

THE ROLE OF WHOLE GENOME SEQUENCE

QUALITY AND SAFETY ASSURANCE OF FISHERY PRODUCTS IN INDONESIA

By

Mochamad Aji Purbayu & Putu Eka Sudaryatma

GENOMTRAKR MEETING

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U.S. FOOD & DRUG
ADMINISTRATION



SPECIAL THANK YOU

- **United States Food and Drug Administration**
- **University of Maryland – Joint Institute for Food Safety and Applied Nutrition**





Introduction



Total land wide: 1.9 million km² (25%)

Total sea wide: 5.8 million km² (75%)

Total islands : 17,504 islands

Offshore line : 99.149 Km (No. 2 of the largest offshore line in the world)

Total population: 272.68 million (Year 2021)

Fishery production (2021) : 21.87 million ton
✓ Capture fishery : 7.22 million ton
✓ Aquaculture : 14.65 million ton

INDONESIA, A NATION BETWEEN TWO OCEANS

Indonesian fishery
products are accepted
in 171 Countries

“Indonesia feeding the world”

top export destination Economies
2022

MFQAA Bolstering the Indonesian Economic Recovery Through Export and Products Competitiveness Enhancement

FISHERY PRODUCTS EXPORT COMMODITIES 2022

TOP 10 EXPORT COMMODITIES

	Commodities	Volume (Kg)	Value (USD)
	Seaweed	255.049.275	598.338.195
	Shrimp (vannamae)	246.676.661	2.167.650.290
	Tuna	203.177.298	931.594.030
	Cephalopod	156.947.737	702.926.085
	Snapper	22.325.663	100.906.467
	Hairtail fish	19.924.214	37.936.712
	Sarden	19.215.070	50.917.344
	Surimi	17.643.327	49.286.247
	Milkfish	14.111.793	20.698.765
	Blue swimming crab	13.219.433	370.407.121
	Others	259.129.214	1.046.635.864
	Grand Total	1.227.419.686	6.077.297.120

TOP 10 EXPORT DESTINATION COUNTRIES

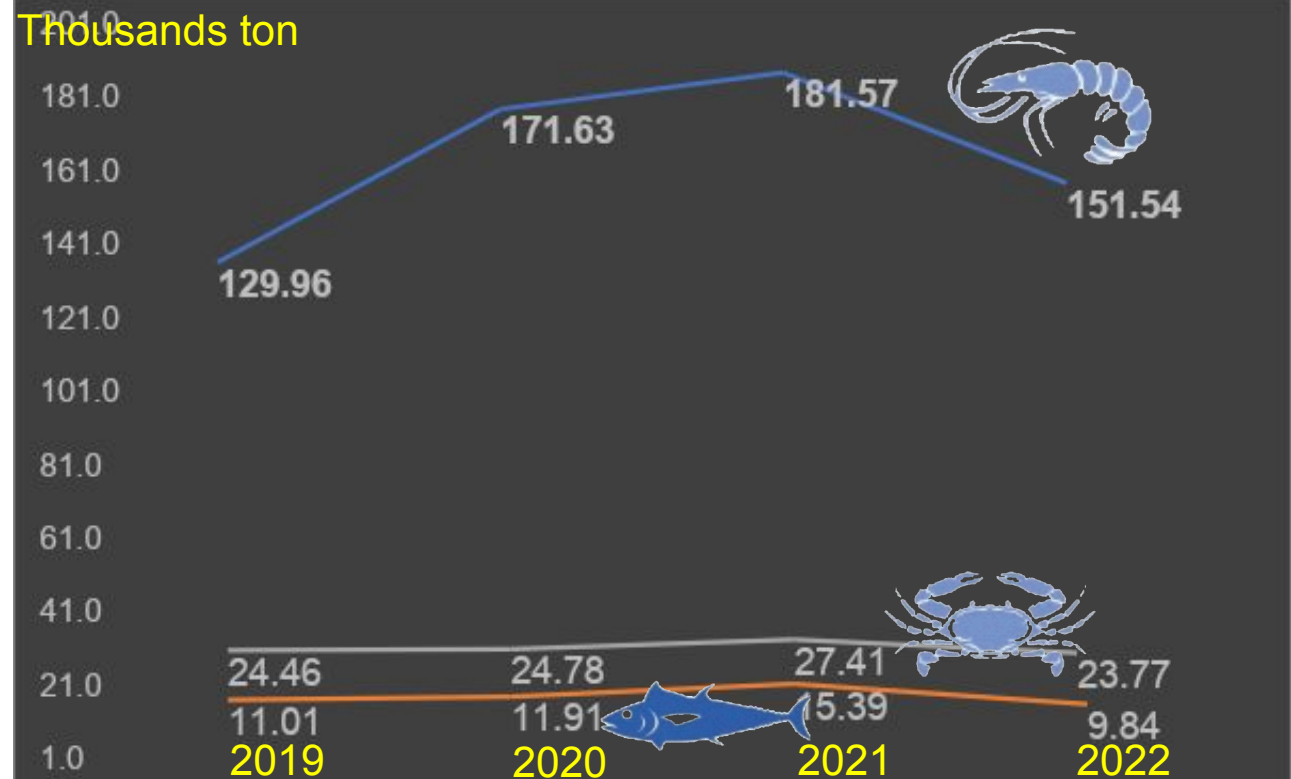
Countries	Volume (Kg)	Value (USD)
China	407.887.949	1.127.846.602
The United States	241.177.925	2.295.261.203
ASEAN Countries	218.400.490	682.726.535
Japan	100.241.432	729.487.608
EU Countries	53.747.802	337.783.938
Chinese Taipei	40.918.465	133.360.492
Korea (South)	29.532.656	100.787.652
Saudi Arabia	22.914.141	97.249.169
Australia	12.267.571	86.837.679
Hong Kong, China	9.349.100	73.072.866
Others	90.982.155	412.883.377
Grand Total	1.227.419.686	6.077.297.120

U.S. Shrimp Imports* November 2021

Economies	November			January-November			Total
	2020	2021	%	2020	2021	%	
INDIA	23,853	29,756	25%	246,345	309,120	25%	271,728
INDONESIA	14,037	14,730	5%	147,641	157,636	7%	160,714
ECUADOR	8,884	14,025	58%	115,729	164,882	42%	125,818
VIETNAM	7,012	7,514	7%	58,603	77,169	31%	65,278
THAILAND	4,305	4,580	6%	36,228	34,871	-4%	40,490
MEXICO	3,783	4,174	10%	23,238	17,813	-23%	25,654
ARGENTINA	2,448	1,928	-21%	15,703	15,117	-4%	17,340
CHINA	585	398	-32%	10,064	7,511	-25%	10,872
PERU	604	405	-33%	6,813	4,964	-27%	7,340
GUYANA	2	31	1450%	2,872	2,020	-30%	3,001
SAUDI ARABIA	236	86	-64%	2,733	1,589	-42%	2,887
VENEZUELA	190	16	-92%	2,111	1,074	-49%	2,132
CANADA	118	184	56%	1,658	1,752	6%	1,760
BANGLADESH	259	142	-45%	1,378	2,274	65%	1,734
HONDURAS	232	132	-43%	1,466	1,309	-11%	1,692
GUATEMALA	141	44	-69%	1,477	1,130	-23%	1,579
NICARAGUA	74	60	-19%	1,100	640	-42%	1,196
PHILIPPINES	126	200	59%	902	1,076	19%	1,027
PANAMA	68	7	-90%	565	680	20%	606
GREENLAND	3	12	300%	379	70	-82%	380
MALAYSIA	34	1	-97%	325	117	-64%	352
SPAIN	2	32	1500%	247	159	-36%	285
NORWAY	21	0	-100%	232	55	-76%	242
SOUTH KOREA	48	24	-50%	189	269	42%	220
DENMARK	5	4	-20%	201	150	-25%	201
SRI LANKA	8	87	988%	107	829	675%	132
BURMA	12	70	483%	91	215	136%	113
Report Total:	67,180	78,745	17%	679,429	805,601	19%	745,675

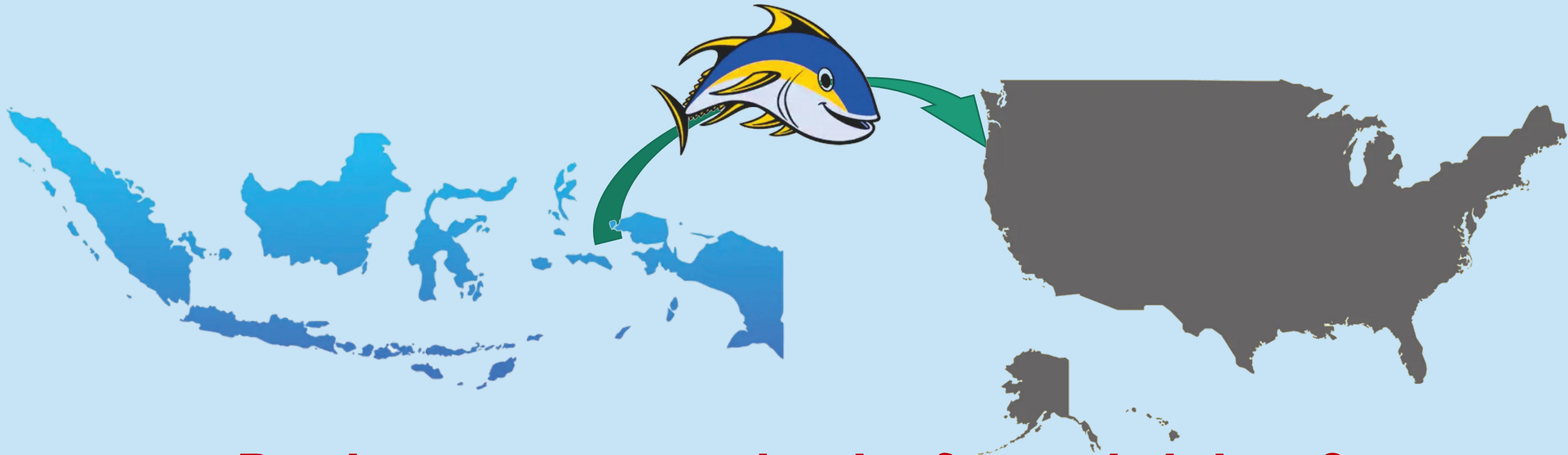
* Metric Tons (1M/T=2,204 lbs)

FISHERY PRODUCTS EXPORT TO THE UNITED STATES





The future looks bright



But how can we make the future brighter?



Present status of food safety capabilities (fishery)

MODERN SHRIMP FARMING IN INDONESIA

Target production 2 million ton/year in 2024



Main Infrastructure:

Production Ponds, Reservoirs, Water Intake, Outlet Channels, WWTP, Laboratories, Feed Warehouses, Post-Harvest Buildings, Ice Factory, Generator Houses, Pond Guard Houses, and Production Roads

Supporting Infrastructure :

Office Buildings, Employee Mess, Public Facilities, Social Facilities, Landscape, Workshops, Guardrails and Gates

MAIN PARAMETER

LAND AREA	100	HA
PRODUCTION AREA	40	HA
PRODUCTIVITY (HA / YEAR)	80	TON
PRODUCTION COST/KG	35.000	KG
SELLING PRICE IN 2022	65.000	IDR
INCREASING SELLING PRICE/YEAR	3	PERSEN
INCREASED COST/YEAR	3	PERSEN
INVESTMENT COST	250	BILLION

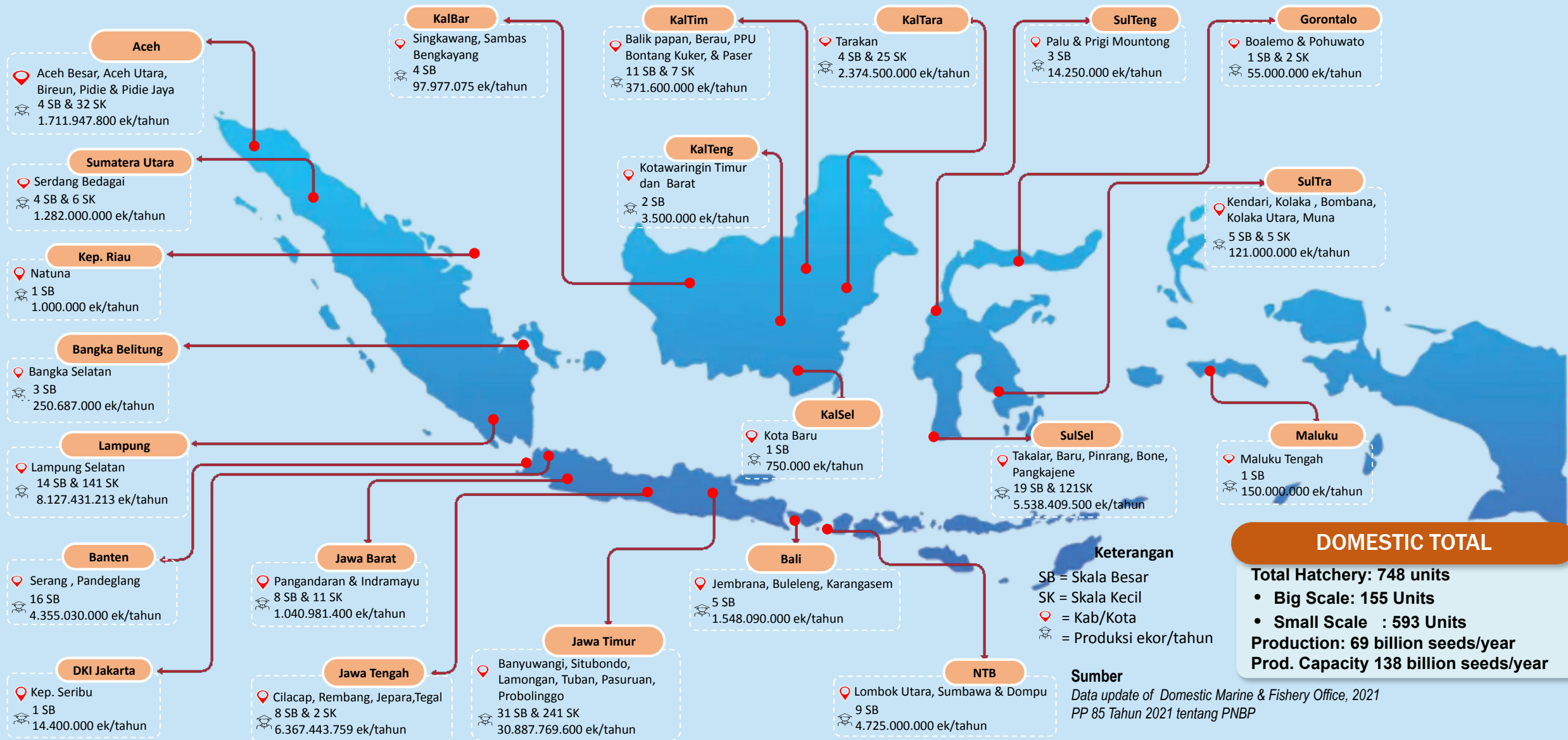
MULTIPLIER EFFECT (2024)

PRODUCTION VOLUME/YEAR	3.200	TON
PRODUCTION VALUE/YEAR	IDR 208	BILLION
PRODUCTION COST/YEAR	IDR 125	BILLION
NET PROFIT/YEAR	IDR 83	BILLION
LABOR	900	PEOPLES
INCOME / MONTH	4.800.000	IDR

FINANCIAL PROJECTION

RETURN OF INVESTMENT CAPITAL	8 th Year	PNBP (20 Years)	REGIONAL INCOME (20 Years)
IRR	28,1 %		
NPV (RUPIAH/IDR)	283 Billion	Production Value- PAD	Perda No. 14 Tahun 2020 Production Value- X 1,85%
PROFIT AFTER INVESTMENT BACK (20 YEARS)	679 BILLION	IDR 929.115.475.288	IDR 97.997.260.141

MAPPING OF SHRIMP CULTURE UNITS



DOMESTIC TOTAL

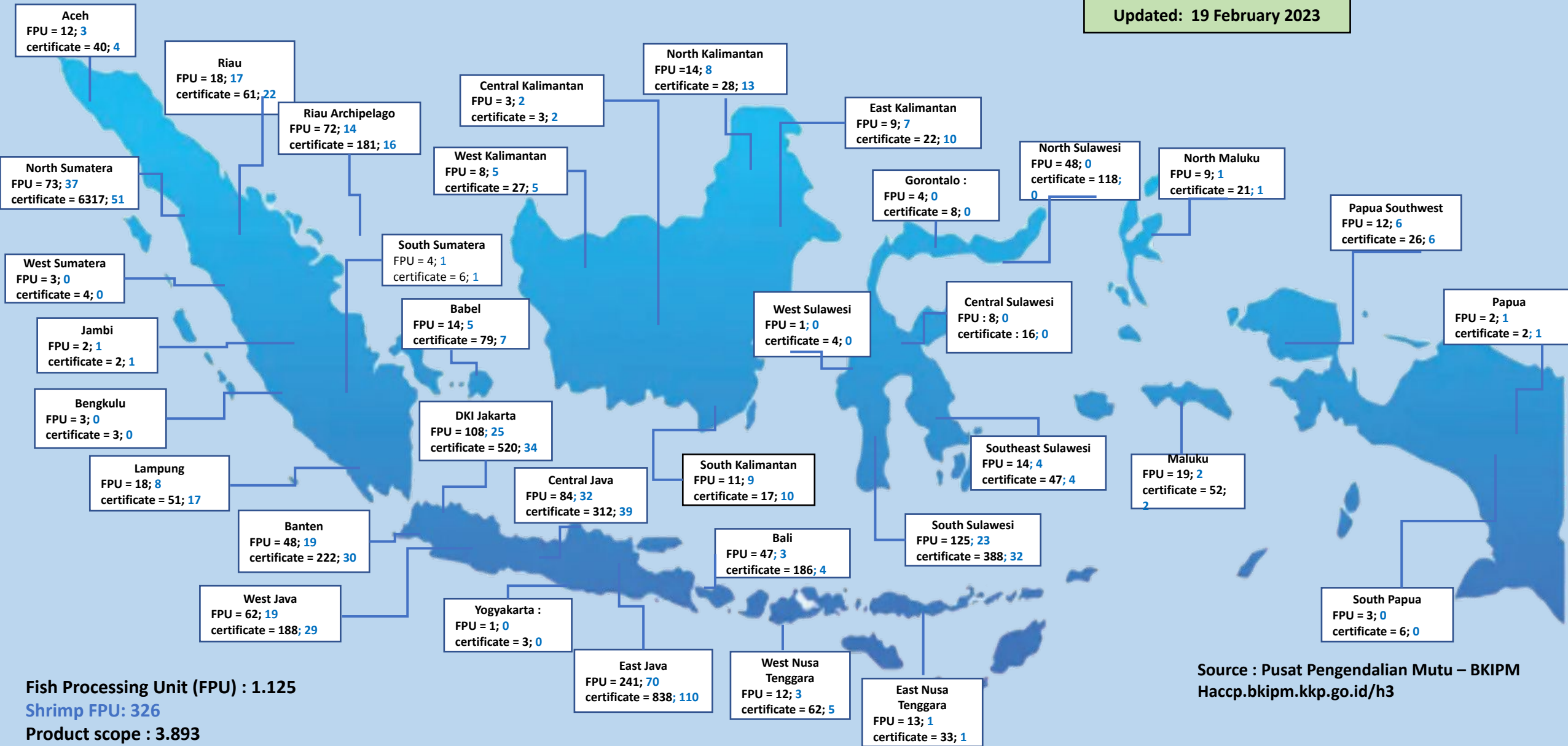
Total Hatchery: 748 units

- Big Scale: 155 Units
- Small Scale : 593 Units

Production: 69 billion seeds/year
Prod. Capacity 138 billion seeds/year

INDONESIA FISH PROCESSING UNIT AND SHRIMP

Updated: 19 February 2023



Fish Processing Unit (FPU) : 1.125

Shrimp FPU: 326

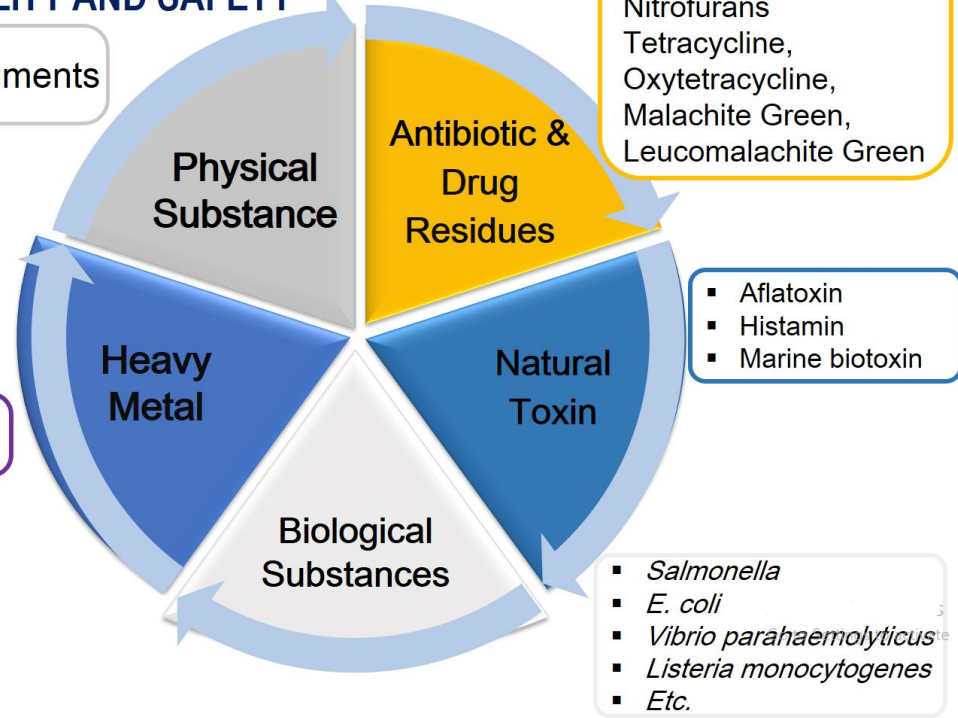
Product scope : 3.893

Shrimp product scope : 457

Source : Pusat Pengendalian Mutu – BKIPM
Haccp.bkipm.kkp.go.id/h3

CHALLENGES TO QUALITY AND SAFETY

Metal Fragments



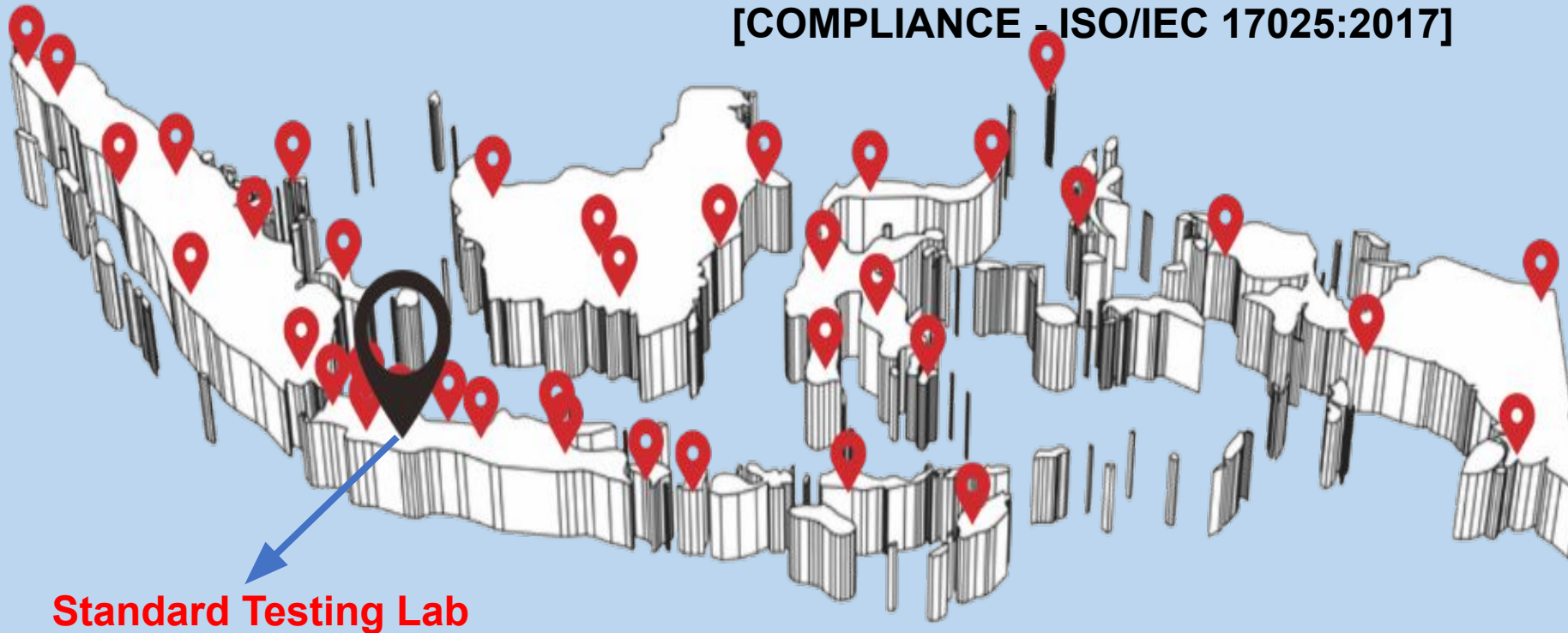
QUALITY ASSURANCE

 2001/254/EC: Commission Decision of 21 March 2001 amending Decision 94/324/EC dated 19 May 1994



Mutual Recognition Arrangement

THE COMPETENCIES OF **QUALITY ASSURANCE TESTING OF LAB** UNDER MFQAA [COMPLIANCE - ISO/IEC 17025:2017]



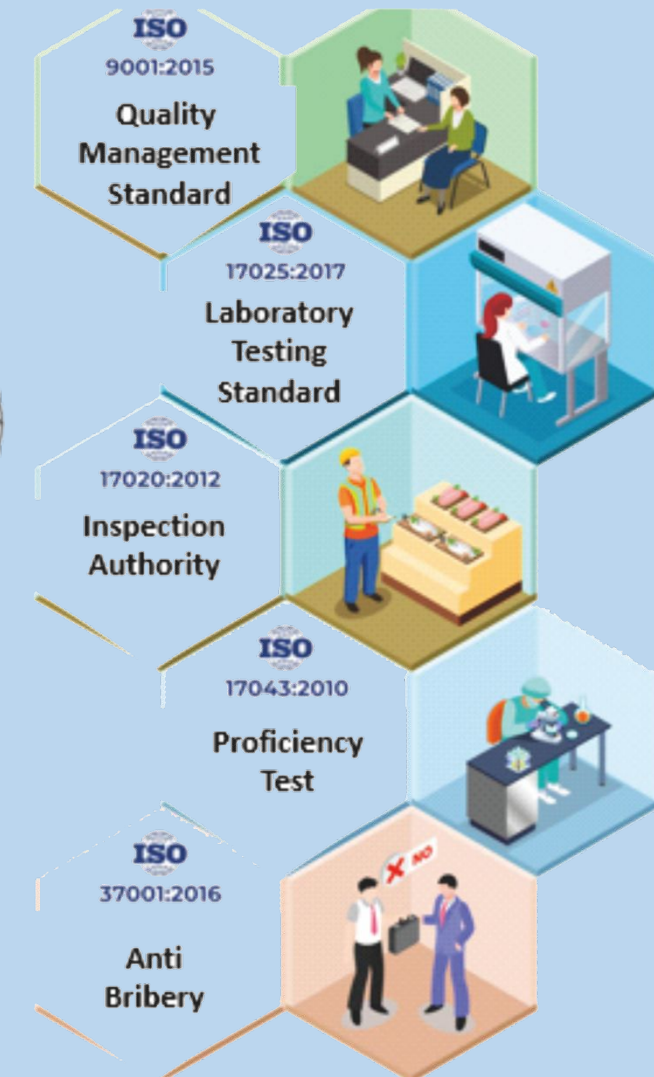
Source: Center of System Standardization & Compliance, MFQAA - 2020

33 Testing Parameter of Quality & Safety Testing of Fishery Products

Chemical	18 testing parameter
Food safety microbiology	10 testing parameter
Organoleptic	1 testing parameter
Molecular testing	4 testing parameter

87 Testing Parameter of Fish Disease/Quarantine Concern

Virus	13 testing parameter
Bacteria	15 testing parameter
Parasite	51 testing parameter
Mycotic	8 testing parameter



ACCREDITED PARAMETERS ISO/IEC 17025:2017

#2023
KHP THRIVE

Virus

TiLV
Hepatitis A (HAV)
DIV 1
WSSV
TSV
IMNV
KHV
SVC
CEV
IHHNV
CMNV
YHV
VHS
VNN
Megalocytivirus

Fish Parasite

EHP
Perkinsus olseni
Perkinsus sp.

Food Borne Bacteria

Escherichia coli
Listeria monocytogenes
Vibrio parahaemolyticus
Escherichia coli Coliform
Enterococci
ALT
Salmonella spp.
Salmonella sp.
Staphylococcus aureus
Enterobacter aerogenes

Fish Bacteria

NHP
Aeromonas salmonicida
Edwardsiella ictaluri
Aeromonas hydrophila
Streptococcus iniae
AHPND
Yersinia ruckeri
Edwardsiella tarda

Chemical

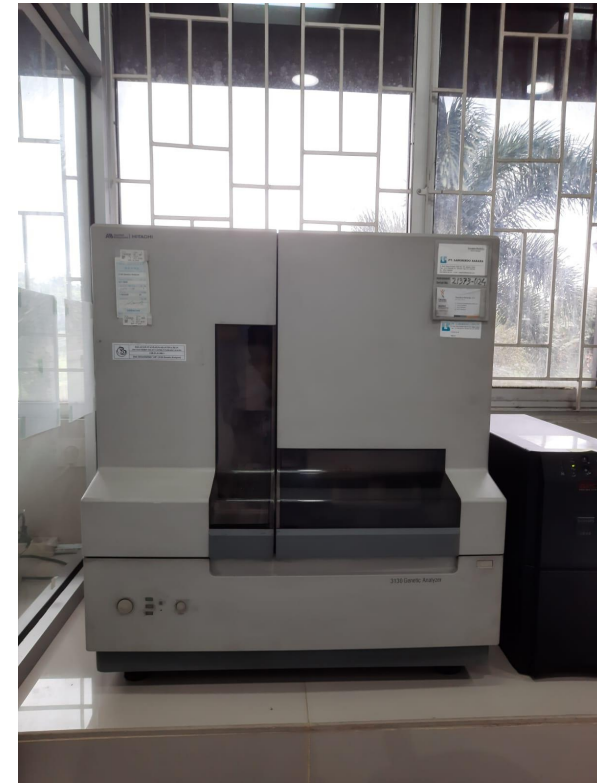
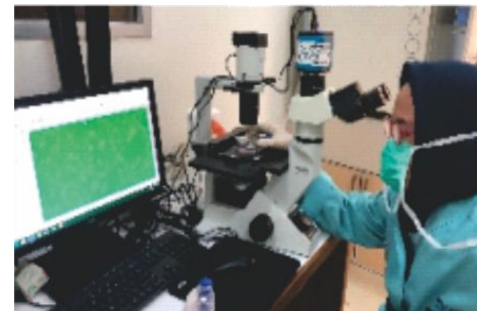
Ciguatoxin
Pb
Cd
Hg
ASP
PSP
Chloramphenicol
Formalin
As Total
Fe
Mn
Zn

Fungus

Aspergillus flavus
Aspergillus fumigatus
Aphanomyces invadans

Food Borne Parasites

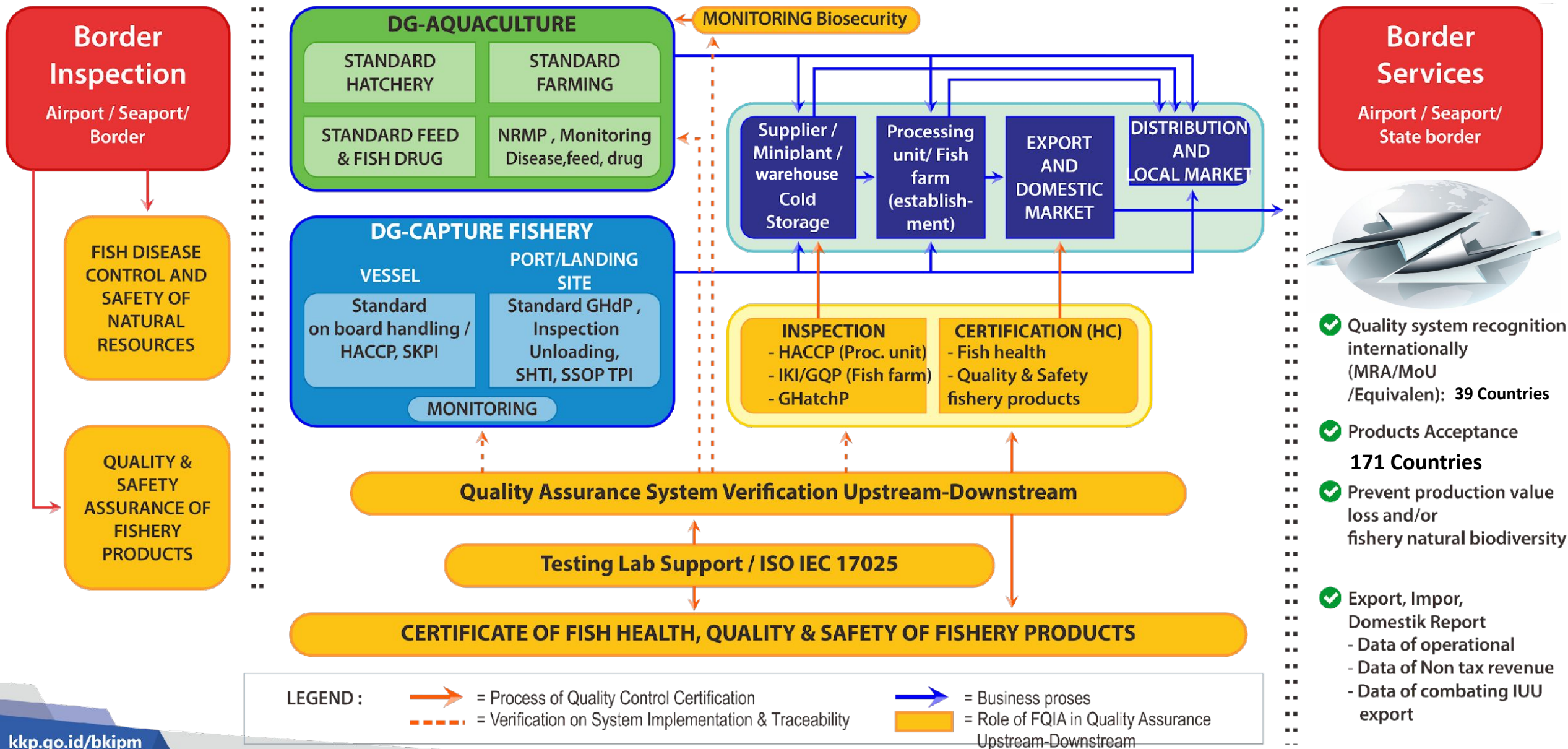
Anisakis sp.
Gnathostoma sp.



Sequencer

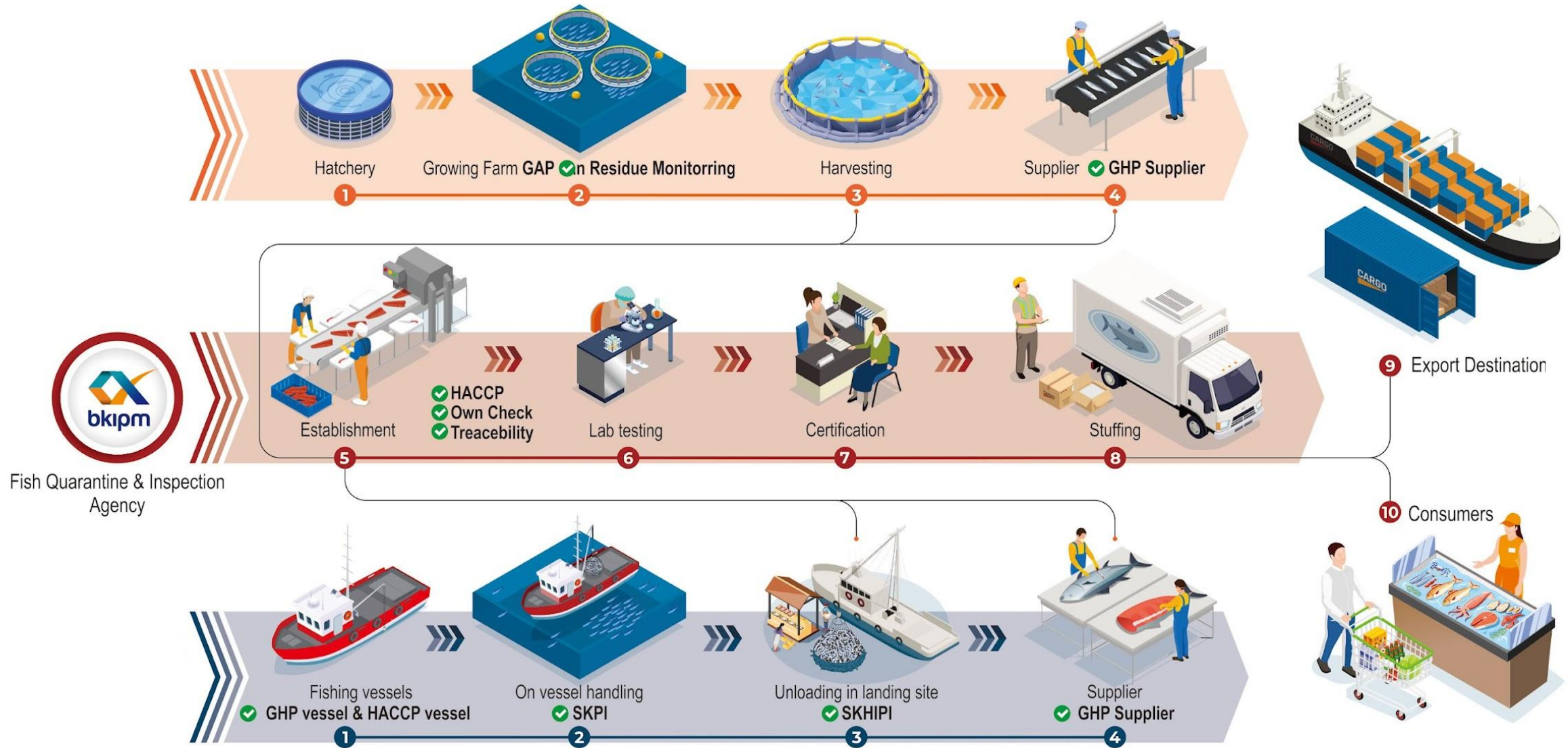
SCOPE OR WORK

THE IMPLEMENTATION OF QUALITY & SAFETY OF FISH AND FISHERY PRODUCTS FROM UPSTREAM TO DOWNSTREAM



OFFICIAL CONTROL

QUALITY & SAFETY OF FISH AND FISHERY PRODUCTS ASSURANCE SYSTEM



No matter how good a company organizes one element of a chain,
if any other part of the chain doesn't perform, the whole chain is contaminated

Source : - PerMenKP No. PER.19/MEN/2010
- PerMenKP No. PER.7/MEN-KP/2019 (Khusus DJPT)

OFFICIAL CONTROL

HEALTH, QUALITY & SAFETY OF FISH AND FISHERY PRODUCTS ASSURANCE SYSTEM

Surveillances in fish/shrimp pond



OFFICIAL CONTROL

HEALTH, QUALITY & SAFETY OF FISH AND FISHERY PRODUCTS ASSURANCE SYSTEM

Surveillance in fish processing unit and market





Aim

- Strategic intervention in the upstream level of fishery production as a prevention to minimize/reduce the impact of pathogen contamination in the supply chain (small scale fishery activities);
- Set minimum requirements for tuna handling facilities in small scale chain of production;
- *Public Awareness Program*: expanding easier information access for fishermen concerning food safety, sanitation and hygiene as well as good handling practices issues.





**WGS knowledge
strengthen food safety
capabilities (fishery)**

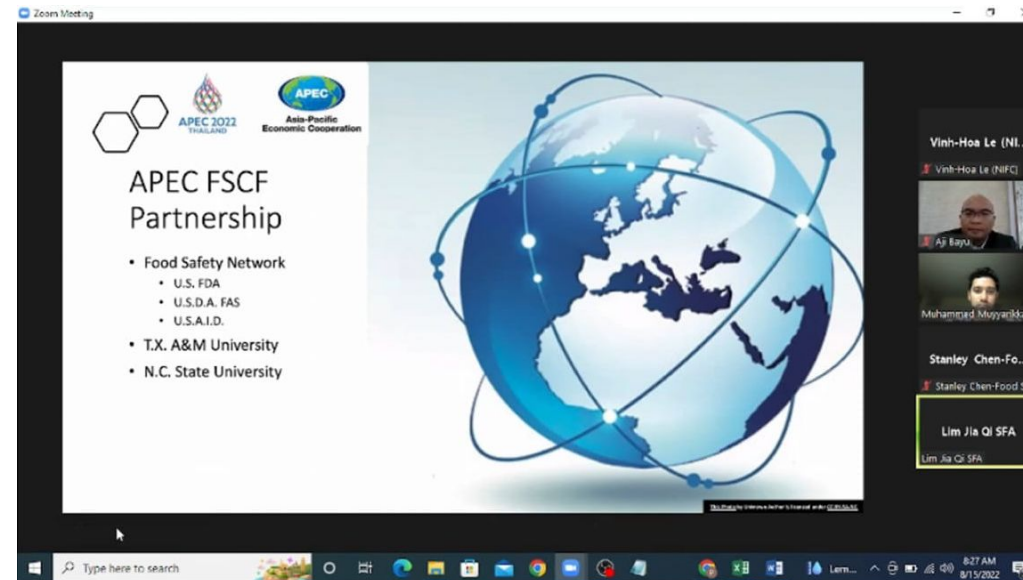
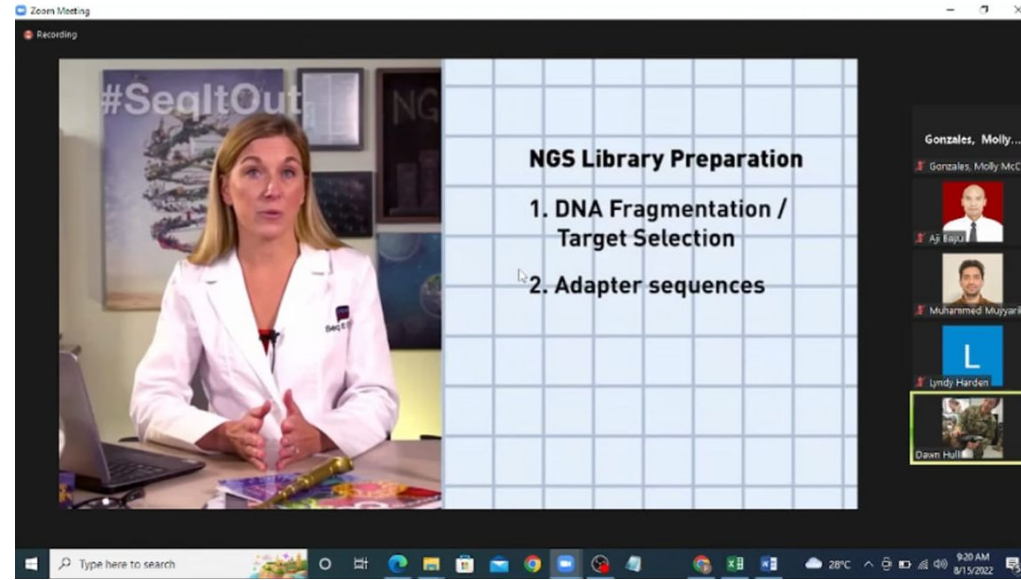


COOPERATION IS THE KEY ROLE TO SUPPORT ECONOMY'S FOOD SAFETY CAPABILITIES



WGS Technical Knowledge & Networking

Virtual In-Laboratory Training, Phase 3 of the Asia Pacific Economic Cooperation (APEC) Food Safety Cooperation Forum (FSCF), 2022



Easy to update knowledge and fill up the gap ☐ international cooperation contact point



Technical harmonization



Lift up the strategic role of cooperation affairs/unit ☐ Secretariat of global cooperation



Human resources in the cooperation affairs ☐ Agent of Changes



COOPERATION IS THE KEY ROLE TO SUPPORT ECONOMY'S FOOD SAFETY CAPABILITIES



WGS Technical Knowledge & Networking

Virtual In-Laboratory
Training, Phase 3 of the
Asia Pacific Economic
Cooperation (APEC)
Food Safety
Cooperation Forum
(FSCF), 2022



DISSEMINATION OF WGS KNOWLEDGE

Strategy



“Bottom – Up”
knowledge input



Mainstreaming
WGS issues in an
internalization
program



Bilateral meeting
with the
international
cooperation
partner



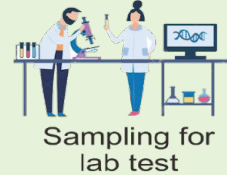
Domestic expert
level discussion

Regular official control: Surveillance

FQIA official control Surveillance



Implementation of GMP/SSOP/HACCP



Sampling for lab test

Non-Comply

Improvement

Comply

Negative

Positive

Investigation

Health Certificate

WGS

Bioinformatics

Report Analysis

Health Risk Assessment

Map reads
Assembly
Quality metrics
Identification
Virulence profile
Typing/Signature sequence

Reference Bank Data

Multilateral Technical Cooperation

After gained WGS Knowledge



WGS AFFECT ECONOMY'S FOOD SAFETY CAPABILITIES

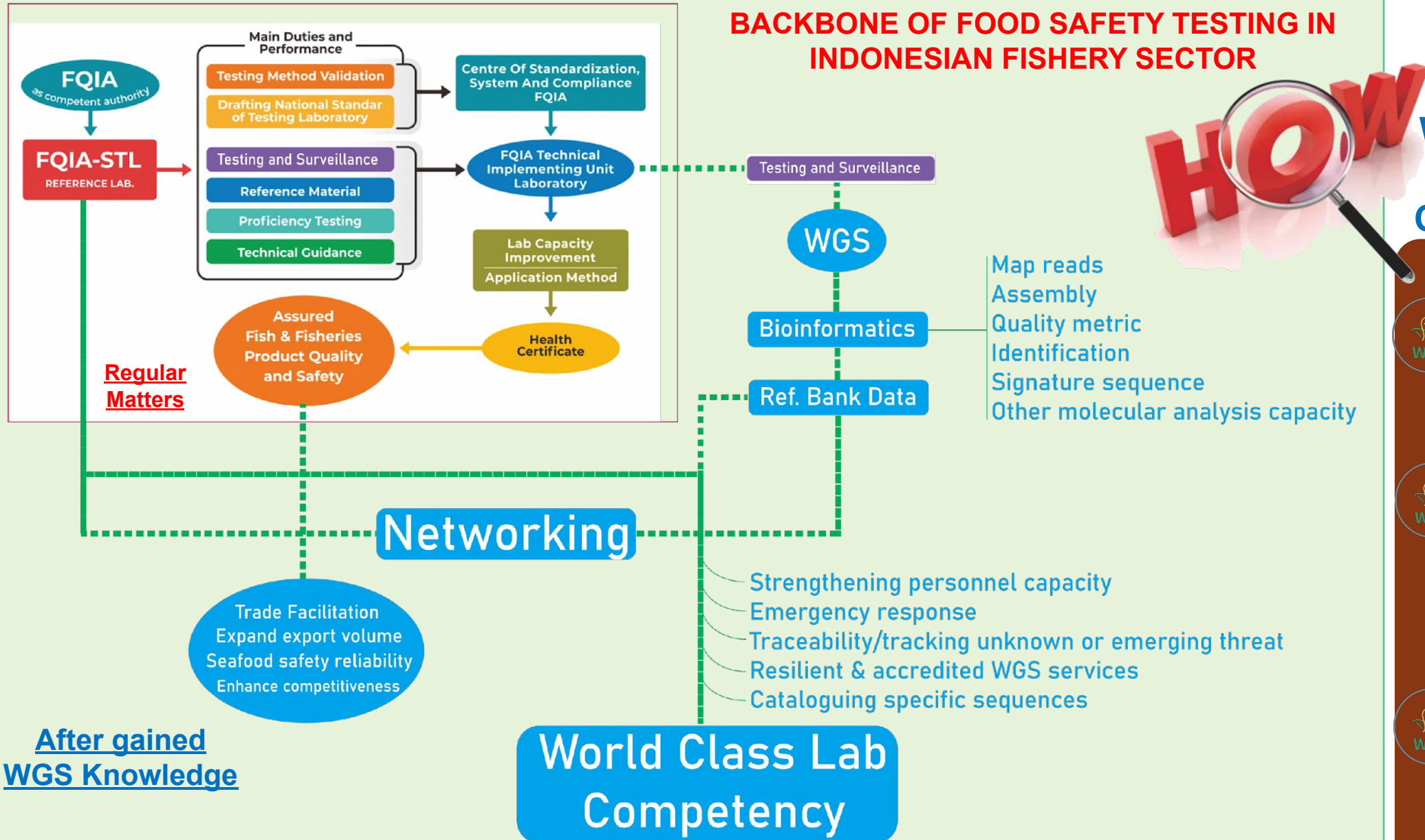
Strengthen the traceability to support food safety surveillance and official control

Strengthen and affect regulatory making

Reliability the implementation of quality & safety assurance system

Support system recognition internationally & expand product acceptance

STANDARD TESTING LAB AS THE BACKBONE OF FOOD SAFETY TESTING IN INDONESIAN FISHERY SECTOR



WGS AFFECT LAB CAPABILITIES



WGS network come up with transfer knowledge, experience & technology

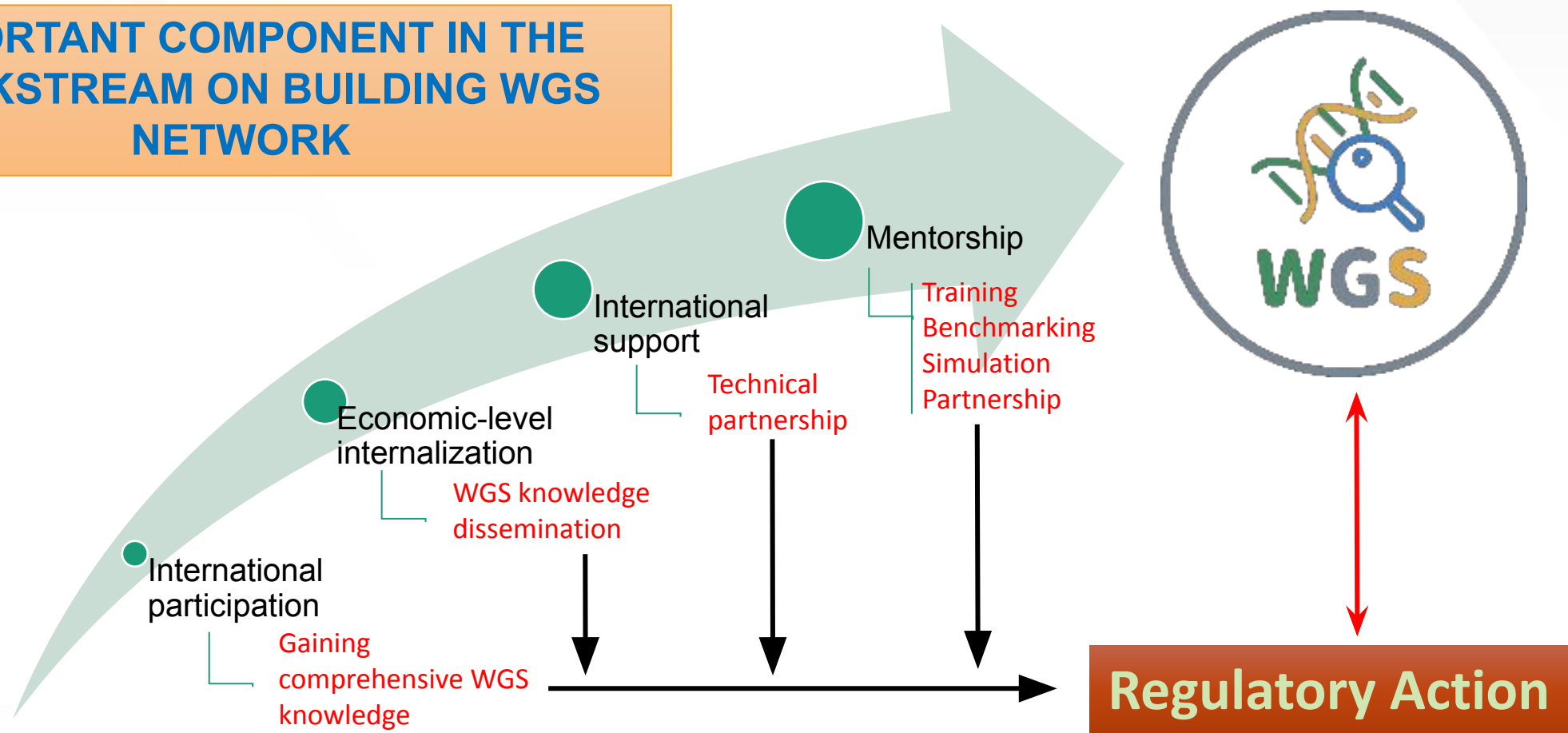


WGS network help together to minimize gap in lab flaw to the improvement



WGS allow lab to conduct a breakthrough program and has more role in the interdisciplinary working (i.e. one health concept)

IMPORTANT COMPONENT IN THE WORKSTREAM ON BUILDING WGS NETWORK

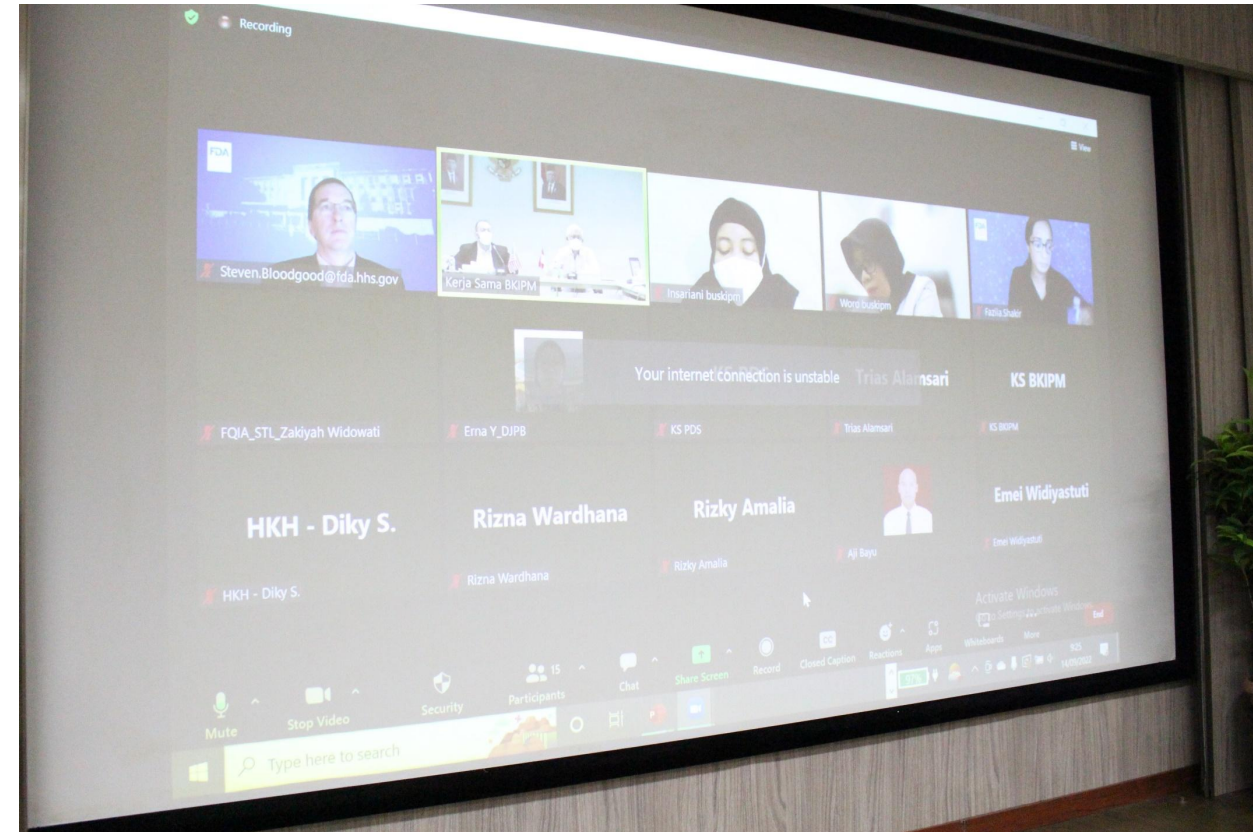


**INDONESIA – USA WHOLE GENOME SEQUENCE PARTNERSHIP
UNDER
Shrimp – food safety Regulatory Partnership Agreement**



WGS Activities With US FDA

Opening meeting U.S. FDA WGS Lab Assessment in Jakarta (2022)



U.S. FDA WGS lab assessment in Standard Testing Lab MFQAA, Jakarta (2022)





Testing and Diagnostic Laboratory MFQAA Regional Office in Bali



Personnel and activities

1. Personnel

- Officers: 49 persons
 - ❖ Laboratory staff □ 16 persons
 - ❖ Technical staff □ 18 persons
 - ❖ Administration □ 15 persons
- Laboratory supporting staff □ 5 persons
- Technical supporting staff □ 17 persons

2. Activities and responsibilities of personnel

- Technical implementation of MFQAA (official control)
 1. Fish diseases
 2. Food safety and quality assurance
- Laboratory testing and diagnostic

Testing laboratory

based on ISO/IEC 17025:2017

Quality management system

based on ISO/IEC 9001:2015

Anti-bribery management systems

based on ISO/IEC 37001:2016

Inspection body

based on ISO/IEC 17020:2012

Scopes of Laboratory Testing (Food safety)

Organoleptic test

- Fresh fish
- Frozen fish
- Canned product
- Dried product

Heavy metals in fish product

- Lead (Pb)
- Cadmium (Cd)
- Mercury (Hg)

Bacterial contamination in fish product

- Total plate count
- Total coliform
- *E. coli*
- *Salmonella* spp.
- *Vibrio parahaemolyticus*
- *Vibrio cholera* (on-review)

Protein

- Histamine in fish product

Bacterial contamination in water

- Total plate count
- Total coliform
- *E. coli*
- *Salmonella* spp.
- *Enterococcus faecalis*

Testing load (average in a year)

1. Fish diseases

- Parasites □ ~200 testing
- Total bacterial □ ~400 testing
- Total viruses □ ~4200 testing

2. Food safety

- *E.coli* and coliform □ ~750 testing
- *Salmonella* spp. □ ~750 testing
- *V. parahaemolyticus* □ ~550 testing
- *V. cholera* □ ~400 testing

1. Heavy metal

- Pb □ ~350 testing
- Cd □ ~350 testing
- Hg □ ~350 testing

2. Histamine □ ~400 testing

3. Organoleptic □ ~2500 testing

4. Water quality □ ~200 testing

5. Histopathology diagnostic □ 100 samples

Facilities and Equipment

Microbiology

- BSL-2 cabinet
- Ultrasonic water-bath
- Membrane-filter system
- Autoclave
- Incubator
- Stomacher
- Hot plate
- Micropipettes
- Freezer –20 °C
- Freezer –80 °C
- Digital microscope

Biology molecular

- Thermal-cycler (PCR)
- real-time PCR
- RNA-workstation
- Thermo block
- Microwave
- UV-transilluminator
- Gel-electrophoresis
- Vortex
- Cold-centrifuge
- Micropipettes
- Freezer –20 °C

Chemical

- Atomic Absorption Spectrophotometer
- UHPLC
- Depth-Microwave
- ELISA reader
- Fume hood
- Oven
- Refrigerator
- UV-spectrophotometer
- Water purifier
- Cold-centrifuge

Facilities and Equipment

Histopathology

- Tissue processor
- Tissue embedding
- Water bath
- Microtome
- Digital-microscope
- Staining-hood
- Refrigerator

Water quality

- UV-vis spectrophotometer
- Chemical distilled
- Water quality checker
- pH meter
- Ozone sterilized
- Refractometer

Supporting facilities

- Organoleptic room
- Sterilizing room
- Acid room
- Storage room
- Media preparation room

WATER SAMPLING TRAINING FOR FOOD SAFETY CONCERN

•PREPARATION METHODS



WATER SAMPLING TRAINING FOR FOOD SAFETY CONCERN

•LABORATORY WORK FOR ISOLATION OF SALMONELLA

Samples from the River:

1. Filter from MMS cassette submerged in BPW
2. Plated the incubated filter into enrichment TT and RV broth, incubated 42 °C
3. After 22 h, each broth streaking into XLD (Oxoid) and HE (Merck) medium, incubated 35 °C
4. After 24 h, pick up positive colony from BOTH XLD and HE medium and plated to TSA (Merck)
5. Single colony propagated into TSB (Merck) and confirmed by PCR of *Salmonella* spp. (Bioline)
6. Deep freezing stock of positive *Salmonella* spp. using BHI contain 25% of glycerol, kept -80 °C
7. Remain bacteria from TSB was using for DNA isolation using Presto™ gDNA Bacteria advanced kit (Geneaid)

□ **TOTAL DNA Isolated 106 samples**



WATER SAMPLING TRAINING FOR FOOD SAFETY CONCERN

•SAMPLING IN THE SHRIMP POND



WATER SAMPLING TRAINING FOR FOOD SAFETY CONCERN

•SAMPLING IN THE RIVER





WATER SAMPLING TRAINING FOR FOOD SAFETY CONCERN

**•LABORATORY WORK FOR
ISOLATION OF SALMONELLA AND
VIBRIO**





MINISTRY OF
MARINE AFFAIRS
AND FISHERIES

Thank You

Ministry of Marine Affairs & Fisheries

Gedung Mina Bahari 2 Lt. 6 Jl. Merdeka Timur No. 16 Jakarta 10110

Phone : +62 (21) 3519070

Fax : +62 (21) 3513282

Email : info@bkipm.kkp.go.id

Wevsite : www.kkp.go.id/bkipm