BETTER

+

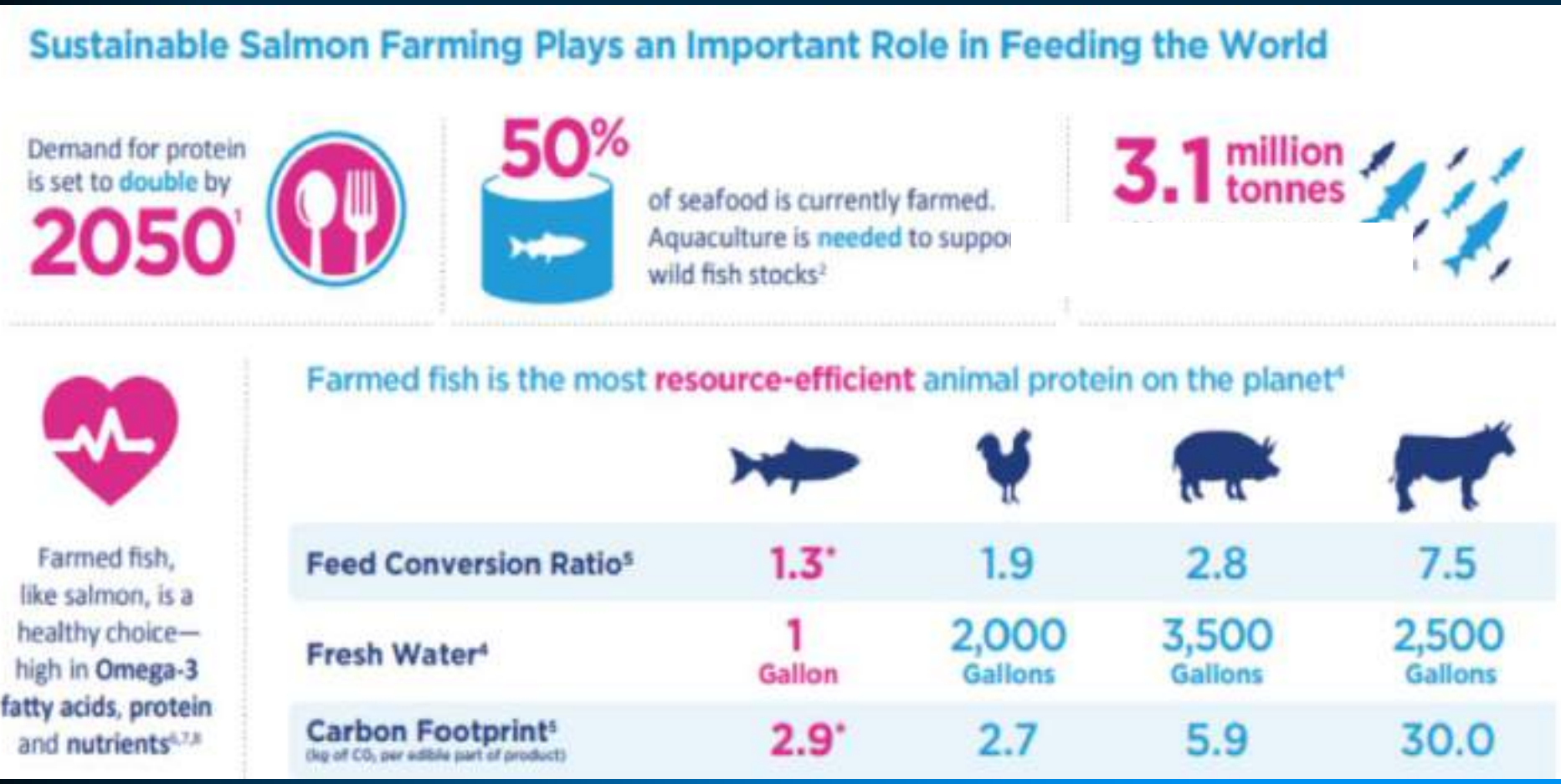
Overview of biosecurity in aquaculture

Prof. Dr **Miroslav I. Urošević**, D.V.M.
University of Novi Sad Faculty of Agriculture, Novi Sad, Serbia

Prof. Dr **A. David Scarfe**, University of Pretoria, South Africa

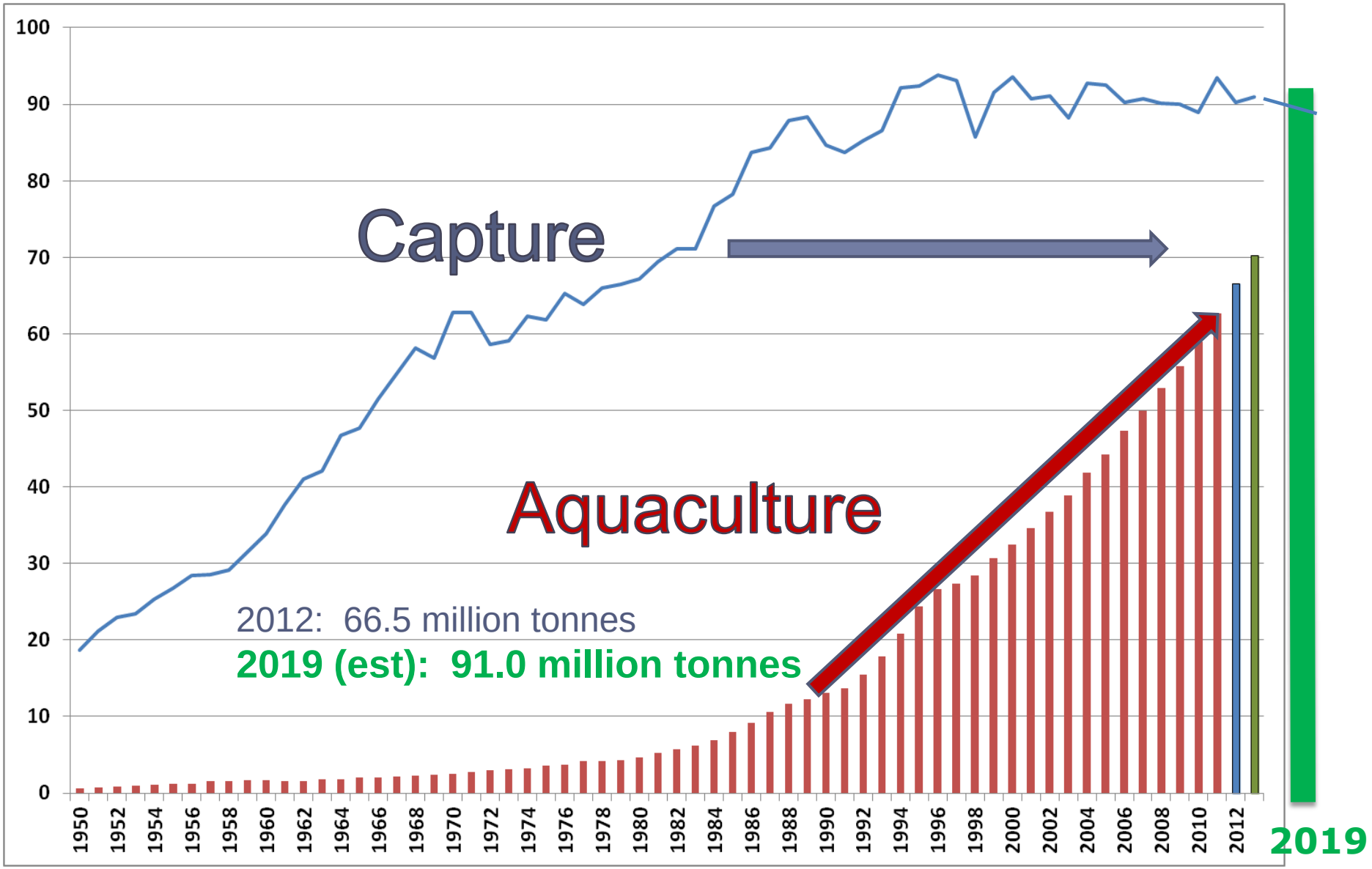
Prof. Dr **Dušan Palić,** D.V.M. Ph.D., Dipl. ECAAH
Chair of Fish Diseases and Fisheries Biology, Faculty of Veterinary Medicine, Ludwig-Maximilians-University Munich, Germany

Why the Emphasis on Aquaculture Biosecurity?



Source: GSI 2016 Sustainability Report

1 Gallon = 3,75 L

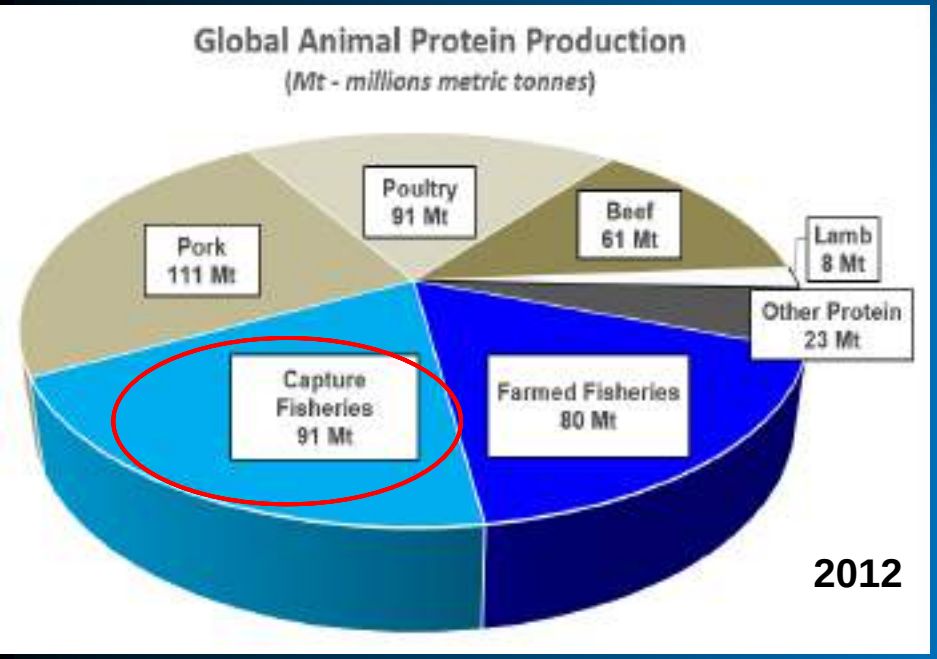

100
90
80
70
60
50
40
30
20
10
0
Capture
Aquaculture
2012: 66.5 million tonnes
2019 (est): 91.0 million tonnes
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2019

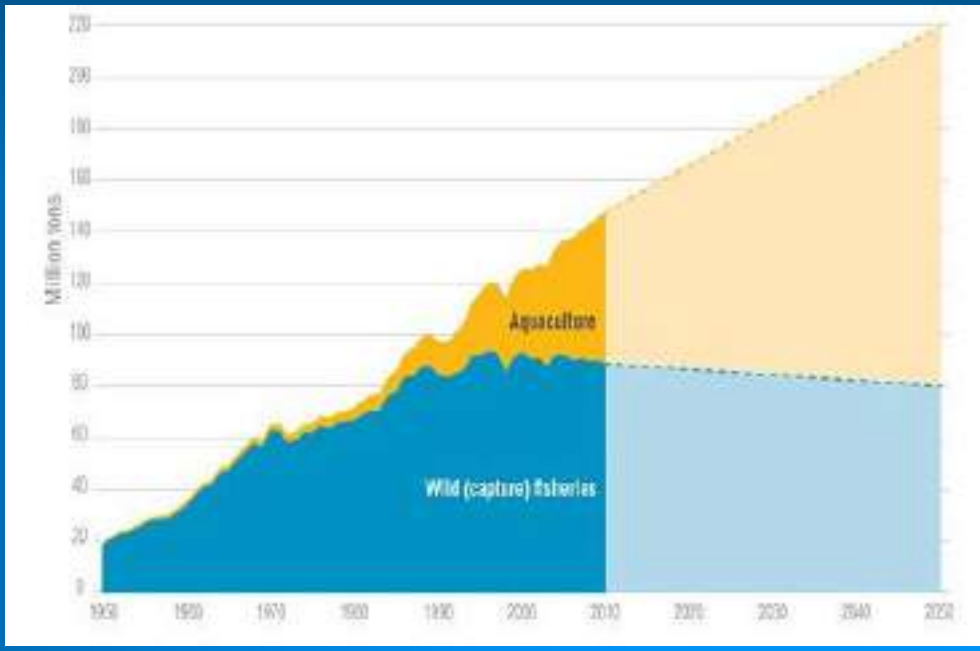
Food Security

"… predictions are that by 2050 half the animal protein consumed by people will come from aquaculture" ***(Barry O'Neil, President OIE – 2009)***

" … by 2050 ~100% more food production needed to feed 9.8 billion+ people"

(Arni Mathiesen, Assistant Director General, FAO), 2020)

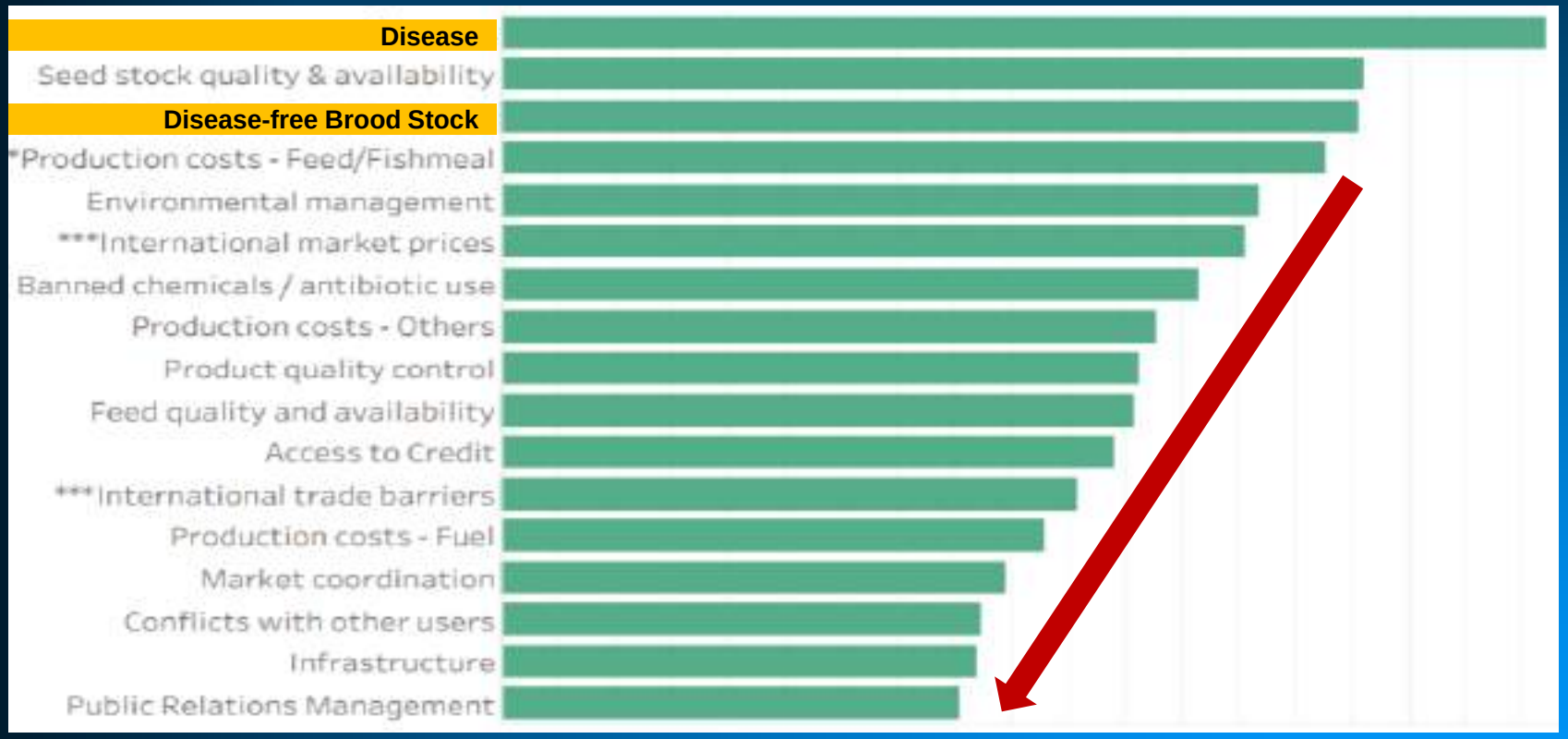




Source: FAO Stat & FishJStats

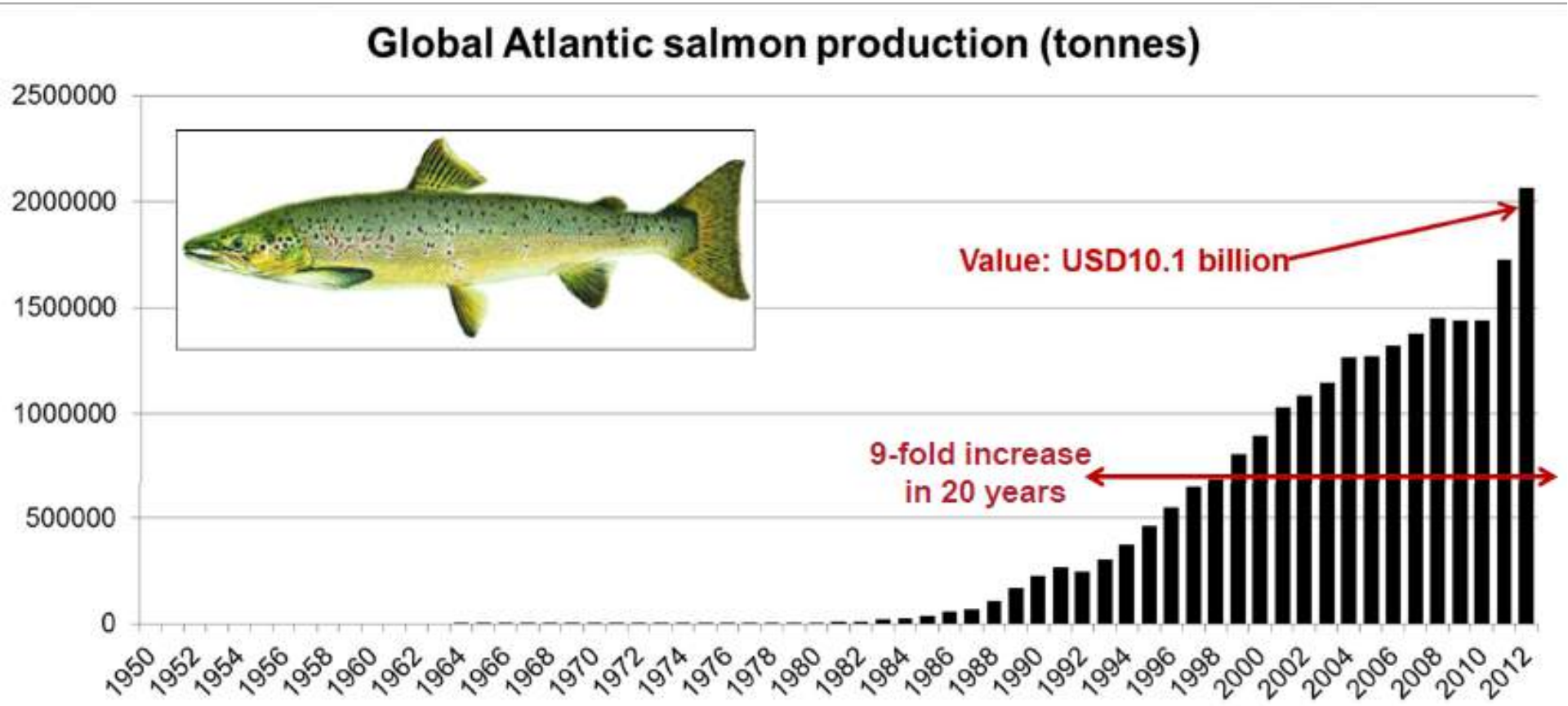
Aquaculture Industry Sustainability Problems

GAA Goal 2017 Aquaculture Survey (all countries)

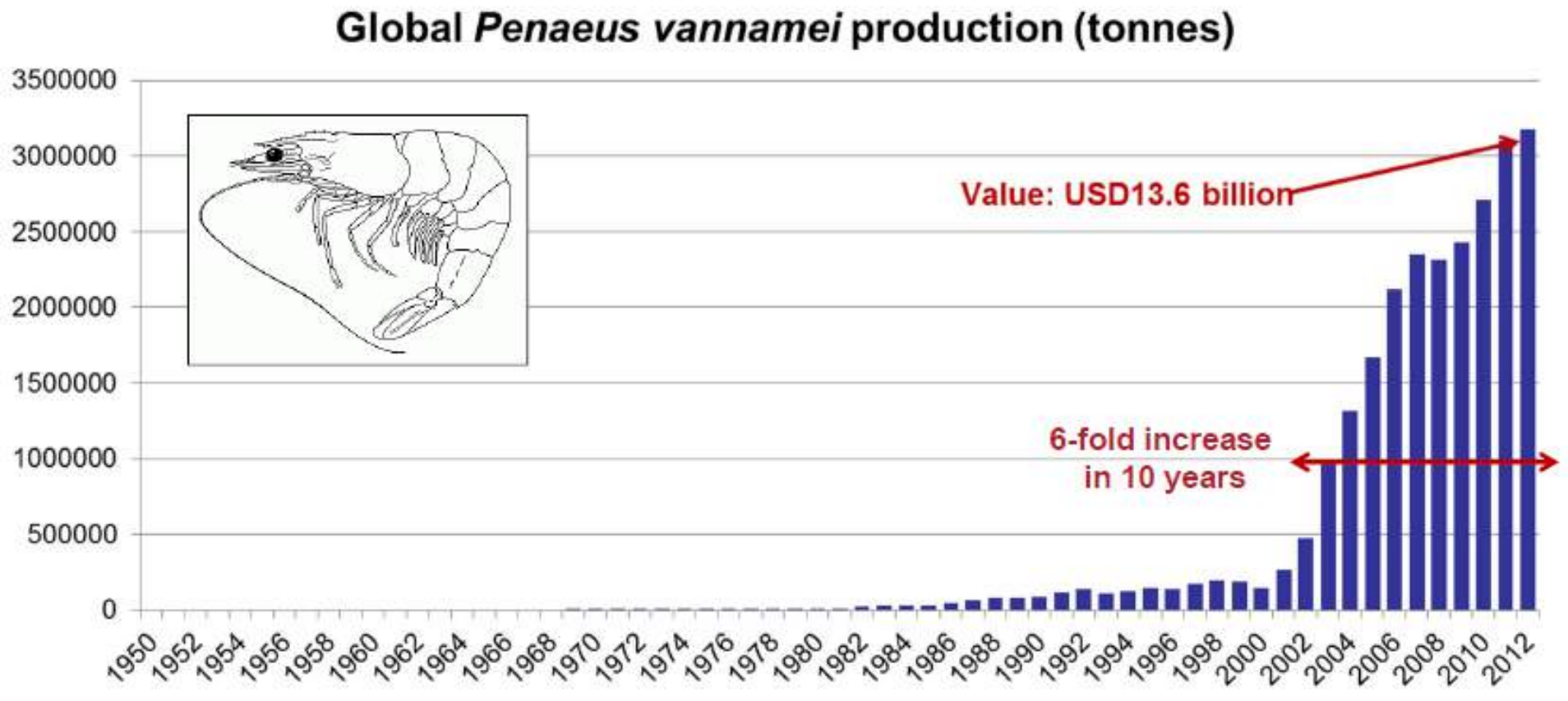


Importance: Not at all — Moderate — Extremely

Changes are rapid and imminent



Increase in production = increase in disease risk?



DISEASES OF FISH (10)

Epizootic haematopoietic necrosis
Infection with *Aphanomyces invadans*
Infection with *Gyrodactylus salaris*
Infection with HPR-deleted or HPR0 infectious salmon anaemia
Infection with salmonid alphavirus
Infectious haematopoietic necrosis
Koi herpesvirus disease
Red sea bream iridoviral disease
Spring viraemia of carp
Viral haemorrhagic septicaemia

DISEASES OF MOLLUSCS (7)

Infection with abalone herpesvirus
Infection with *Bonamia ostreae*
Infection with *Bonamia exitiosa*
Infection with *Marteilia refringens*
Infection with *Perkinsus marinus*
Infection with *Perkinsus olseni*
Infection with *Xenohaliotis californiensis*

DISEASES OF CRUSTACEANS (8)

Crayfish plague
Infection with yellow head virus
Infectious hypodermal and haematopoietic necrosis
Infectious myonecrosis
Necrotising hepatopancreatitis
Taura syndrome
White spot disease
White tail disease

DISEASES OF AMPHIBIANS (2)

Infection with *Batrachochytrium dendrobatidis*
Infection with ranavirus

DISEASES OF FISH (10)

Epizootic haematopoietic necrosis
Infection with *Aphanomyces invadans*
Infection with *Gyrodactylus salaris*
Infection with HPR-deleted or HPR0 infectious salmon anaemia
Infection with salmonid alphavirus
Infectious haematopoietic necrosis
Koi herpesvirus disease
Red sea bream iridoviral disease
Spring viraemia of carp
Viral haemorrhagic septicaemia

DISEASES OF MOLLUSCS (7)

Infection with abalone herpesvirus
Infection with *Bonamia ostreae*
Infection with *Bonamia exitiosa*
Infection with *Marteilia refringens*
Infection with *Perkinsus marinus*
Infection with *Perkinsus olseni*
Infection with *Xenohaliotis californiensis*

DISEASES OF CRUSTACEANS (8)

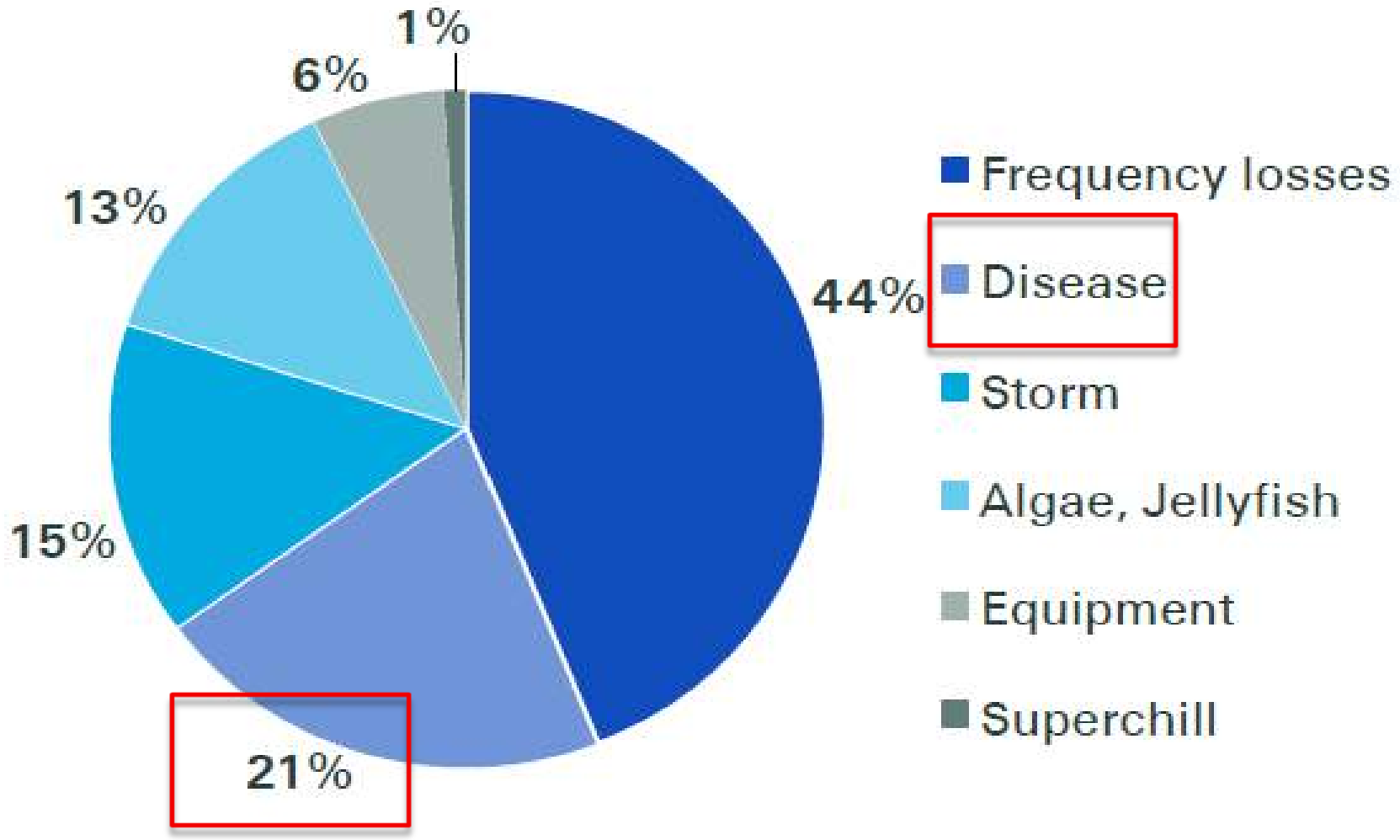
Crayfish plague
Infection with yellow head virus
Infectious hypodermal and haematopoietic necrosis
Infectious myonecrosis
Necrotising hepatopancreatitis
Taura syndrome
White spot disease
White tail disease

DISEASES OF AMPHIBIANS (2)

Infection with *Batrachochytrium dendrobatidis*
Infection with ranavirus

- *Red are diseases introduced on the list since 2000. In 20 years, 19 new diseases…

Major Aquaculture Risk Factors

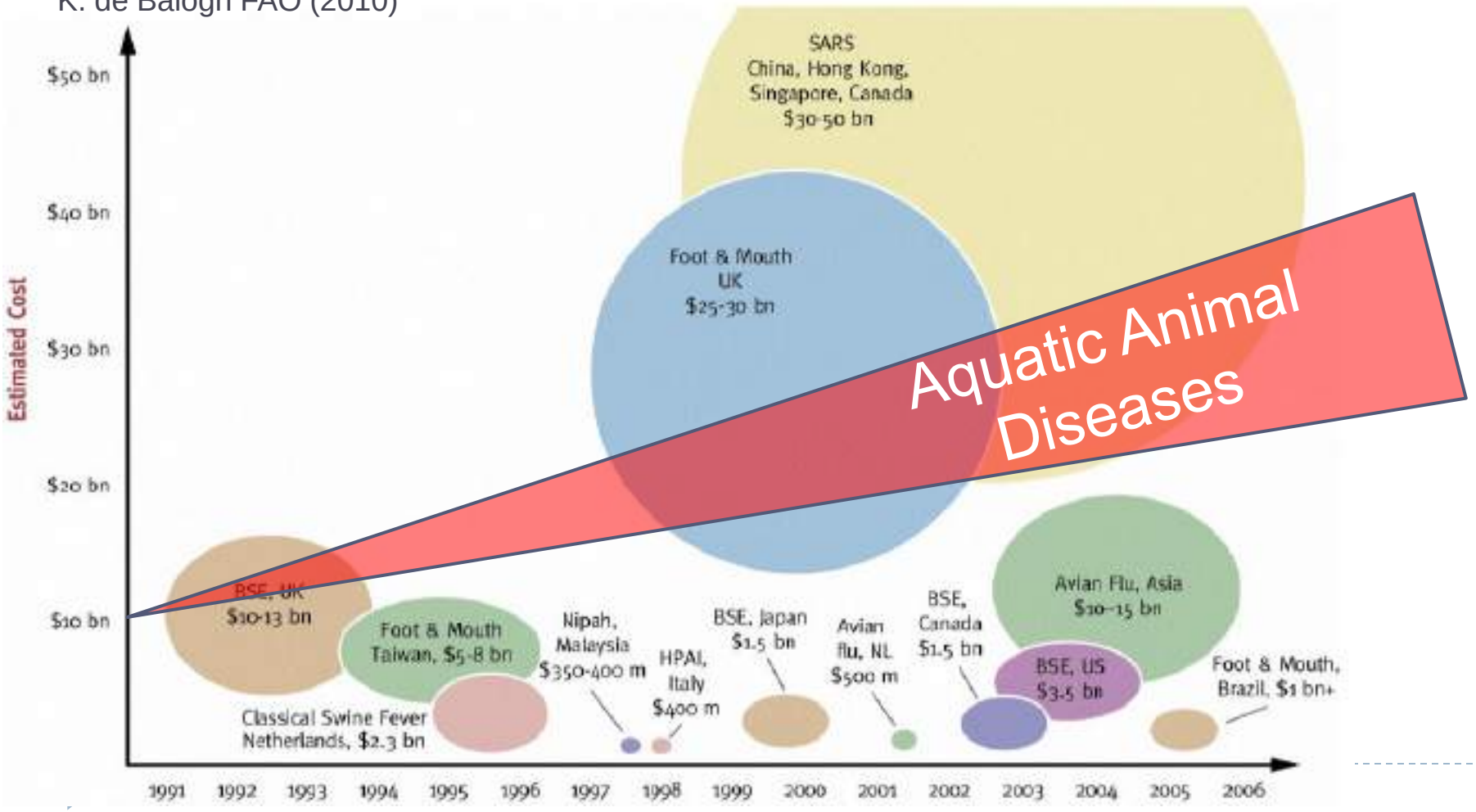


Swiss Re

Impact of Disease Outbreaks

Aquatic and Terrestrial Animal Diseases

K. de Balogh FAO (2010)



(Maldonado-Miranda et al., 2022)

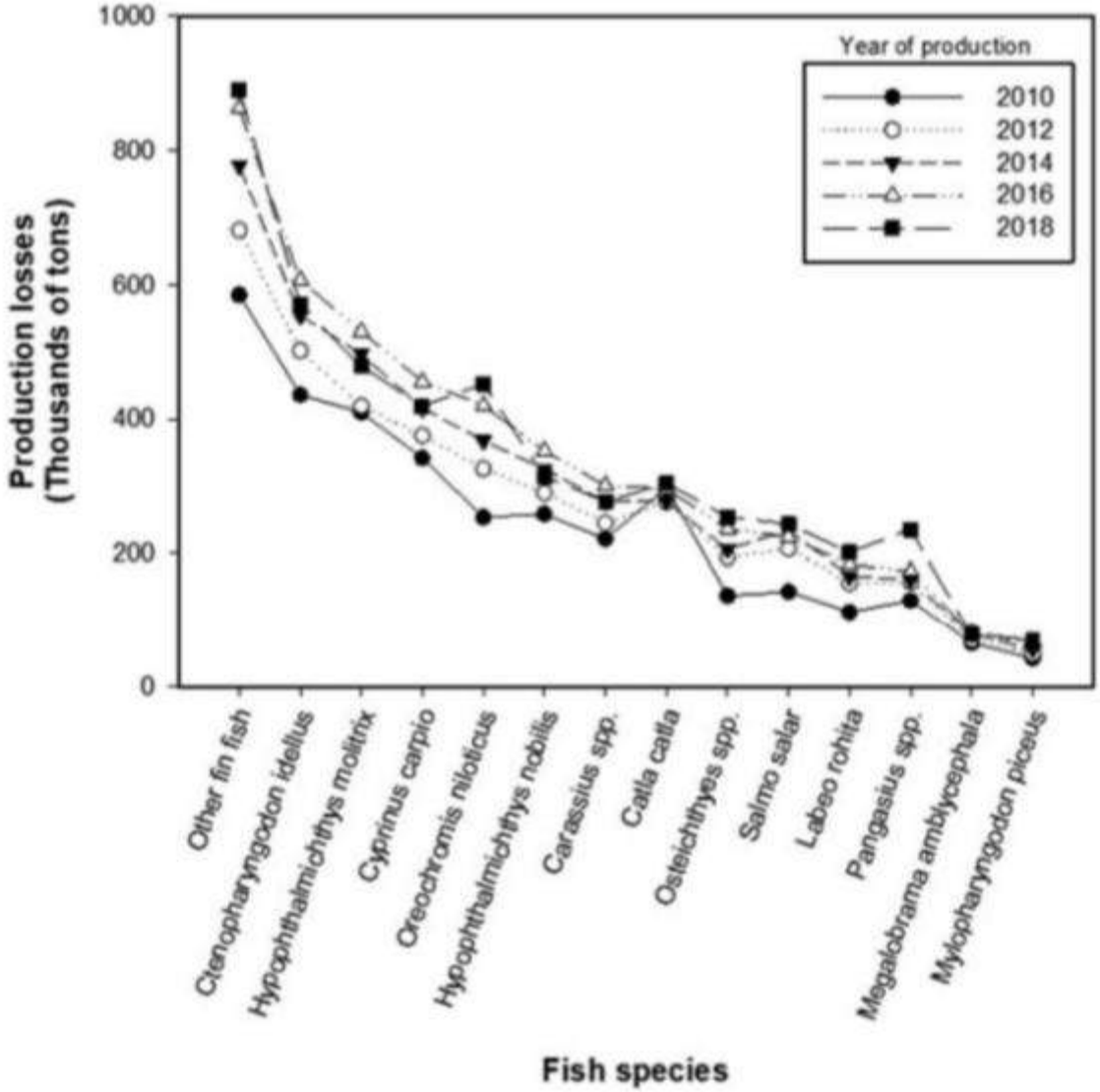


FIGURE 19.3

Economic loss for the principal species of food fish worldwide.

The Problem - Diseases

- Disease is the major catastrophic risk element in aquaculture.
- $1 billion annual losses in Vietnam
- $2 billion – cost of ISAV outbreak in Chile
- Estimated - $10 billion a year lost globally throughout the value chain.

PREVENTION IS THE KEY
AND
VETERINARIANS CAN HELP




Biosecurity and disease control

- The intensification of aquaculture and the globalization of trade in aquatic products have led to the emergence and re-emergence of infectious diseases representing a significant economic and environmental challenge to society.
- The Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB), endorsed and welcomed by the Tenth session of the COFI Sub-Committee on Aquaculture (FAO, 2019), is risk-based, collaborative and progressive and builds on management capacity using bottom-up and top-down approaches.
- The adoption of “critical control point thinking” and a “risk mindset” along the value chain is important to identify the hazards and understand and manage the risk at every stage of production from seed source and grow-out operations to market.

- A ten-point biosecurity best practice provides a broad biosecurity landscape:

1. know your species,
2. know your system,
3. know your pathogens,
4. know your contamination pathway,
5. source healthy seed,
6. maintain good husbandry,
7. use antimicrobials prudently,
8. respect food safety requirements,
9. respect the environment and
10. have a biosecurity plan.

IAVBC Biosecurity Objectives

Effective biosecurity is more than hygienic practices, quarantine, etc.

- ✓ Outcome must be evidence-based with clear end-points
- ✓ Standardized, scientifically sound & justifiable approaches
- ✓ Encompass disease prevention, control & eradication
- ✓ Meets regulatory requirements (Local/State/National)
- ✓ Promote business continuity (fits routine production systems, economical, practical, efficient & effective)
- ✓ Producer, veterinary & government incentives/rewards (government / industry collaboration & cost-sharing)

- Implementing biosecurity practices on aquaculture appears to be a fairly straight forward concept.
- The old adage that “prevention is better than cure” certainly applies to aquaculture diseases, particularly when the economic impacts of disease outbreaks have proven to be huge and, clearly, biosecurity practices can prevent these

Primary Focus & Ultimate Objective of Biosecurity

To ensure that an *epidemiological unit* is not diseased / infected …

… and remains that way.

Prevention!…
Control!...
Eradication!

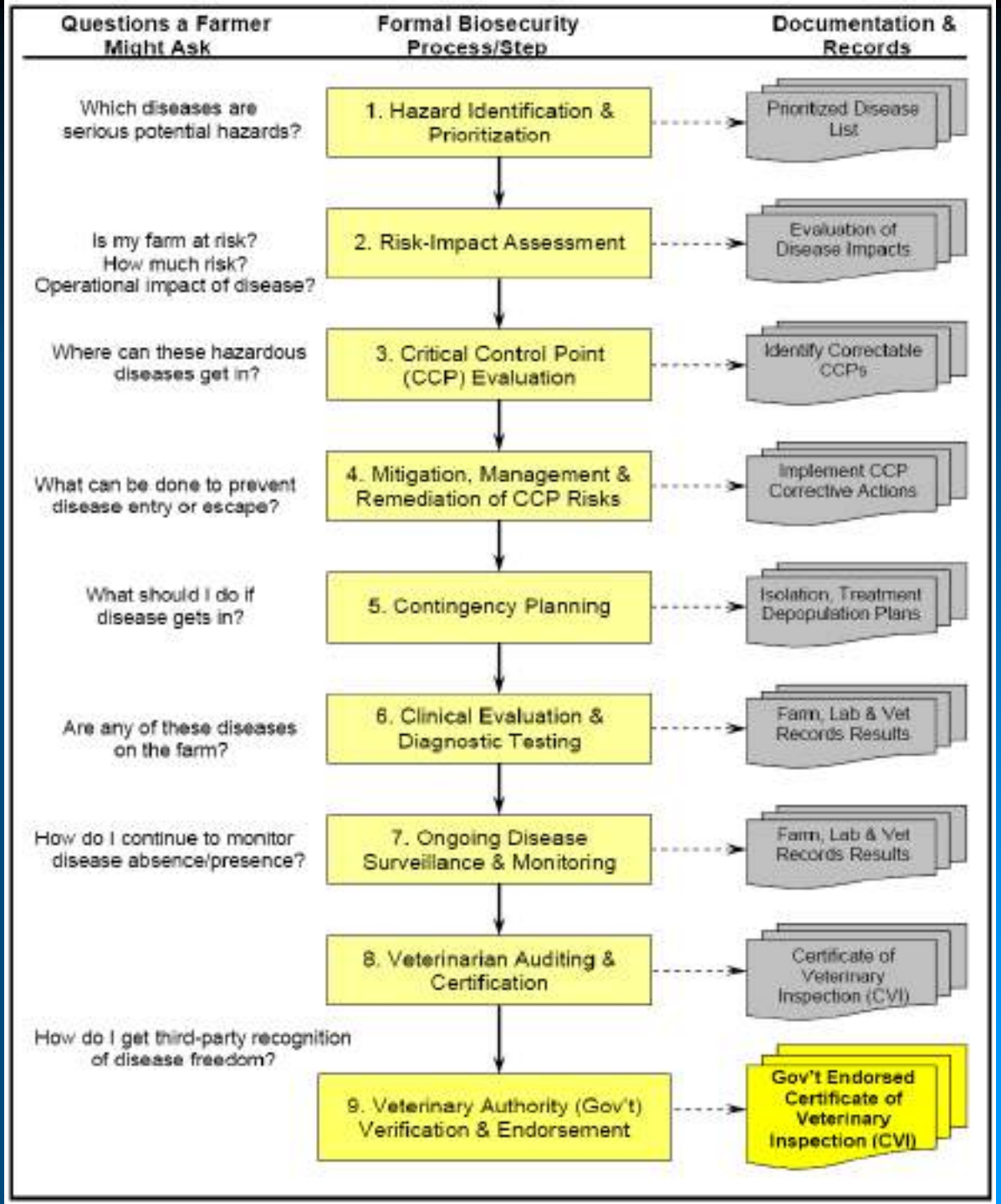
- An Epidemiological Unit, is a group of animals that share approximately the same risk of exposure to a pathogenic agent, within a defined location.
- This may be because they share a common aquatic environment (e.g. fish in a pond, caged fish in a lake), or because management practices make it likely that a pathogenic agent in one group or population of animals would quickly spread to other animals (e.g., all the ponds on a farm, all the ponds in a village system) (OIE, 2019a—Glossary).

IAVBC Biosecurity Components

—

Any Epidemiologic Unit

- ✓ Establishment
- ✓ Compartment
- ✓ Zone
- ✓ Region
- ✓ Country



STAGE PROGRESSION in the PROGRESSIVE MANAGEMENT PATHWAY

MAINTAIN 4: NATIONAL AND INTERNATIONAL CONFIDENCE IN MANAGEMENT MAINTAINED

4 SUSTAINABLE NATIONAL AQUACULTURE SYSTEM

3 NATIONAL BIOSECURITY MANAGMENT SYSTEM

FROM 3 TO 4
Competence to sustain aquaculture health (defending and maintaining specified disease freedom)

2 BIOSECURITY
Managed in specific sectors/ compartments

FROM 2 TO 3
National Biosecurity Management system plan adopted

1 RISK ASSESSMENTS

FROM 1 TO 2
Strategic Bioscurity Action Plan

FAO FIAT PANIS

Definitions

BIOSECURITY means a set of ***management and physical measures*** designed to ***reduce the risk of introduction, establishment and spread*** of *pathogenic agents* to, from and within an *aquatic animal* population.

BIOSECURITY PLAN means a plan that identifies significant potential pathways for the introduction and spread of *disease* in a *zone* or *compartment*, and describes the measures which are being, or will be, applied to mitigate the *risks* to introduce and spread *disease*, taking into consideration the recommendations in the ***Aquatic Code*.** The plan should also describe how these measures are audited, with respect to both their implementation and their targeting, to ensure that the *risks* are regularly re-assessed and the measures adjusted accordingly.

Definitions contd.

BASIC BIOSECURITY CONDITIONS means a minimum set of conditions required to ensure biosecurity for a particular disease, in a country, zone or compartment that should include:

1. ***Compulsory notification*** of the disease or suspicion of the disease to the Competent Authority;
2. An ***early detection system***; and,
3. Requirements to prevent the introduction of the pathogenic agent into a free country, zone or compartment, or the ***spread*** within or from infected zones and protection zones, in accordance with the relevant disease-specific chapter.

Applying Biosecurity to an Epidemiological Unit

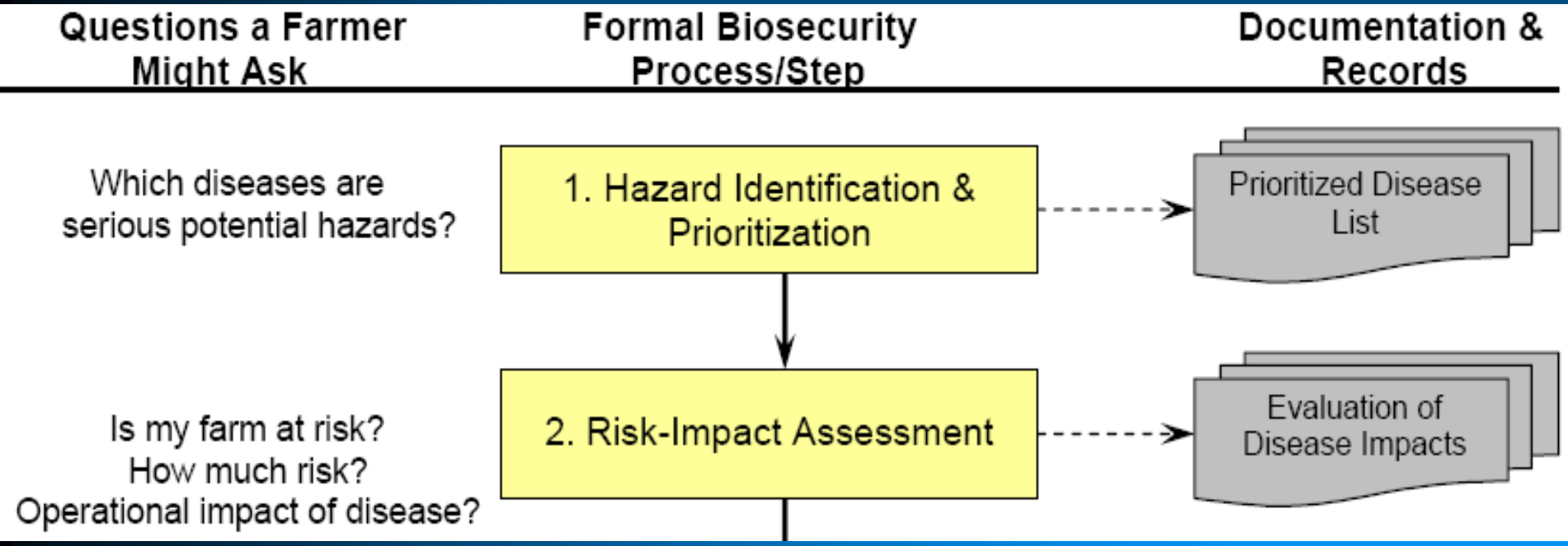
- 300,000 lbs. ($1.5M) annual production
- Integrated production – buys & sells live fish, larvae & fillets internationally
- Imports breeding stock & eggs
- Uses river & groundwater
- ~500 visitors / year
- 50 employees

1 pund = 1 lb = 0,45 kg

NO biosecurity plan in place:

HIGH risk of a disease outbreak

Identify Disease Hazards & Risks



Process: Determine Disease Hazards & 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 & price
- Regulatory restrictions

✓ Create prioritized disease list based on severity of potential impact

Qualitative or Semi-quantitative Risk/Impact Analysis

Risk Matrix		Consequence / Potential Impacts					
		Negligible	Minor	Moderate	Severe	Major	Catastrophic
Likelihood / Probability		0	1	2	3	4	5
Remote	1	0	1	2	3	4	5
Rare	2	0	2	4	6	8	10
Unlikely	3	0	3	6	9	12	15
Possible	4	0	4	8	12	16	20
Occasional	5	0	5	10	15	20	25
Likely	6	0	6	12	18	24	30

Negligible	Low Risk	Moderate Risk	High Risk	Extreme Risk >
0	1 - 6	7 – 12	13 - 18	19

Process: Identified Hazards & Risk Levels

Disease Hazard	Risk Level	Impact
❖ Viral Hemorrhagic Septicemia	Extremely High	Extremely High
	Endemic - OIE/Nat'l/State regulated / lethal	
❖ *Streptococcus iniae*	High	Moderate
	Ubiquitous / Unregulated / high morbidity	
❖ Columnaris Disease	Low	Moderate
	Exotic / State regulated / high morbidity)	
❖ Enzootic Ulcerative Syndrome	Low	High
	Exotic / OIE/Nat'l/State regulated / low morbidity	

➢ Biosecurity Plan tailored to selected disease hazards

Determine & Mitigate Critical Points where can disease can enter or leave

Where can these hazardous diseases get in?

3. Critical Control Point (CCP) Evaluation

Identify Correctable CCPs

What can be done to prevent disease entry or escape?

4. Mitigation, Management & Remediation of CCP Risks

Implement CCP Corrective Actions

Process: Determine Critical Points

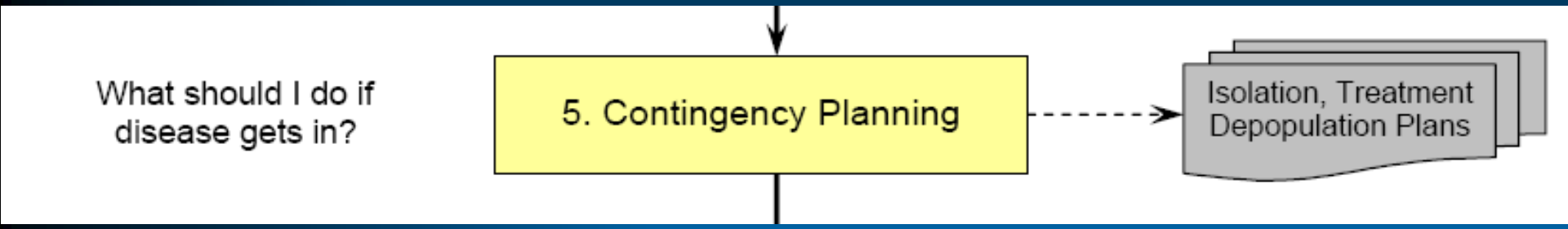
- Vectors
- Personnel
- Animals
- Vehicles
- Fomites
- Equipment
- Water
- Feed

Process: Mitigating Critical Points

? What actions will rectify critical points where disease can enter or leave

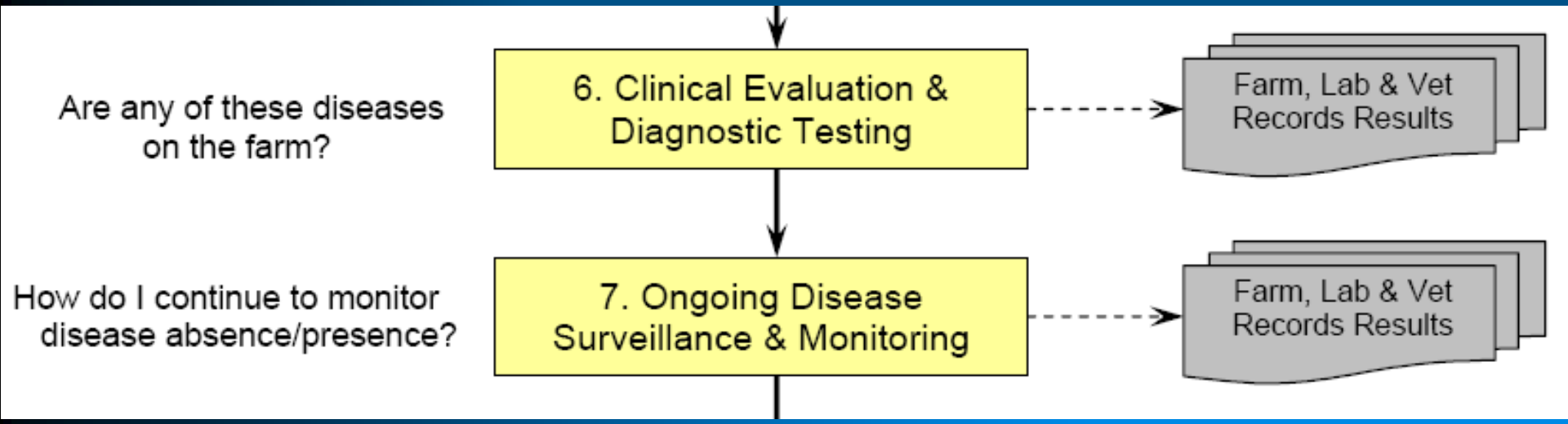
Vectors & Fomites: ✓Personnel, ✓Animals, ✓ Vehicles, ✓ Equipment, ✓ Water, ✓Feed, etc.

Developing Contingency Plans (what if …?)



- ✓ Isolating (quarantine) epidemiologic unit parts
- ✓ Communicating / reporting disease outbreak
- ✓ Re-evaluating & correcting **Critical Control Points**
- ✓ Implement recovery - depopulation / treatment / vaccination (business continuity ……)

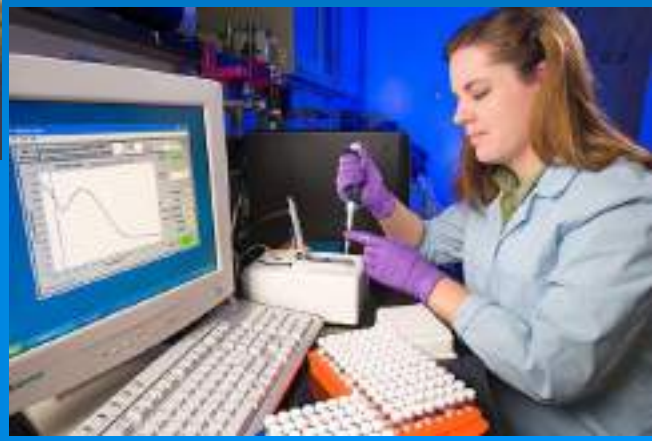
Veterinary Diagnostics, Surveillance & Monitoring



Identifying what's there:
Clinical & Lab Diagnostics

Is the disease present or absent?

- Appropriate veterinary clinical evaluation & sampling of all populations
- DX lab confirmation
- Full epidemiological evaluation & diagnostic interpretation



Personnel & Diagnostic Laboratory Resources

Finding veterinarians/para-veterinarians and diagnostic labs to assist

AquaVetMed.Info

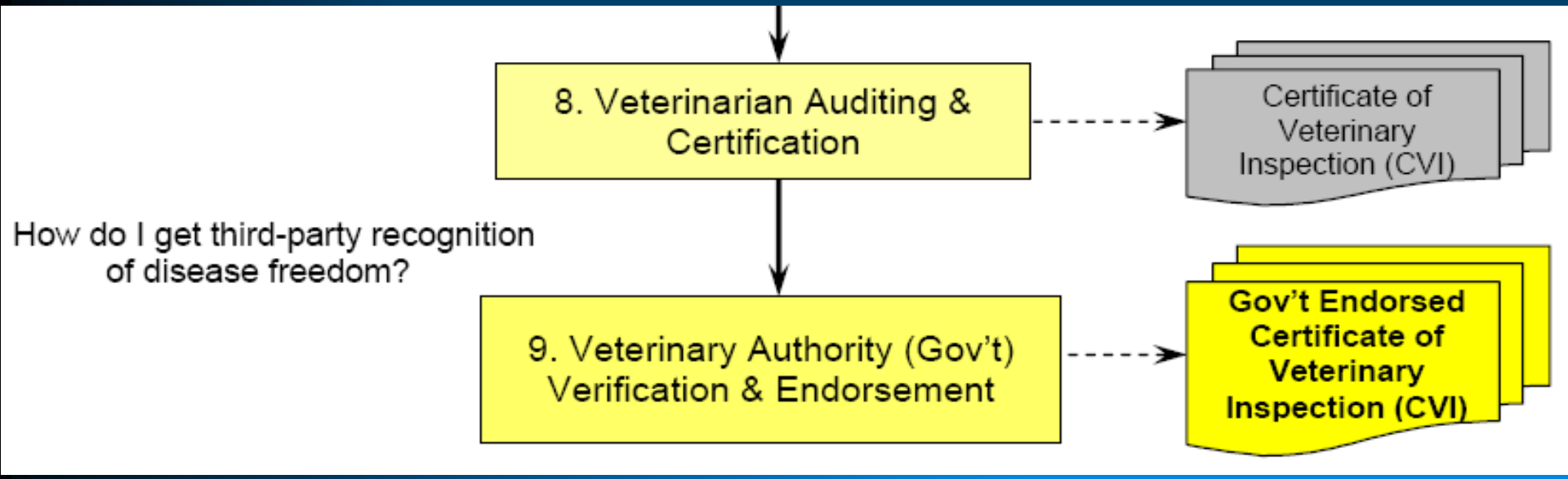
Search Directories of

Aquatic Veterinarians and Disease Diagnostic Laboratories

These directories assist veterinarians, veterinary-allied professionals, aquatic animal owners, aquaculture industries, governments, and the general public.

www.AquaVetMed.info
www.aphis.usda.gov/animal_health/nahln

Auditing & Certification



Process: Audit vs. Certify

Audits

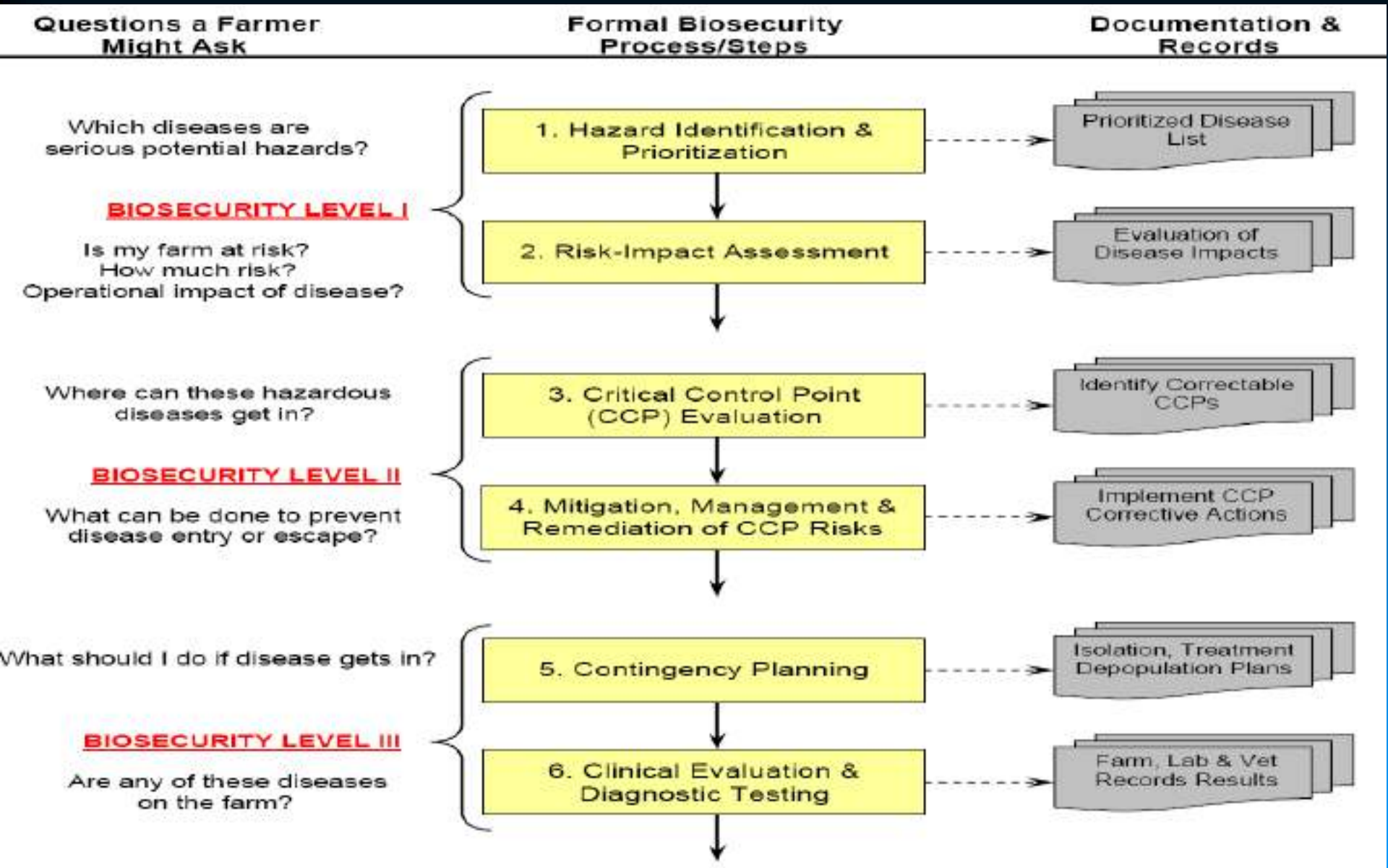
Periodic site visits to verify:

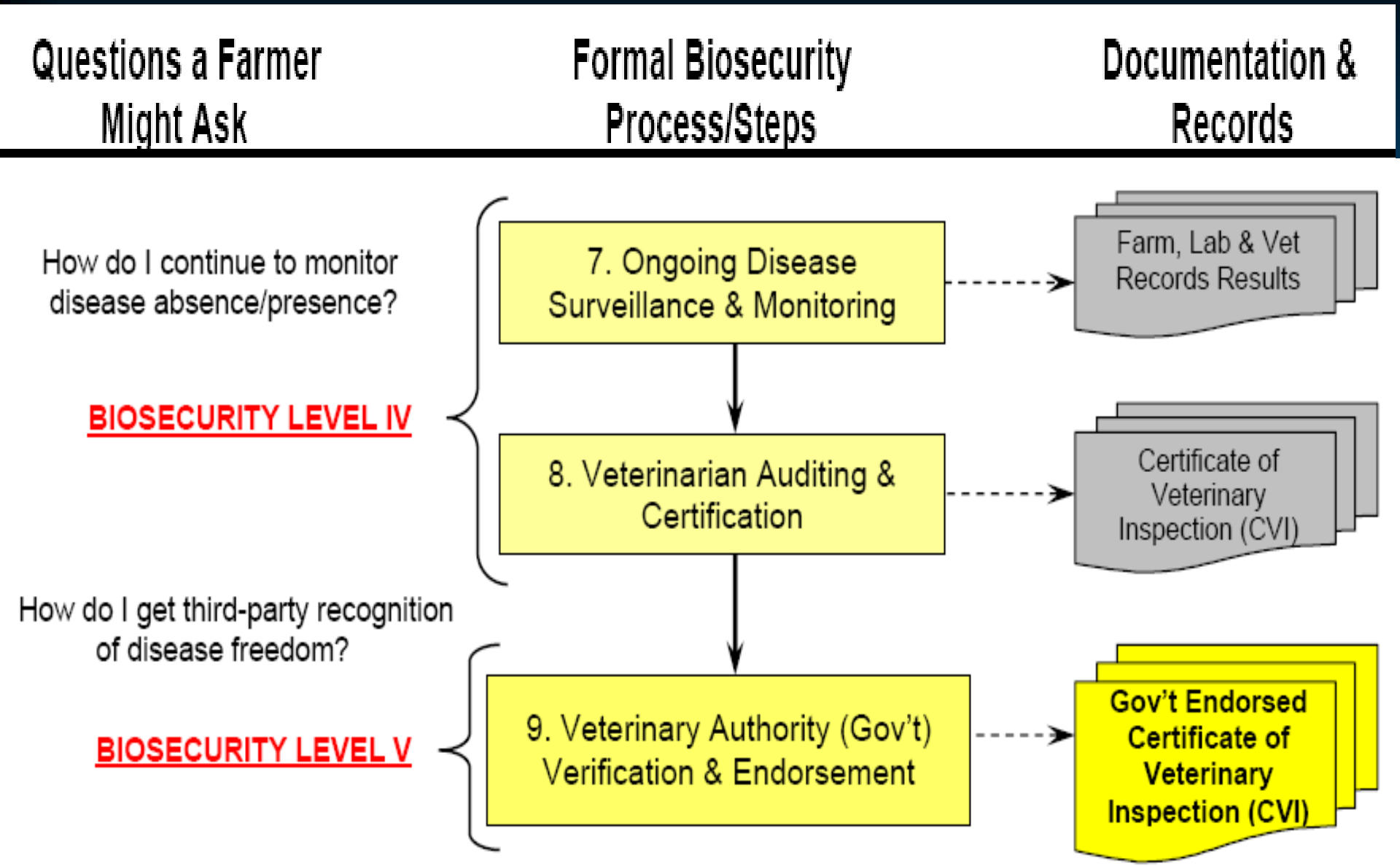
- ✓Processes are in place
- ✓Examine documentation
- ✓Assist correcting deficiencies
- ✓Look for clinical disease

Certification

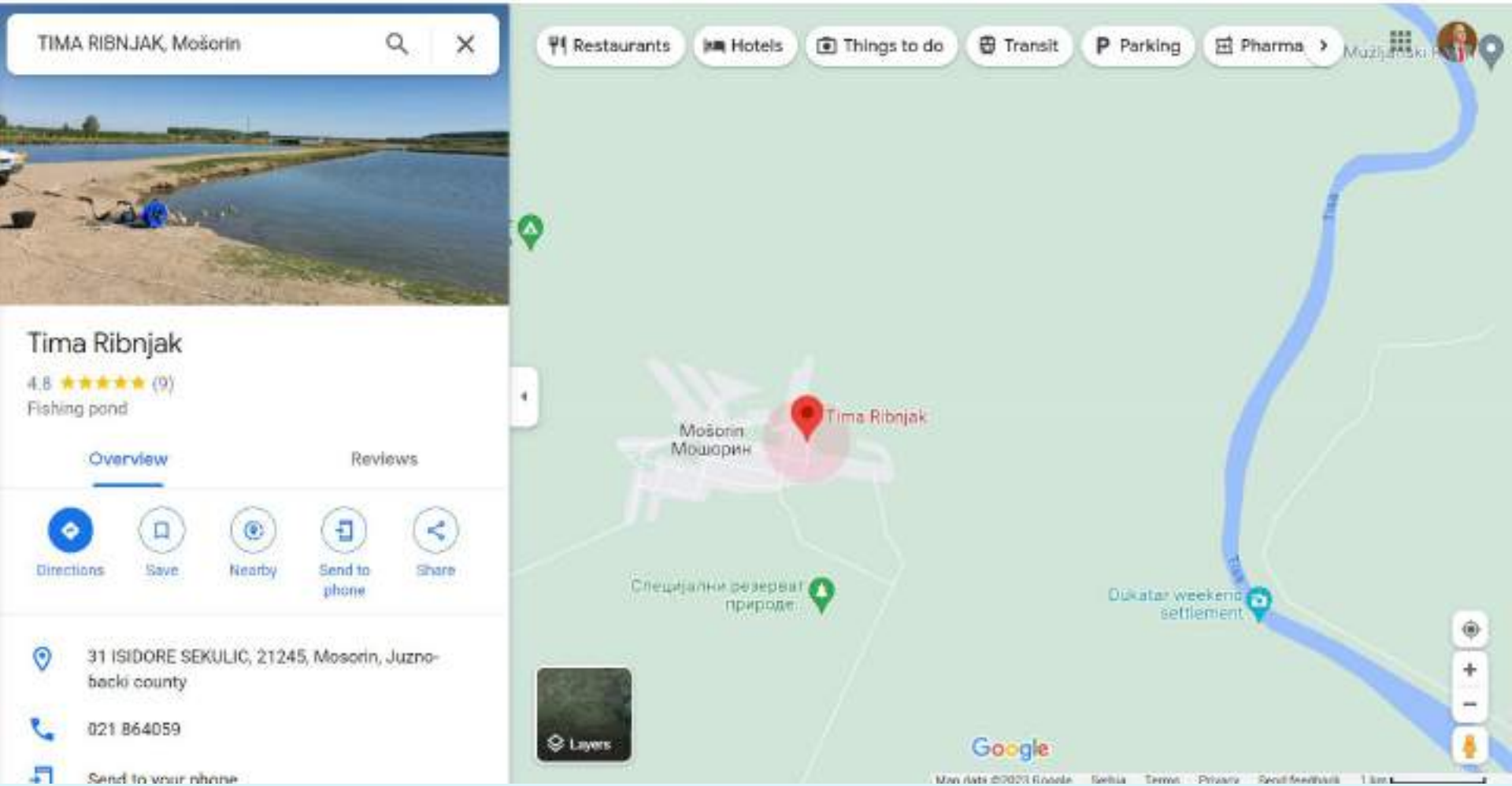
Issue certificate to validate:

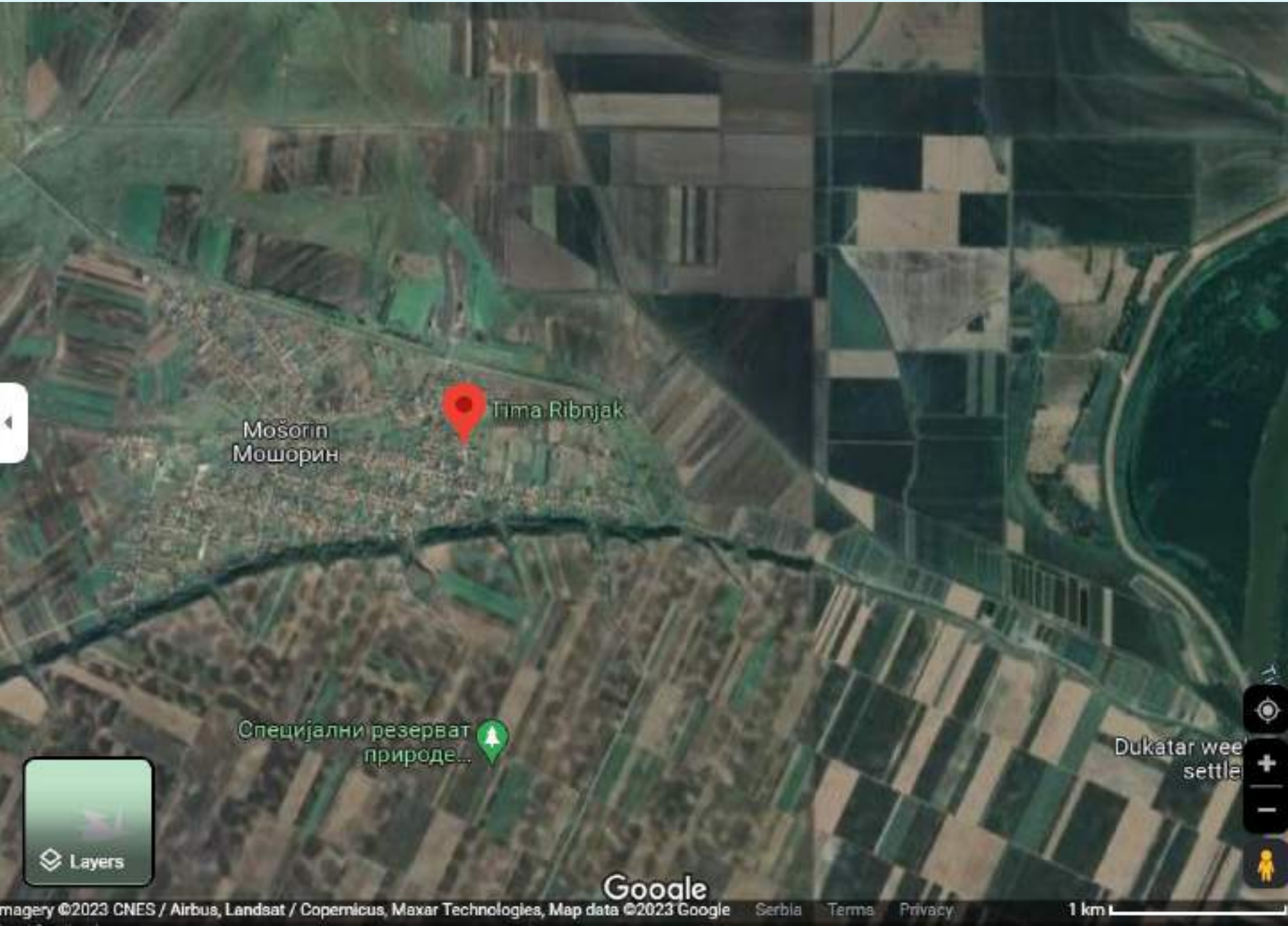
- ✓Processes are in place
- ✓Level of biosecurity
- ✓Disease status of operation


Questions a Farmer Might Ask
Formal Biosecurity Process/Steps
Documentation & Records
Which diseases are serious potential hazards?
BIOSECURITY LEVEL I
Is my farm at risk?
How much risk?
Operational impact of disease?
1. Hazard Identification & Prioritization
2. Risk-Impact Assessment
Prioritized Disease List
Evaluation of Disease Impacts
Where can these hazardous diseases get in?
BIOSECURITY LEVEL II
What can be done to prevent disease entry or escape?
3. Critical Control Point (CCP) Evaluation
4. Mitigation, Management & Remediation of CCP Risks
Identify Correctable CCPs
Implement CCP Corrective Actions
What should I do if disease gets in?
BIOSECURITY LEVEL III
Are any of these diseases on the farm?
5. Contingency Planning
6. Clinical Evaluation & Diagnostic Testing
Isolation, Treatment Depopulation Plans
Farm, Lab & Vet Records Results


Questions a Farmer Might Ask
Formal Biosecurity Process/Steps
Documentation & Records
How do I continue to monitor disease absence/presence?
BIOSECURITY LEVEL IV
How do I get third-party recognition of disease freedom?
BIOSECURITY LEVEL V
7. Ongoing Disease Surveillance & Monitoring
8. Veterinarian Auditing & Certification
9. Veterinary Authority (Gov't) Verification & Endorsement
Farm, Lab & Vet Records Results
Certificate of Veterinary Inspection (CVI)
Gov't Endorsed Certificate of Veterinary Inspection (CVI)

GPS: 45.30404947004533, 20.17823480636779




Tima Ribnjak
Mošorin
Мошорин
Специјални резерват природе...
Layers
Google
magery ©2023 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, Map data ©2023 Google
Serbia
Terms
Privacy
1 km

Cyprinid fish pond in northern Serbia

- Using a novel approach to assess Irish salmon farms, Yatabe et al. (2018) clearly showed that implementing biosecurity practices decreases the number of pathogens a farm will encounter, and it also has been established that modeling risk of disease introduction relative to disease surveillance and monitoring of fish farms represents very important segment of biosecurity practices

- What is the secret of success?
- Right decisions.

- How do you make right decisions?
- Experience.

- How do you gain experience?
- Wrong decisions.


THANKS FOR
YOUR ATTENTION
ANY QUESTION
SEARCH IN GOOGLE
memegenerator.es