
Aquatic animal diseases	
Title of activity	Scope
	Metagenomic/metatranscriptomic analysis of skin biopsies from salmon affected by "Red Skin Disease" an apparently

Emerging disease investigation – Atlantic salmon	emerging condition in Atlantic salmon. Coordination with Marine Scotland and Environment Agency; samples accumulated from England and Scotland; RNAseq and other analyses are ongoing.
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## TOR3: HARMONISATION OF STANDARDS

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the main focus area for which you were designated

Proposal title	Scope/Content	Applicable area
Crustacean ad hoc group	CCEAAD invited to be part of this ad hoc group, first priority to identify susceptible species for infection with Decapod iridescent virus 1 (DIV1)	Laboratory expertise
Infection with Tilapia lake virus (TiLV) Chapter for Aquatic Manual	CCEAAD invited to lead the production of a chapter on infection with Tilapia lake virus (TiLV) and associated diagnostic methods for inclusion in the Manual of Diagnostic Tests for Aquatic Animals	Laboratory expertise Training and education

4. Did your Collaborating Centre maintain a network with other WOAHA Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
EURL for Fish and Crustacean Diseases	DTU, Denmark	Europe	Sharing of information on fish and crustacean health, participation in interlaboratory proficiency tests, and attendance at National Reference Laboratory meetings.
EURL for Mollusc Diseases	IFREMER, France	Europe	Sharing of information on mollusc health, participation in interlaboratory proficiency tests.
WOAH Reference Laboratory for AHPND, IHNV, NHP, TSV, WSSV	University of Arizona, USA	Americas	Participation in histological proficiency test for crustacean diseases.

FAO Antimicrobial Resistance (AMR) Reference Centre	UK	Europe	Provide services in identifying AMR risks to aquatic animals and to help develop and assess the effectiveness of alternatives to use of antibiotics for control of diseases of farmed aquatic animals (particularly in finfish and shrimp).
International Council for the Exploration of the Seas (ICES). Expert working group on Pathology and Diseases of Marine Organisms	Denmark	Europe	Chair of the Working Group. Reporting of disease emergence and trends in marine fish and shellfish (wild stocks and aquaculture).
International Council for the Exploration of the Seas (ICES). Expert group on crab	Denmark	Europe	Reporting of disease emergence and trends in wild shellfish stocks
Worldfish	Malaysia	Asia and Pasific	Coordination of Cefas activities and those of Worldfish.
Indian Council of Agricultural Research (ICAR)	India	Asia and Pasific	Provision of positive control reference materials. Collaboration with ICAR (an Assoc Partner laboratory) in India on a British High Commission funded piece of work on shrimp health.
ASEAN Aquatic Animal Health Network	Thailand	Asia and Pasific	Collaboration with Mahidol University and BIOTEC (Thailand) on shrimp health
NIWA New Zealand/Biosecurity NZ	New Zealand	Asia and Pasific	Collaboration to investigate health issues in mussels, the presence of Francisella haliotidica and vibrios in Ostrea chilensis and Perna sp. samples and the occurrence and genetic typing of Bonamia ostreae.
			WOAH CC Director provided keynote at EPI Research

Emerging Pathogens Institute, University of Florida	USA	Americas	Symposium to cover One Health Aquaculture. Inward visit to UK by Professor Behringer from EPI to discuss collaboration in aquatic animal health
EvaG	Various	Europe	An international group of 47 laboratories that represent an extensive range of virological disciplines, generating and distributing diagnostic materials and protocols globally.
National Agricultural Research Organization (NARO)	Uganda	Africa	Establishment of MOU, advice provided on screening for tilapia viral diseases including Infectious Spleen and Kidney Necrosis Virus (ISKNV), tilapia lake virus (TiLV), tilapia parvovirus (TiPV), nodavirus and herpesvirus (TLEV). Preparation for a mission in 2023 and analysis of samples.
Department for Animal Production and Health (DAP&H)	Sri Lanka	Asia and Pasific	Collaboration to develop a project investigating slow growth syndrome in shrimp
Ministry of Fisheries and Aquaculture Development, Fisheries Commission, Fish Health Unit	Ghana	Africa	Ongoing advice, training and capacity building. Preparation for mission undertaken in Jan 2023. Co-supervision of Ghanaian PhD student.

## TOR4 AND 5: NETWORKING AND COLLABORATION

5. Did your Collaborating Centre maintain a network with other WOAHA Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
			Discussions on collaboration and extension of the GBAD

WOAH Collaborating Centre for Economics in Animal Health	Liverpool, UK	Europe	approach to cover wider aquatic hazards which impact yield and safety of products arising from aquaculture. Funded work to develop this approach as part of a 'One Food' tool with separate funding from UK Government
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## TOR6: EXPERT CONSULTANTS

6. Did your Collaborating Centre place expert consultants at the disposal of WOA?H?

Yes

NAME OF EXPERT	KIND OF CONSULTANCY	SUBJECT
Prof Grant Stentiford	Advice	Expert pathologist for investigation of aquatic animal diseases. Head of the WOA?H Collaborating Centre for Emerging Aquatic Animal Diseases. Advocate for One Health Aquaculture
Dr Kelly Bateman	Advice	Expert in crustacean diseases and coordinator for the WOA?H Collaborating Centre for Emerging Aquatic Animal Diseases
Dr Richard Paley	Advice	Expert virologist and Chair of the ICES Working Group on Pathology and Diseases of Marine Organisms.
Dr Frederico Batista	Advice	Expert in molluscan diseases and emerging molecular diagnostic tools
Dr Edmund Peeler	Advice	Expert in epidemiology and Risk.
Dr Jessica Witt	Advice	WOA?H Focal point for Aquatic Animal Health for the UK
Prof David Bass	Advice	Molecular parasitologist with emphasis on pathogen diversity and life cycles; and molecular systematics of novel/emergent pathogens
Dr David Verner Jeffreys	Advice	Expert aquatic animal bacteriologist with specific expertise in antimicrobial resistance.

		Director of FAO AMR Centre at Cefas
Dr David Stone	Advice	WOAH expert on Koi Herpesvirus (KHV) and Spring Viraemia of Carp (SVC)
Mr Michael Gubbins	Advice	Head of the Fish Health Inspectorate, responsible for the National control of aquatic animal diseases in England and Wales.

## TOR7: SCIENTIFIC AND TECHNICAL TRAINING

7. Did your Collaborating Centre provide advice/services to requests from Members in your main focus area?

Yes

*EURL for Fish and Crustacean Diseases - assistance with reviewing "Diagnostic methods and procedures for the surveillance and confirmation of TSV and YHV1*

8. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by WOA, to personnel from WOA Members?

Yes

a) Technical visit : 1

b) Seminars : 6

c) Hands-on training courses: 3

d) Internships (>1 month) : 8

TYPE OF TECHNICAL TRAINING PROVIDED (A, B, C OR D)	CONTENT	COUNTRY OF ORIGIN OF THE EXPERT(S) PROVIDED WITH TRAINING	NO. PARTICIPANTS FROM THE CORRESPONDING COUNTRY
a	Training in histological processing and reading of fish and crustacean tissues and molecular analysis for aquatic animal pathogens	Qatar	5
b	One Health Aquaculture African Workshop (online event)	Various (Africa)	100
b	Sri Lanka Veterinary Association 74th Annual Scientific Session 2022	Sri Lanka	100
b	One Food Workshop event, Pretoria (hybrid meeting)	South Africa	100



b	Overview of Finfish Biosecurity at the Fin Fish Guidelines Workshop (hybrid meeting)	Bangladesh	100
b	Overview of AMR surveillance in aquaculture at the 3rd Webinar AQUAE STRENGTH: OIE Cooperation Project	Paris	10
b	South Africa WAVMA meeting	Various (Africa)	100
c	Provision of materials to the European Union Reference Laboratory for Crustacean diseases for online training course in Histopathology of crustacean tissues	Various (Europe)	25
c	Provision of training in histopathology of crustacean tissues and diseases	UK	1
c	Provision of training in histopathology of molluscan diseases, including TEM and molecular techniques	UK	3
d	PhD students in various aspects of shellfish health and pathogen systematics	Various	8

## TOR8: SCIENTIFIC MEETINGS

9. Did your Collaborating Centre organise or participate in the organisation of scientific meetings related to your main focus area on behalf of WOA?H?

Yes

NATIONAL/INTERNATIONAL	TITLE OF EVENT	CO-ORGANISER	DATE (MM/YY)	LOCATION	NO. PARTICIPANTS
International	WOAH Regional online seminar for Aquatic Animals Focal Points in Asia	WOAH	2022-07-20	Kyrgyzstan	40

## TOR9: DATA AND INFORMATION DISSEMINATION

10. Publication and dissemination of any information within the remit of the mandate given by WOAHA that may be useful to Members of WOAHA

a) Articles published in peer-reviewed journals:

24

- Amon, D., Metaxas, A., Stentiford, G.D., Escovar-Fadul, X., Walker, T.R., Diana, Z., Karathanasi, F., Voyer, M., Hemery, L. (2022). Blue economy for a sustainable future. *One Earth* 5, 960-963. <https://doi.org/10.1016/j.oneear.2022.08.017>
- Bass, D., Christison, K., Stentiford, G.D., Cook, L.S.J., Hartikainen, H., (2022). Environmental DNA/RNA (eNA) for pathogen detection, surveillance, and ecology. *Trends in Parasitology* (in press).
- Bateman, K.S., Stentiford, G.D., Kerr, R., Hooper, C., White P., Edwards, M., Ross, S., Hazelgrove, R., Daumich, C., Green, M.J., Ivory, D., Evans, C., Bass, D. (2022). Amoebic Crab Disease (ACD) in edible crab (*Cancer pagurus*) from the English Channel, United Kingdom. *Diseases of Aquatic Organisms*, 150, 1-16 <https://doi.org/10.3354/dao03668>
- Bøgwald, M., Skår, C.K., Karlsbakk, E., Alfjorden, A., Feist, S.W., Bass, D., Mortensen, S. (2022) The infection cycle of *Marteilia pararefringens* in blue mussels, *Mytilus edulis* in a heliothermic marine oyster lagoon in Norway. *Diseases of Aquatic Organisms*, 148:167-181.
- Bojko, J., Reinke, A.W., Stentiford, G.D., Williams, B., Rogers, M.S.J., Bass, D. (2022). Microsporidia: a new taxonomic, evolutionary and ecological synthesis. *Trends in Parasitology* 38, 642-659 <https://doi.org/10.1016/j.pt.2022.05.007>
- Caputo, A., Bondad-Reantaso, M.G., Karunasagar, I, et al. Antimicrobial resistance in aquaculture: A global analysis of literature and national action plans. *Rev Aquac.* 2022; 1- 11. <https://doi.org/10.1111/raq.12741>
- Collins, E., Ward, G.M., Bateman, K.S., Cheslett, D.L., Hooper, C., Feist, S.W., Ironside, J.E., Morrissey, T., O'Toole, C., Tully, O., Ross, S.H., Stentiford, G.D., Swords, F., Urrutia, A., Bass, D. (2022). High prevalence of *Paramarteilia canceri* infecting velvet swimming crabs *Necora puber* in Ireland. *Diseases of Aquatic Organisms* 148, 167-181. <https://doi.org/10.3354/dao03652>
- Cottier-Cook, E.J., Cabarubias, J.P., Brakel, J., Brodie, J., Buschmann, A.H., Campbell, I., Critchley, A.T., Hewitt, C.L., Huang, J., Hurtado, A.Q., Kambey, C.S.B., Lim, P-E., Liu, T., Mateo, J.P., Msuya, F.E., Qi, Z., Shaxson, L., Stentiford, G.D., Bondad-Reantaso, M.G. (2022). A new progressive management pathway for improving seaweed biosecurity. *Nature Communications Nat Communications* 13, 7401. <https://doi.org/10.1038/s41467-022-34783-8>
- Dhar, A.K., Cruz-Flores, R., Bateman, K.S. (2022) Viruses of Commercially Exploited Crustaceans, In: Rowley, A.F., Coates, C.J., Whitton, M.M.A. (Eds.), *Invertebrate Pathology*, Oxford University Press.
- Diggles, B.K., Bass, D., Bateman, K.S., Chong, R., Daumich, C., Hawkins, K.A., Hazelgrove, R., Kerr, R., Moody, N., Ross, S., Stentiford, G.D. (2022). *Haplosporidium acetes* n. sp. infecting the hepatopancreas of jelly prawns *Acetes sibogae australis* from Moreton Bay, Australia. *Journal of Invertebrate Pathology* 190, 107751. <https://doi.org/10.1016/j.jip.2022.107751>.
- Edwards M, Bignell JP, Papadopoulou A, Trani E, Joseph AW, Wood G, Stone DM (2022) First detection of *Cyclopterus lumpus* virus (CLuV) in England, following a mortality event in farmed cleaner fish. *Bulletin of the European Association of Fish Pathologists*. <https://doi.org/10.48045/001c.56559>
- Hooper, C., Debnath, P.P., Stentiford, G.D., Bateman, K.S., Krishna, S.R., Bass, D. (2022). Diseases of the giant freshwater prawn *Macrobrachium rosenbergii*: A review for a growing industry. *Reviews in Aquaculture* <https://doi.org/10.1111/raq.12754>
- Itoiz S, Metz S, Derelle E, Reñé A, Garcés E, Bass D, Soudant P and Chambouvet A (2022) Emerging parasitic protists: the case of *Perkinsea*. *Front. Microbiol.* 12:735815. doi: 10.3389/fmicb.2021.735815
- Light, E., Baker-Austin, C., Card, R.M., Ryder, D., Teixeira Alves, M., Al-Sarawi, H.A., Abdulla, K.H., Stahl, H., Al-Ghabshi, A., Alghoribi, M.F., Balkhy, H.H., Joseph, A., Hughes, A., LeQuesne, W.J.F., Verner-Jeffreys, D.W., Lyons, B.P. (2022) Establishing a marine monitoring programme to assess antibiotic resistance: A case study from the Gulf Cooperation Council (GCC) region. *Environmental Advances* 9 <https://doi.org/10.1016/j.envadv.2022.100268>
- Liu, X., Stentiford, G.D., Ren, S., Wen, M., Yu, J., Li, D., Xiang, J., Zhang, J. (2022). *Naidispora caidianensis* n. gen. n. sp. infecting coelomocytes of oligochaete *Branchiura sowerbyi* (Oligochaeta: Naididae) in China. *Journal of Invertebrate Pathology* <https://doi.org/10.1016/j.jip.2022.107768>
- Millard, R.S., Bickley, L.K., Bateman, K.S., Verbruggen, B., Farbos, A., Lange, A., Moore, K.A., Stentiford, G.D., Tyler, C.R., van Aerle, R., Santos, E.M. (2022). Resistance to WSSV in the shore crab is associated with suppressed virion trafficking and increased immune responses over time. *Frontiers in Immunology* <https://doi.org/10.3389/fimmu.2022.1057421>
- Munkongwongsiri, N., Prachumwat, A., Eamsaard, W., Lertsiri, K., Flegel, T.W., Stentiford, G.D., Sritunyalucksana, K. (2022). *Propionigenium* and *Vibrio* species identified as possible component causes of shrimp white feces syndrome (WFS) associated with the microsporidian *Enterocytozoon hepatopenaei*. *Journal of Invertebrate Pathology* 192, 107784. <https://doi.org/10.1016/j.jip.2022.107784>
- Papadopoulou A, Monaghan SJ, Bagwell N, Alves MT, Verner-Jeffreys D, Wallis T, Davie A, Adams A, Migaud H (2022) Efficacy testing of an immersion vaccine against *Aeromonas salmonicida* and immunocompetence in ballan wrasse (*Labrus bergylta*, Ascanius). *Fish &*

Shellfish Immunology 121:505-515

- Persson, B.D., A. Aspán, D. Bass, and C. Axén (2022) 'A Case Study of *Dermotheca Gasterostei* (= *Dermocystidium Gasterostei*, Elkan) Isolated from Three-Spined Stickleback (*Gasterosteus Aculeatus*) Captured in Lake Vättern, Sweden.' *Bulletin of the European Association of Fish Pathologists*, October 2022.
- Prachumwat, A., Munkongwongsiri, N., Eamsaard, W., Lertsiri, K., Flegel, T.W., Stentiford, G.D., Sritunyalucksana, K. (2021). A potential prokaryotic and microsporidian pathobiome that may cause shrimp white feces syndrome (WFS). *BioRxiv* <https://doi.org/10.1101/2021.05.23.445355>
- Skujina, I., Hooper, C., Bass, D., Feist, S.W., Bateman, K.S., Villalba, A., Carballal, M., Iglesias, D., Cao, A., Ward, G.M., Ryder, D.R.G., Bignell, J.P., Kerr, R., Macarie, N.A., Prentice, M., King, N., Thorpe, J., Malham, S., McKeown, N.J., Ironside, J.E. (2022) Discovery of the parasite *Marteilia cocosarum* sp. nov. in common cockle (*Cerastoderma edule*) fisheries in Wales, UK and its comparison with *Marteilia cochillia*. *Journal of Invertebrate Pathology*, 192, 107786, <https://doi.org/10.1016/j.jip.2022.107786>.
- Stentiford, G.D., Peeler, E.J., Tyler, C.R., Bickley, L.K., Holt, C., Bass, D., Turner, A., Baker-Austin, C., Ellis, T., Lowther, J., Posen, P., Bateman, K.S., Verner-Jeffreys, D., van Aerle, R., Stone, D., Paley, R., Trent, A., Katsiadaki, I., Higman, W., Maskrey, B., Devlin, M., Lyons, B.P., Hartnell, D., Younger, A., Bersuder, P., Warford, L., Losada, S., Clarke, K., Hynes, C., Dewar, A., Greenhill, B., Huk, M., Franks, J., Dal-Molin, F., Hartnell, R. (2022). A seafood risk tool for assessing and mitigating chemical and pathogen hazards in the aquaculture supply chain. *Nature Food* 3, 169–178. <https://doi.org/10.1038/s43016-022-00465-3>
- Stentiford, G.D., Holt, C. (2022). Global adoption of aquaculture to supply seafood. *Environmental Research Letters* 17, 041003 <https://doi.org/10.1088/1748-9326/ac5c9f>
- Warren, D.A., Burgess, A.L., Karemera, F., Bacela-Spychalska, K., Rachaelewski, M., Stentiford, G.D., Bojko, J. (2022). Histopathological survey for parasite groups in *Gammarus varsoviensis* (Amphipoda). *Diseases of Aquatic Organisms* 149:47-51 <https://doi.org/10.3354/dao03658>

b) International conferences:

12

- CCEAAD colleagues organised and participated in the One Health Aquaculture African Workshop, 16th – 17th March 2022. This was a dual in person and online event and involved a series of presentation and bilateral workshop/breakouts.
- Dr Richard Paley was invited to present at the 26th Annual Workshop of the National Reference Laboratories for Fish Diseases, Organised by the European Union Reference Laboratory for Fish Diseases, Online meeting, 30th - 31st May 2022. Presentations on *Cyclopterus lumpus* virus (CLuV) and the WOAHA CC E
- Dr Kelly Bateman attended the 13th Annual Workshop of the National Reference Laboratories for Crustacean Diseases, Organised by the European Union Reference Laboratory for Crustacean Diseases, Online meeting, 1st June 2022.
- Dr Kelly Bateman attended the 54th Annual Meeting of the Society for Invertebrate Pathology, online meeting 1st – 4th August 2022.
- Dr Kelly Bateman presented an overview of the CCEAAD at the WOAHA Regional online seminar for Aquatic Animals Focal Points in Asia, 20th – 21st July 2022.
- Dr Athina Papadopoulou organised the Bangladesh Fin Fish Guidelines Workshop Dhaka, Bangladesh 21-Sep-22.
- Head of CCEAAD presented at the 74th Annual Scientific Sessions of the Sri Lankan Veterinary Association, virtual attendance, 21st October 2022.
- CCEAAD colleagues participated at the 7th World One Health Congress. Sands Expo & Convention Centre, Singapore. 7-11 November 2022.
- CCEAAD colleagues presented at the International Symposium of Ecology and Evolution of Marine Parasites and Diseases, La Rochelle, France 15th – 18th November 2022.
- CCEAAD colleague presented at the Aquatic Veterinary Medicines Association World Aquatic Health Conference. Pretoria University, South Africa. 4-7 December 2022.
- Head of CCEAAD provided keynote presentation on 'One Health Aquaculture' at European Society of Comparative Physiology and Biochemistry meeting, Naples, Italy, 30th August 2022.
- CCEAAD colleagues presented at the International Symposium on Ecology and Evolution of Marine Parasites and Diseases, organised by Ifremer. La Rochelle, France, November 2022, and contributed to a workshop on high throughput sequencing, bioinformatics, eDNA, and improved understanding of disease aetiologies and trajectories.

c) National conferences:

3

- CCEAAD colleagues attended a meeting for the UK National Reference Laboratories for fish, mollusc and crustacean diseases, online event, 11th May 2022.
- CCEAAD colleagues attended the European Association for Fish Pathologists (EAFP) UK branch meeting held in Portland, Dorset, 14th – 15th September 2022.
- CCEAAD colleagues attended and presented at the 4th International Symposium for Advances in Marine Mussel Research, organised by Exeter University; Saunton Sands Hotel, North Devon, November 2022.

d) Other (Provide website address or link to appropriate information):

1

<https://eafpbulletin.scholasticahq.com/article/36235-workshop-report-diseases-of-ornamental-and-laboratory-fishes>

11. What have you done in the past year to advance your area of focus, e.g. updated technology?

*Development of virtual slide systems to provide online access to histological materials in the Registry of Aquatic Pathology (RAP). The RAP is an exclusive database and specimen archive system which includes hundreds of examples of disease conditions and parasites from cultured and wild fish, bivalve molluscs and crustacea from freshwater and marine environments around the world.*

12. Additional comments regarding your report: