



## Advances and Perspectives on the Use of Genome-Edited Animals for Food Security

# The current state of animal biotech globally and the perspectives on Food Security - An APEC PPFS case study

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### A Global Overview:

- 1. Animal biotechnology, particularly genome editing, is experiencing rapid advancements and adoption worldwide.
- 2. Different regions are embracing these technologies at varying paces due to differences in research priorities, regulatory environments, and public acceptance.

A Global Overview:

**United States:** The U.S. is currently leading in animal biotech innovation.

**Europe:** The European Union has stricter regulations on genome editing compared to the U.S.

**Asia:** In Asia, countries like China and Japan are investing heavily in animal biotech.

**Africa:** In Africa, the focus is often on addressing food security through increased productivity and disease resistance in livestock.

### **Perspectives on Food Security:**

The intersection of animal biotech and food security is crucial as we face global challenges such as population growth, climate change, and resource constraints. Here are some key perspectives:

**Enhancing Productivity**: Genome editing holds the promise of significantly improving livestock productivity.

**Disease Resistance**: With the increasing prevalence of animal diseases, genome editing can provide solutions for developing disease-resistant livestock.

**Environmental Sustainability:** Genome-edited animals can contribute to more sustainable agricultural practices. 4

### **Perspectives on Food Security:**

**Economic Implications**: The economic benefits of animal biotech include reduced production costs and increased market competitiveness.

**Ethical and Social Considerations:** Ethical concerns, such as animal welfare and genetic diversity, must be addressed to gain public trust and acceptance.

## **Animal Biotech in the United States**

- 1. Leading innovations
- 2. Regulatory landscape
- 3. Applications in agriculture



## **Animal Biotech in Europe**

- 1. Strict regulations
- 2. Public perception
- 3. Research and applications



## **Animal Biotech in Asia**

- 1. Investment and research
- 2. Key countries Investment
- 3. Focus areas



## **Animal Biotech in Africa**

- 1. Emerging initiatives
- 2. Focus on food security
- 3. Challenges and opportunities



## **Perspectives on Food Security**

- 1. Enhancing productivity
- 2. Disease resistance
- 3. Environmental sustainability
- 4. Economic implications
- 5. Ethical considerations

## **Challenges and Future Directions**

- 1. Technical and regulatory challenges
- 2. Future research areas
- 3. The role & importance of international collaboration



# **Upcoming Activities – PPFS WG1 collaboration with GK Aqua**

- An APEC case study Commercial Use of Animal Biotech & its Impact on Food Security
  - All-Male Prawn Breeding Biotechnology



# **Improving Productivity in**

Aquaculture Biotechnology for Sustainable Aquaculture

**GK AQUA** 

Sustainable Farming



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# **PROBLEM STATEMENT**

#### Udang Galah



Large Freshwater Prawns One of Asia's well-loved local delicacies



### **Global Market Size of over USD 2**

billion

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### Asian Freshwater Prawn Supply-Demand Mismatch

- We import 90% of freshwater prawns (2,700 tonnes) to meet local demand.
- Stagnant production of Freshwater prawn in Malaysia for last 13 years,



- This mismatch in Supply-Demand is mainly due to
  - Inefficient Traditional Farming
    System
  - High cost & risk deter ventures into prawn farming



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# **The Biotechnology Solution**

Our Answer to the Problem







# **GK Aqua Proprietary Biotechnology**

#### RNA Interference Technology

- Genes of male androgenic gland is silenced temporarily without modifying M.rosenbergii genetic
- Specific dsRNA are injected to interfere and silence Macrobrachium rosenbergii-insulin like hormone (Mr-IAG)

#### dsRNA Production



#### **Plasmid Extraction**





Mr-IAG DNA sequence



um

chemically synthesized siRh

diated Target Recognitio



dsRNA at different concentrations. Size of dsRNA is at 600 base pairs (bp).

### **Production of Neofemales**

into post-larvae Observation of gonopore complexes on juveniles

Production of dsRNA for microinjection

#### dsRNA Microinjection Process



ds

RNA

Automated machine injection method



dsRNA injection process

Manual Injection Method

Identification of neofemales through

sex markers

# **IP FILING IN SUBMISSION PROCESS**



IP: Mono-sex Technology in Freshwater Prawn

WRITER'S NAME : Usamah Shaukany WRITER'S E-MAIL : ideas@kass.asia OUR REF : P1609MY YOUR REF : Please Advice DATE : 8 December 2022

BY E-MAIL ONLY

GK Aqua Sdn Bhd Lot 5602-5603 Jalan Haiwan Ladang 100 Ekar 71960 Port Dickson, Malaysia

Dear Sirs,

New Patent Application in Malaysia No. Pl2022006870 Filing Date: 06 December 2022 Applicant: GK AQUA Sdn Bhd Entitled: A SEX SPECIFIC MARKER FOR PRAWNS

We are pleased to inform you that we have filed the above-mentioned application together with request for substantive examination at the Intellectual Property Corporation of Malaysia (MyIPO) on 6 December 2022.

#### PROTECTION IN OTHER COUNTRIES/REGION

Now that the patent application has already been filed in Malaysia, we bring to your attention some important information relating to other actions to be taken. If priority is to be claimed, any foreign patent application for the same invention must be filed by **6 December 2023** in accordance with the PARIS Convention or Patent Cooperation Treaty (PCT). This date is not extendable. We would be able to assist you in the filing of the patent application in any country.

#### PRODUCT MARKING

You are advised to bring to the attention of the public that the invention is subject matter of a patent application. You could place a marking seal as "Malaysian Patent Pending. No. PI2022006870" in a prominent part of the product, or packages, or product literature or by other appropriate means.

#### INFRINGEMENT

Rights to infringement of patent only come into existence upon grant of patent. However the applicant can send warning notices to potential infringers on the existence of the patent application after the publication of this application (which should be the same date as in the publication date of the parent PCT application).

#### WARNING NOTICE

We would also recommend you to publish a warning notice in major newspapers to inform potential infringers of the existence of the present application. Please let us know if you wish to publish such a warning notice and I would be pleased to draft a warning notice with the minimal cost of RM 1000.00

#### ASSIGNMENT/LICENSING

Should you wish to enter commercial arrangements with third parties on exploitation of the invention, please contact us for advice on assignments, licensing, joint collaboration and etc.





#### IP: Fermented *Sesbania* grandiflora leaves as feed ingredient for BSF larvae

WRITER'S NAME : Tharishini Manalan WRITER'S E-MAIL : tharishini@kass.asia OUR REF : P1705MY YOUR REF : Please advise DATE : 06th September 2022

Dr. Janaranjani GK Aqua Sdn Bhd Jalan 100 Ekar, Kampung Sungai Atas, 71960 Port Dickson, Negeri Sembilan.

Dear Dr. Janaranjani,

Novelty Patent Search Report – Fermented Sesbania grandiflora Leaves as Feed Ingredient for Black Soldier Fly (BSF) Larvae

We attach herewith our patent search report, along with the retrieved prior art documents for your perusal and further action. Please peruse and do let us know should there be any comments on the report.

To summarize, the purported invention as disclosed in your disclosure <u>appears to be Novel and Inventive</u> in view of the teachings of the cited prior art documents.

In the view of the above, if you would like us to proceed with the drafting of the specification for this invention, please do let us have your instructions to proceed.

Meanwhile, please do not hesitate to contact us should there be any further questions.

Thank you and have a good day.

#### Kindly acknowledge safe receipt of this letter and documents.

Yours sincerely,



THARISHINI MANALAN KASS International Sdn. Bhd. Encl. 1) Novelty Patent Search Report 2) Prior art Documents 1-3

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# **Farmers Results**

1<sup>st</sup> Batch All Male Post Larvae Stocking – 6<sup>th</sup> April 2017



Juvenile Transfer – 21<sup>st</sup> May 2017 65% survival



90 days in Grower Pond (20<sup>th</sup> Aug 2017)



# **International Traction & Demand**

# Secured International Demand and Partnership for GK Aqua





- Signed Cooperation Agreement with El Komy Group in Dubai Expo 2020 on 11th Oct 2021
- Setting up JVC in Bangladesh for potential market share of 10 Billion Post Larvae
- Signed Cooperation agreement in India for 1 Billion PL production in next 3 years. India market share is 5 Billion PL.
- China has market share of 40 Billion Post larvae requires 400,000 NF broodstock
- Other collaborations include America, Latin America, Thailand, Qatar and Philippines





# Farm to Fork Model for Interested Economies

Our farm-to-fork business model adds value to the whole value chain for Neo-Female Freshwater Prawns



Broodstock Development



Broodstock Multiplication



Hatchery Phase



Nursery Phase



Prawn Farming



Downstream Activities to Consumers













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# **MUGA - Social Enterprise**



# **Opportunity for Collaboration**

Joint Venture with Experienced Farmers:

Supporting Each Other in Creating and Sustaining Strategic Competitive Advantage



# **Business Model**







**Professor Matthew Tan** 





# APECPERU 2024



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