



Evaluations of Biosecurity on Fish Farms: “How to?”

Prof. Dr Miroslav I. Urošević, University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia

Prof. Dr Dušan Palić, Chair for Fish Diseases and Fisheries Biology, Faculty of Veterinary Medicine, Ludwig-Maximilians-Universität München, Germany

Dr Saraya Tavornpanich, National Veterinary Institute, Ås, Norway

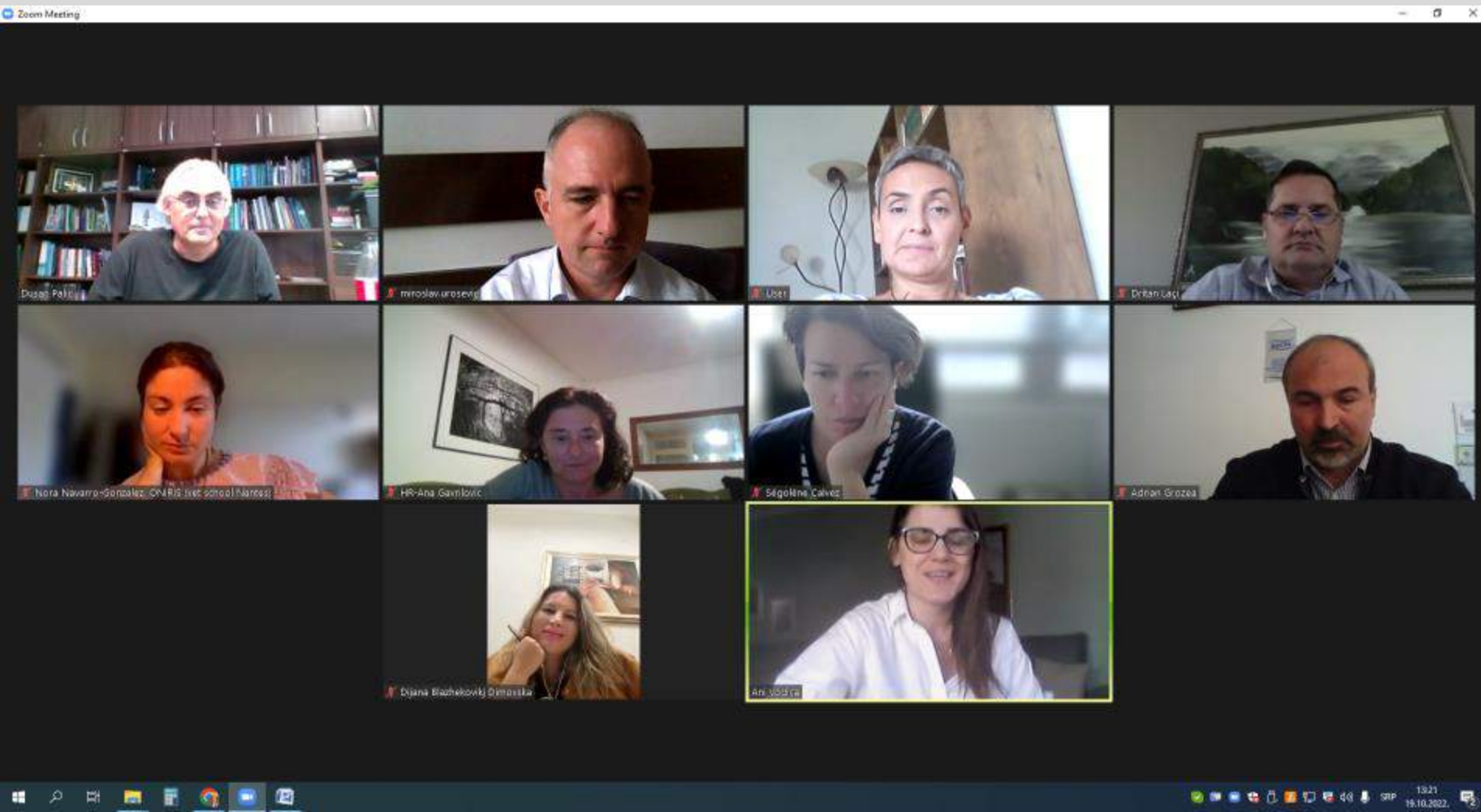
*Prof. Dr Ksenija Aksentijević, Department for Fish Diseases, Faculty of Veterinary Medicine University of Belgrade, Serbia



International
Aquatic
Veterinary
Biosecurity
Consortium



During the autumn of 2022, the idea to establish the subgroup "Biosecurity in Aquaculture" within the COST action BETTER was proposed during a discussion between veterinarians, researchers in aquaculture, and experts in aquatic animal health. Nowadays it consists of **15 members from 9 countries**: Albania, Croatia, France, Germany, Greece, North Macedonia, Norway, Serbia and Turkey.



Examples are based on International Aquatic Veterinary Biosecurity Consortium on-farm questionnaire, materials developed for terrestrial animals in the WG-3 of COST action “BETTER”, and a comprehensive survey designed to evaluate and quantify biosecurity measures in Mediterranean farmed seabass.

Optimal Biosecurity Program

Can be applied to:

- **Any** infectious and contagious disease
- **Any** type of operation (aquaculture or livestock and from the farm to the nation)

Has practical outcome and evidence-based process with clear end-points that are

- Consistent with WOAHP Code/Manual approaches
- Meet EC 2006/88 or other National regulations



The Primary Focus of Biosecurity

To ensure that an epidemiological unit is not diseased/infected and remains that way.

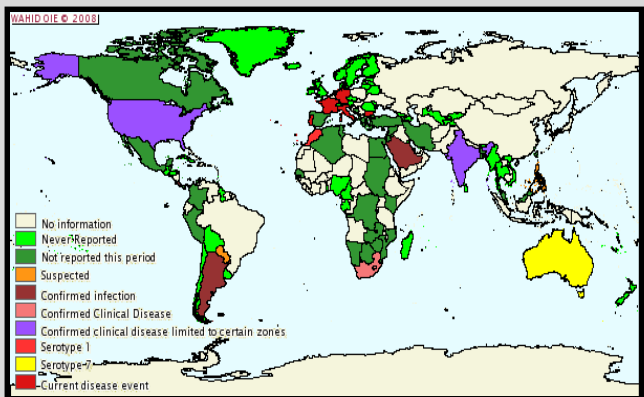
Prevention! ... Control! ... Eradication!



Epidemiological Units: from a Farm to a Nation

Epidemiologic Unit—a defined population of animals, separated to some degree from other populations, in which infectious and contagious diseases can be transmitted

- Establishment
- Compartment
- Zone
- Region
- Country



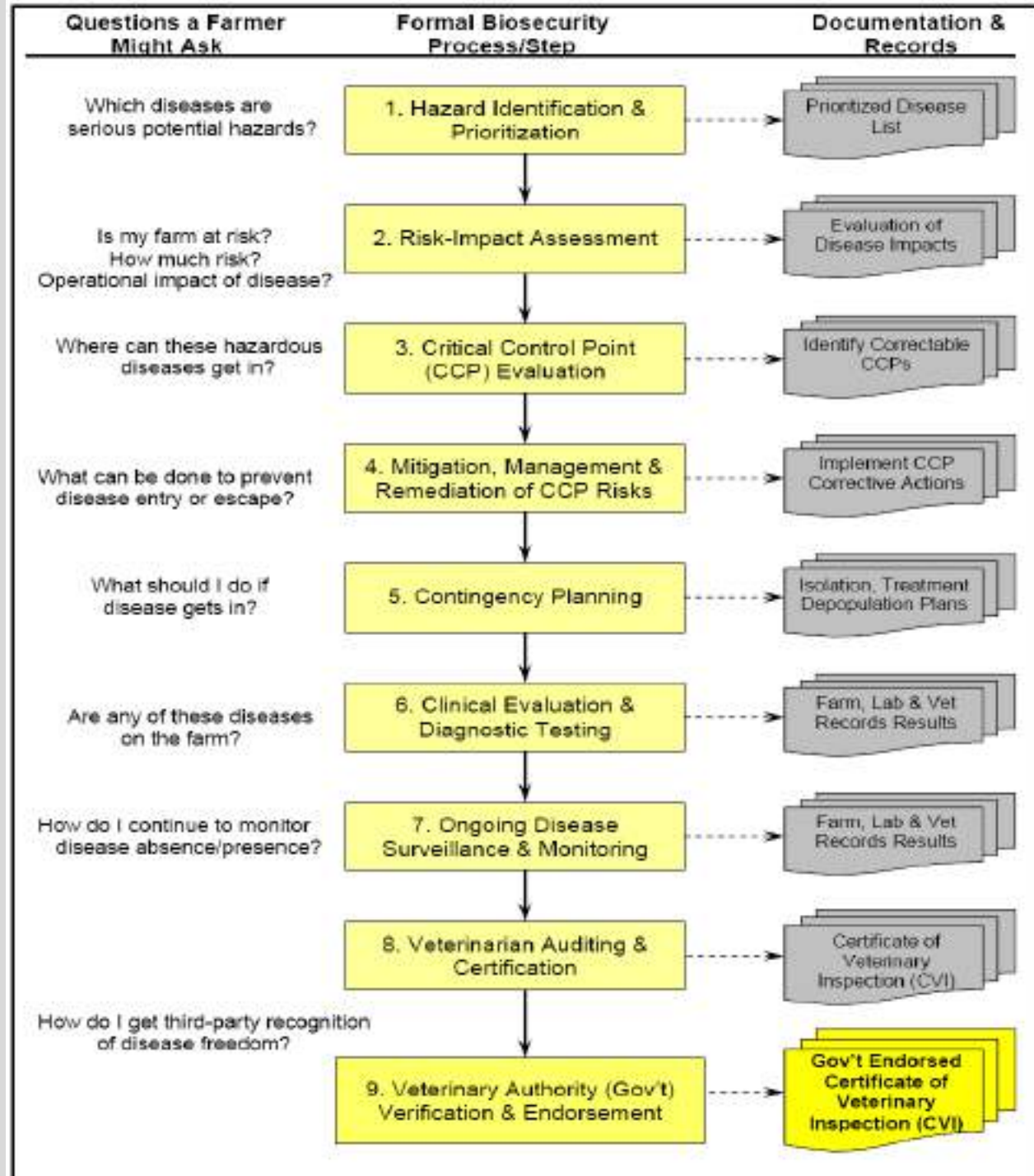
Common to *all* Programs

For the prevention, control and eradication of infectious and contagious diseases

- Identify disease ***Hazards and Risks*** (hazard ID and risk analysis)
- Identify ***Critical Control Points*** (for disease entry / escape)
- Establish ***Mitigating Actions*** for all Critical Control Points (risk management)
- Determine ***Disease Status / Freedom*** (what's there?)
- Develop ***Contingency Plans*** (what if?)
- Monitor progress and ***Audit*** implementation
- ***Certify*** Biosecurity Levels / Disease Freedom



Integrating Biosecurity Components



Questionnaire examples (COST-BETTER)*:

What are the main objectives of the biosecurity assessment?

Select all the options that apply

Fish categories		Certification for exportation	Certification for quality scheme	Audits and/or inspection	Voluntary assessment for improving biosecurity	Specific disease or AMR audit / inspection:	Other: _____
Cyprinid ponds	Hatchery						
	Ongrowing fish						
Salmonid raceways	Hatchery						
	Ongrowing fish						

* Modified from COST-BETTER WG 3 questionnaire models

Cyprinid fish pond in northern Serbia



Rainbow trout farm in southwest Serbia



“MedAID” project “Biosecurity and risk of disease introduction and spread in Mediterranean seabass and seabream farms”, 2018-2019

Questionnaire design

Total of 160 self-explanatory questions were structured into 19 sections:

- 1) Activity general description (i.e. type of production, facility location..)
- 2) Production statistics (i.e. stocked species, stocking density, annual production)
- 3) Source of live fish (broodstock, larvae, fry and fingerlings)
- 4) Vaccine and vaccination procedures
- 5) Water source and treatment
- 6) Introduction of live fish onto the facility
- 7) Rearing management (i.e. stress minimizing, transfer of fish between units)
- 8) Feed
- 9) Harvesting
- 10) Facility entry and exit
- 11) Equipment and vehicles
- 12) Vectors (animals/wildlife)
- 13) Vectors (on-site personnel)
- 14) Vectors (people, visitors)
- 15) Waste management
- 16) Use of divers
- 17) Fish health monitoring and management (i.e. mortality record, disinfection...)
- 18) Diagnoses and reporting (i.e. surveillance system, health inspection...)
- 19) Biosecurity programme and record-keeping (i.e. SOPs, training and compliance...)



IAVBC Application: Disease Hazards and Risks

- Which important diseases are present or can potentially affect the farm (Epi-Unit)?
- What might be the impacts on the farm?
 - Decreased production, increased costs
 - Negative product demand and price
 - Regulatory restrictions

Create prioritized disease list based on severity of potential impact:



IAVBC Worksheet to identify and list infectious diseases that producer and veterinarian believe may be hazardous to a finfish EpiUnit (farm). The disease hazard prioritization is based on the assessment of likelihood that specific disease will affect the EpiUnit and relative impact that it may have on the operation. WS: white spot disease (*Ichthyophthirius multifiliis*); VHS: viral haemorrhagic septicaemia.

Disease	Is this Disease Present in this EpiUnit/? (Y/N)	Likelihood this disease will be introduced on this EpiUnit/farm? (Rank: 0=none low; 5=v. high)	What would be the impact of this disease on production? (Rank: 0=no impact; 5=devastating)	Describe the impacts (e.g. decreases production, high mortality, government depopulation, etc.)	For each disease: Likelihood (L) x Impact (I)	Rank: (WS vs. VHS)
WS	Y	5	1	Decrease production, low mortality	5	2
VHS	Y	3	5	High mortality, possible depopulation	15	1





Example from “MedAID” project:

Viral encephalopathy and retinopathy (VER), also known as viral nervous necrosis (VNN)

Figure 16 – Risk matrices used to combine likelihoods of VER/VNN introduction and economic consequences for risk estimation

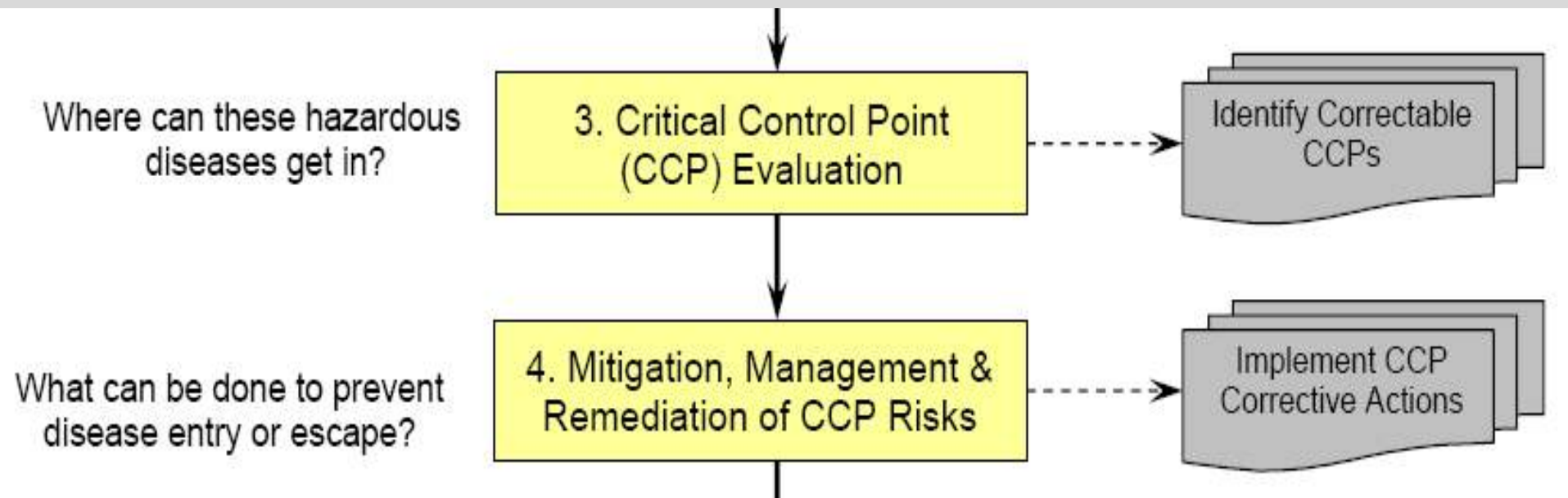
		Likelihood of introduction					
		Very unlikely (0)	Unlikely (1)	As likely as not (2)	Likely (3)	Very likely (4)	Almost certain (5)
Economic consequences	No impact (0)	0	1	2	3	4	5
	Low impact (1)	1	2	3	4	5	6
	Minor impact (2)	2	3	4	5	6	7
	Moderate impact (3)	3	4	5	6	7	8
	Major impact (4)	4	5	6	7	8	9
	Devastating impact (5)	5	6	7	8	9	10



Table 28 – Risk estimate for on-growing

Risk question (On-growing)		
What is the risk of VER/VNN on on-growing facility by disease introduction through live fish (seabass)?	Likelihood of introduction	4
	Uncertainty	4-5
	Economic consequences	3 (Moderate impact)
	Overall risk	7
	Risk estimate	High
What is the risk of VER/VNN on on-growing facility by disease introduction through water?	Likelihood of introduction	5
	Uncertainty	NA
	Economic consequences	3 (Moderate impact)
	Overall risk	8
	Risk estimate	High
What is the risk of VER/VNN on on-growing facility by disease introduction through wild fish/ pests?	Likelihood of introduction	5
	Uncertainty	NA
	Economic consequences	3 (Moderate impact)
	Overall risk	8
	Risk estimate	High
What is the risk of VER/VNN on on-growing facility by disease introduction through well boats?	Likelihood of introduction	4
	Uncertainty	4-3
	Economic consequences	3 (Moderate impact)
	Overall risk	7
	Risk estimate	High
What is the risk of VER/VNN on on-growing facility by disease introduction	Likelihood of introduction	4
	Uncertainty	3-4

IAVBC process: Determine and Mitigate Critical Points (where disease can enter or leave)



Identifying the Critical Points where disease can enter or leave your farmCheck Yes or No for each question.**Fish Movement**

- | Yes | No | |
|-------------------------------------|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Have you restricted or stopped all fish movement on or off your farm to prevent entry or spread of any disease? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Have you implemented strict biosecurity measures for fish, water sources, equipment, vehicles, wildlife vectors and people on your farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Are you closely and frequently monitoring your fish for signs of disease? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you limit contact between your fish stock and wild fish stocks? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you limit the frequency and number of new introductions of fish onto your farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you limit purchases to a few sources with known and trusted fish health programs? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you know the health status and the source of the fish brought onto your farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you only bring animals onto your farm, that have been inspected or tested to be free of the disease you listed above? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you request copies of treatment records (and vaccinations, if applicable) for all purchased fish? |
| <input type="checkbox"/> | <input type="checkbox"/> | Do you disinfect eggs upon arrival to the farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you require that newly acquired or returned fish for your farm are quarantined for at least 3 weeks upon arrival? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Are your quarantine facilities separate from all other fish areas? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you prevent the sharing of water, facilities or equipment between newly acquired or returned fish and your currently stocked fish? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | If equipment must be used elsewhere on the farm, do you clean and disinfect the item before moving it from one location and another location? |

12 1 Total Number of Yes and No answers**Farm Entrance**

- | | | |
|-------------------------------------|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Do you limit access to your farm? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Do you have only one gated entrance to fish production areas on your farm to better control and monitor visitors and vehicles? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Do you keep the gate locked when not in use? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Have you posted signs at the farm entrance to inform visitors to stay off your farm unless they have received permission? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Is traffic on or off your farm closely monitored and recorded? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you maintain a log sheet to record any visitors or vehicles that come onto your farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you require delivery vehicles and visitors follow your farm biosecurity guidelines regarding parking and fish contact? |

3 4 Total Number of Yes and No answers**Water Sources**

- | | | |
|-------------------------------------|--------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you use known pathogen-free water sources on your farm (e.g., well water, spring water)? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you avoid surface water sources on your farm? |
| <u>H/P</u> <input type="checkbox"/> | <input type="checkbox"/> | If surface waters are used, do you filter and disinfect water prior to using it with your fish stock to exclude unwanted aquatic species and pathogens? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you take measures to prevent effluent from other locations from entering your operation? |

3 0 Total Number of Yes and No answers**Animal Management**

- | | | |
|-------------------------------------|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you maintain optimum stocking densities in efforts to minimize stress to your fish? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you limit transfers of fish between units or locations to only those that are necessary? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you gentle crowding and fish handling methods when working with fish? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you maintain optimum water quality for fish species reared on your farm? |
| <u>H/P</u> <input type="checkbox"/> | <input type="checkbox"/> | Do you obtain live feed from reliable sources? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you secure all feed storage areas and clean up spilled feed to minimize access by rodents or birds? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Are you familiar with the diseases that you feel are important to your operation and the signs of infection? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Have you educated your employees about these diseases and the clinical signs of infection? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you closely monitor fish daily for signs of illness? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Do you promptly remove any dead or dying fish? |
| <input type="checkbox"/> | <input type="checkbox"/> | Do you promptly euthanize animals that are not going to recover? |
| <input type="checkbox"/> | <input type="checkbox"/> | Do you submit dead or dying fish for diagnostic testing or necropsy to determine the cause of death? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you immediately remove and isolate sick fish to minimize disease spread? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you prevent direct contact between isolated fish and other fish on the farm? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you maintain separate water sources for isolation areas? |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Do you use separate facilities, equipment, and staff to handle isolated fish? |
| <input type="checkbox"/> | <input type="checkbox"/> | If it is not possible to use separate facilities, equipment and staff, do you handle or visit the isolated animals LAST? |
| <input type="checkbox"/> | <input type="checkbox"/> | Do you clean and disinfect all equipment, clothing, boots, etc. that are exposed to other animals, particularly those that are sick or have been quarantined? |
| <input type="checkbox"/> | <input type="checkbox"/> | Do you always wash or sanitize your hands after any contact with sick or dead fish to prevent disease spread to other animals? |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Do you require your employees to wash or sanitize their hands after contact with sick or dead fish? |

12 3 Total Number of Yes and No answers

Motivation for Implementation

Producers

- Protect investments
- Maximize production
- Value-added certified product

Domestic Governments

- Meet regulations
- Protect industries
- Increase production and trade

International

- Prevent disease spread
- Meet international trade requirements



Although there is no single universal tool for assessment of biosecurity measures on fish farms, it is very likely that the described approaches can substantially contribute to the enhancement of existing biosecurity plans.

