THE CENTER FOR AQUACULTURE TECHNOLOGIES

Sentinel Trials: Local Selection

John Buchanan & *Oscar Hennig

TCRS Shrimp Summit

INDONESIA 2025

CAT is part of the **Cuna del Mar** family which focuses on sustainable aquaculture by investing in eco-friendly fish farming, advanced systems, and innovative feed solutions to reduce aquaculture's impact on wild fish.

We share Cuna del Mar's mission for economic, social, and environmental progress, supporting biodiversity and ocean health through collaboration with entrepreneurs, scientists, and specialists.

THE CENTER FOR AQUACULTURE TECHNOLOGIES · onda · INNOVASEA · Blue Ocean MARICULTURE · SOL AZUL BAJA OYSTERS · santomar · openblue

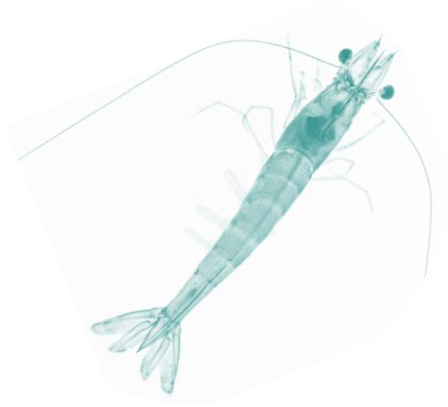
Trusted worldwide

We operate on a global scale, serving clients across multiple countries

Australia, Austria, Brazil, Canada, Chile, China, Colombia, Denmark, **Ecuador**, France
Germany, Ghana, Hong Kong, India, Indonesia, Korea, Mexico, Netherlands, New Zealand
Norway, Panama, Peru, Portugal, Saudi Arabia, South Africa, Spain, United Arab Emirates
United Kingdom, United States

Ecuador

Successful introduction of genomic selection

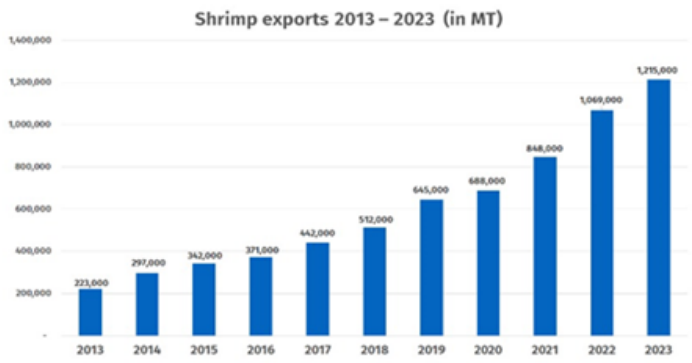


First small Low-Density (LD) genotyping project

CAT introduced both Low-Density & High-Density SNP panels in Ecuador

2017 → **2020** → **2023**

NATIONAL CHAMBER OF AQUACULTURE



Year	MT	% inc
2012	209,000	
2013	223,000	6.7
2014	297,000	33.2
2015	342,000	15.2
2016	371,000	8.5
2017	442,000	19.1
2018	512,000	15.8
2019	645,000	26.0
2020	688,000	6.7
2021	848,000	23.3
2022	1,069,000	26.1
2023	1,215,000	13.66

On average, in the last decade Ecuador has doubled its shrimp exports every 2.5 years.

Source: Central Bank of Ecuador (BCE)

Since 2023, CAT has genotyped using:
Low Density SNP Panel: >314K samples
Parental Assignment; Inbreeding control; Genetic Overview....

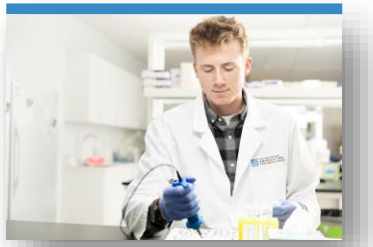
High Density SNP Panel: >84K samples
Genomic Selection

CAT Clients in Ecuador: > 45% of production in 2023

Our technical expertise

Turning science into meaningful innovation for the aquaculture industry

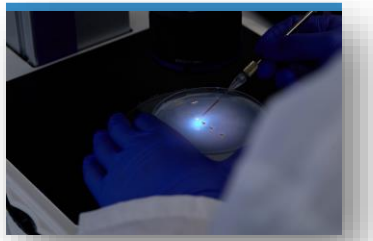
GENOTYPING



GENETIC SERVICES

ANALYSIS

COMMERCIAL SCALE GENOME EDITING



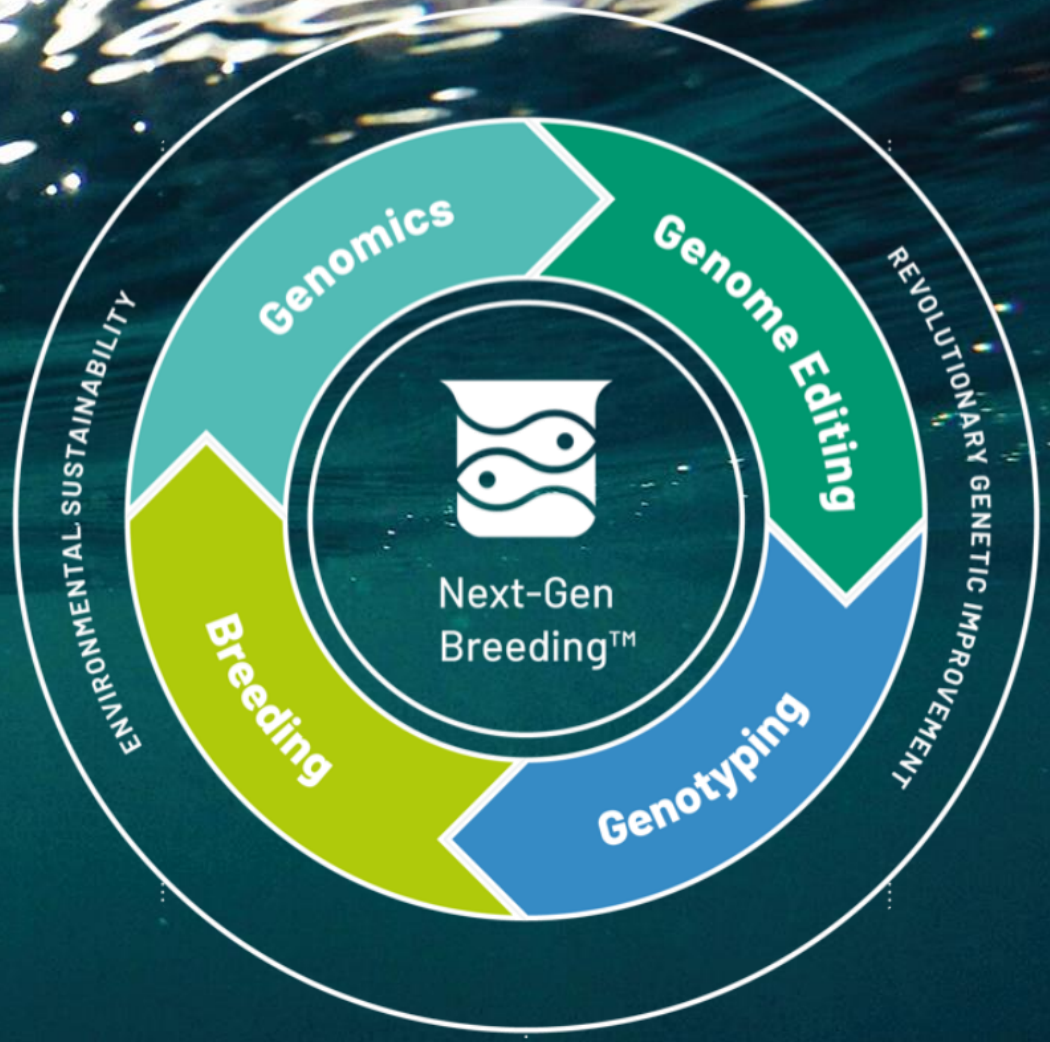
GENOME EDITING R&D

GENETIC INNOVATION

CAT is at the leading edge of genetic innovation within the aquaculture industry

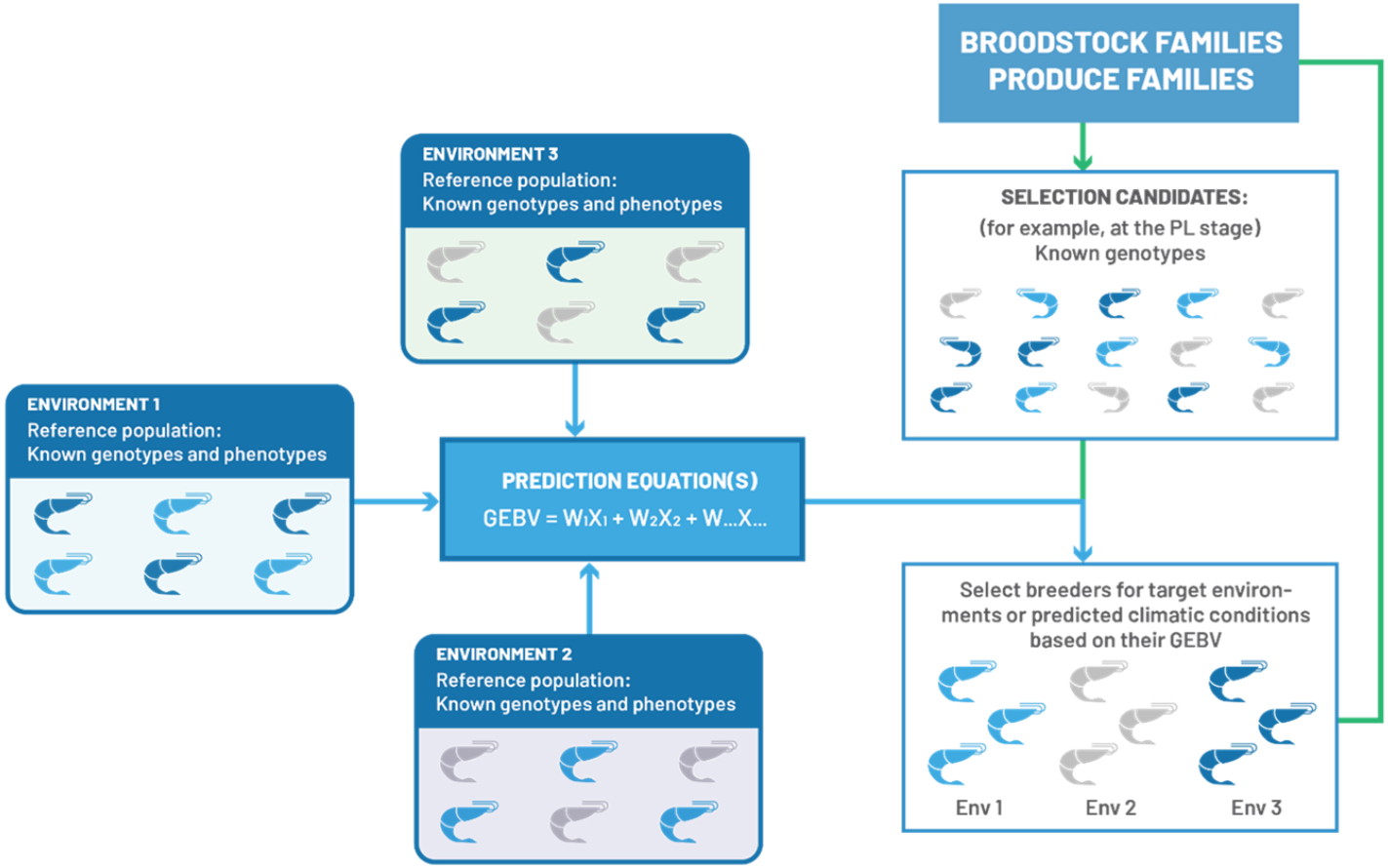
We are experts in genetic improvement for aquatic species, committed to delivering tailored solutions that meet the unique needs of our clients. With guaranteed high-quality service and robust internal quality control, we ensure you receive reliable data and actionable results that drive value for your business.

DR. JOHN BUCHANAN , CEO



Sentinal Trials

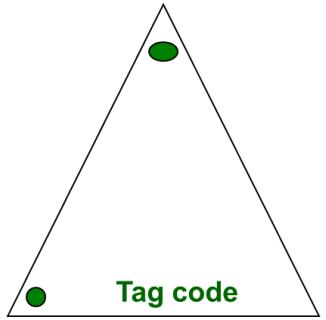
- **Selection is based on field results**
- **Lines for specific locations/time of the year**
  - Green/Red zone
  - Low salinity/High salinity
  - Low density/High density....



Sentinal Trials: Before



Individual larval rearing, nursery and growout*

***Or: Individual larval rearing and nursery + elastomer tag**

- **Not so good:**
  - **Between family selection only**
  - **Separated tanks/hapas**
    - Tagging: 50+ days
    - Hapas/tanks: entire cycle
  - **Non-commercial environment**
  - **Hard to find tagged animals**
  - **Density differential**

Sentinal Trials: Now, DNA tools (SNP panels)

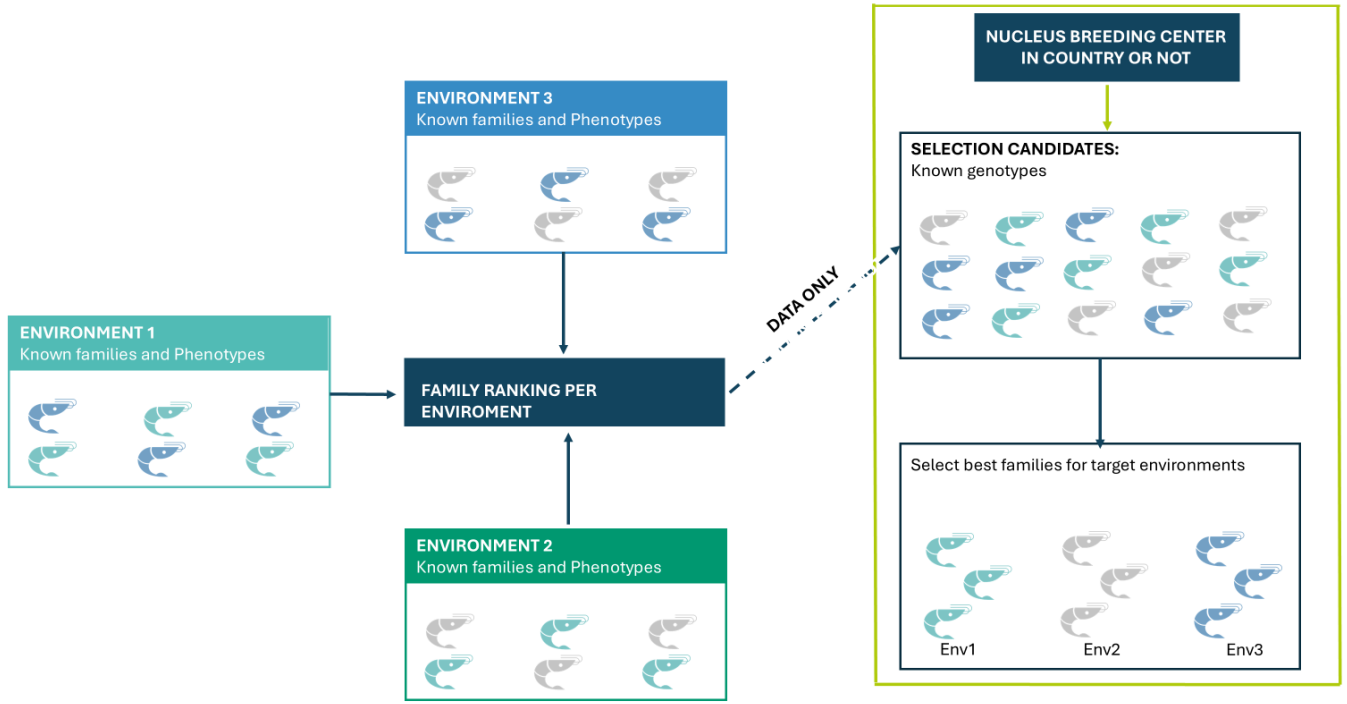
- **Between and within family selection**
  - Possible
- **Common environment since hatching**
- **Selection in commercial infrastructure**
  - Larviculture/Nursery/Ponds

Types of sentinel trials

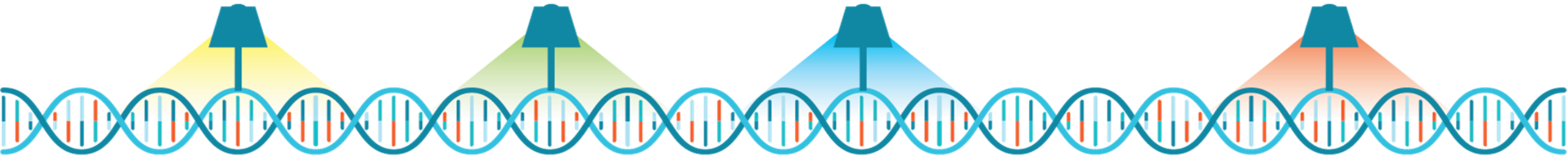
Better

Between family selection

- Best families mated to produce the next generation
- Low Density SNP panels used to identify siblings
- Multiple traits with good accuracy.



Low Density SNP Panel: **192 - 500**

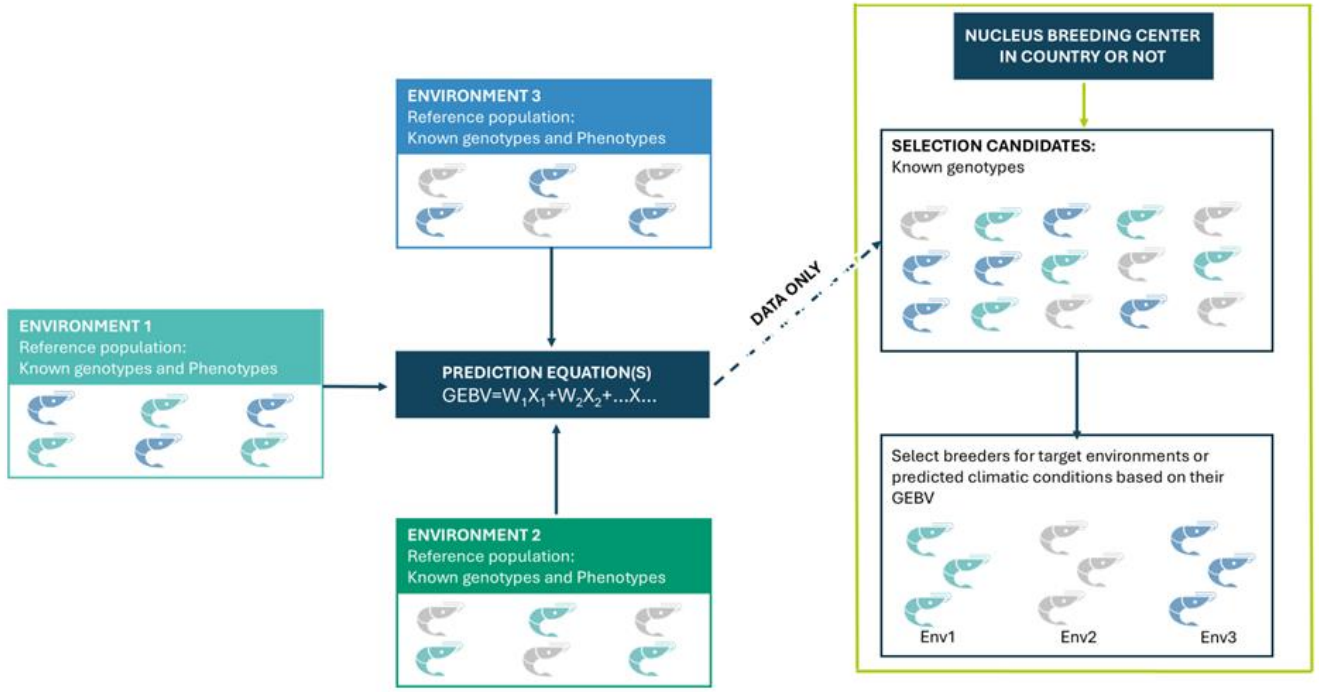


Types of sentinel trials

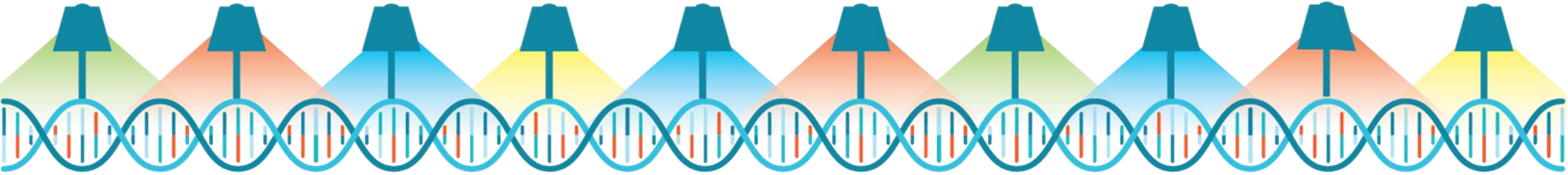
Best

Between and within Family selection: Genomic selection

- Best individuals based on Genomic Breeding Value mated to produce the next generation
- Faster genetic improvement
  - Not all sibling are born equal!
- Requires High Density SNP panel



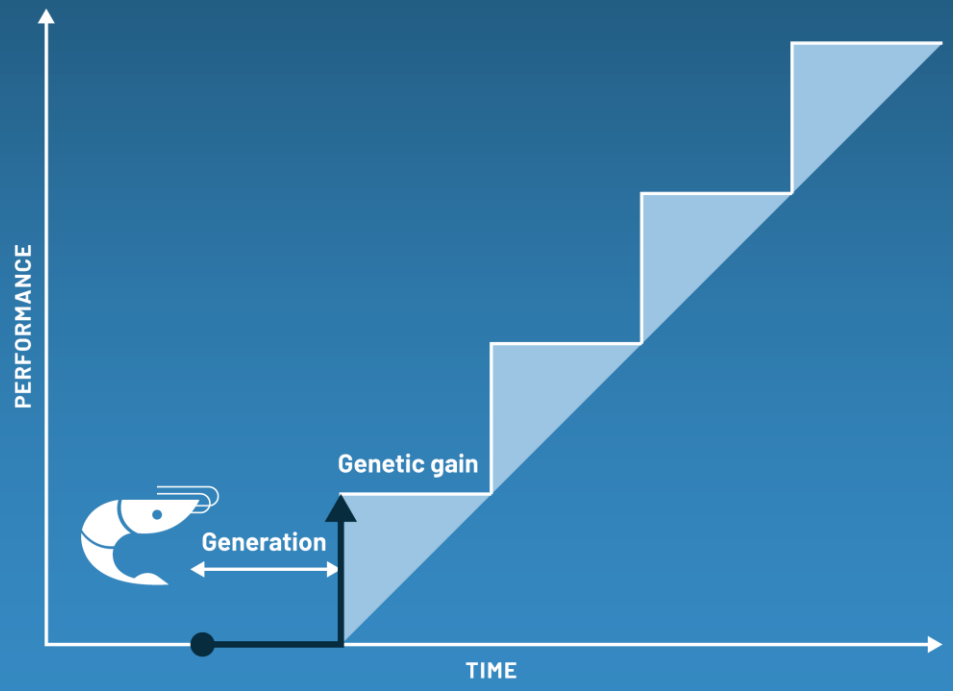
High Density SNP Panel: **50,000**



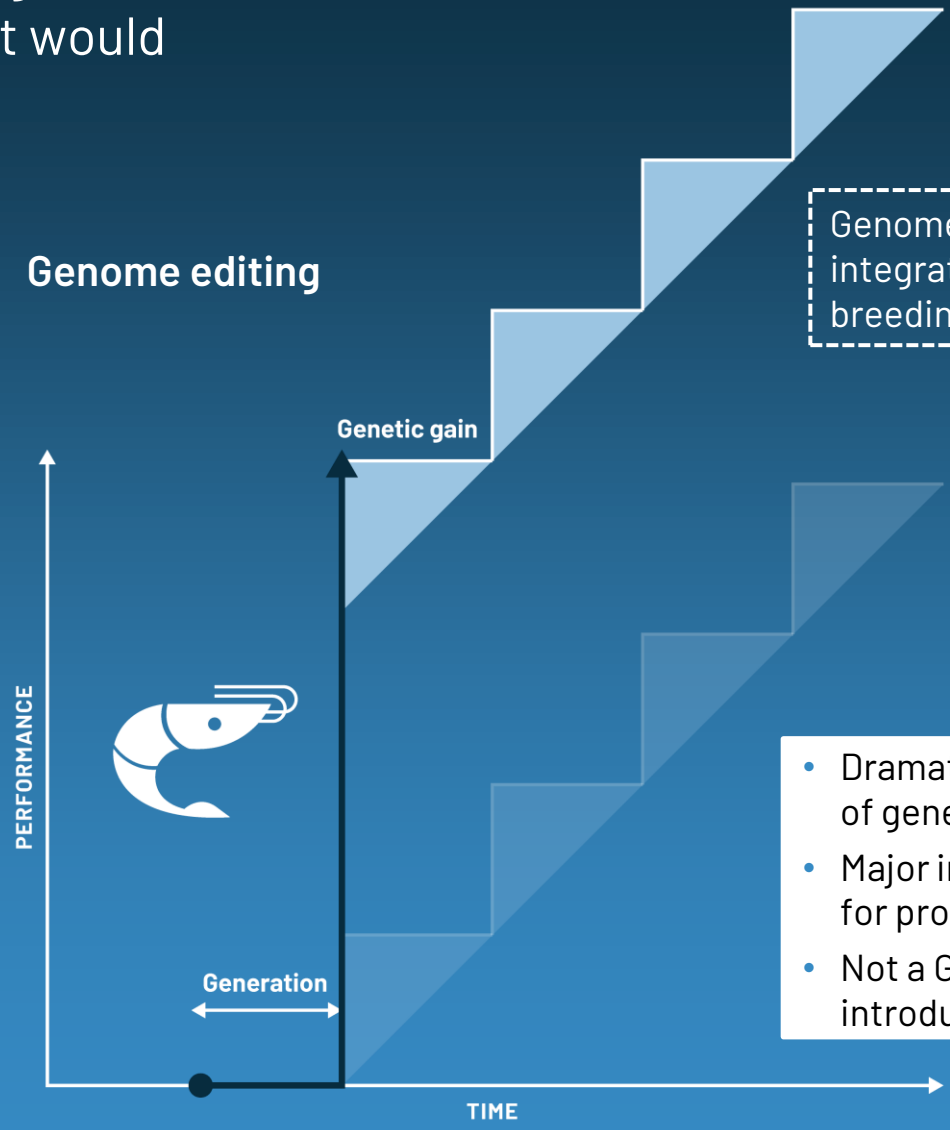
What's Next?

Through precise changes in DNA, Genome Editing accelerates the selection for desirable traits that would typically require many generations.

Conventional breeding program



Genome editing



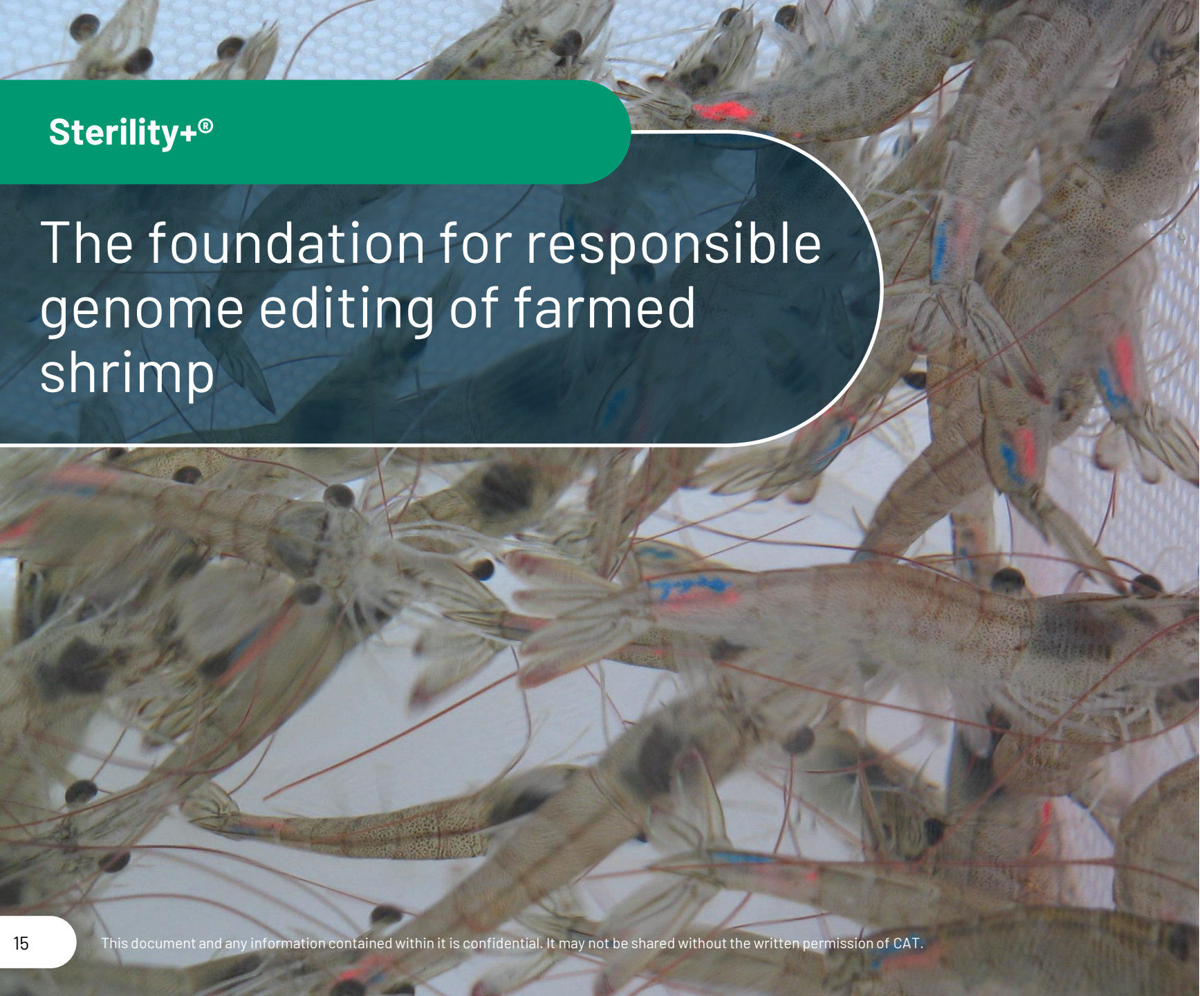
Genome Editing (GE) will integrate with (not replace) breeding programs

- Dramatic increase in the speed of genetic improvement
- Major increase in value created for producers
- Not a GMO – no foreign DNA introduced

Increased growth and fillet yield in tilapia

	Growth rate	Feed efficiency	Filet Yield
Gene 1	62%	12%	ND
Gene 2	38%	11%	ND
Gene 3	8%	6%	58%

- From CAT studies in tilapia
- Full sibling comparison
- Myostatin gene has been edited; F2 generation
- Gene 1 and 2 studies still in progress



Sterility+®

The foundation for responsible genome editing of farmed shrimp

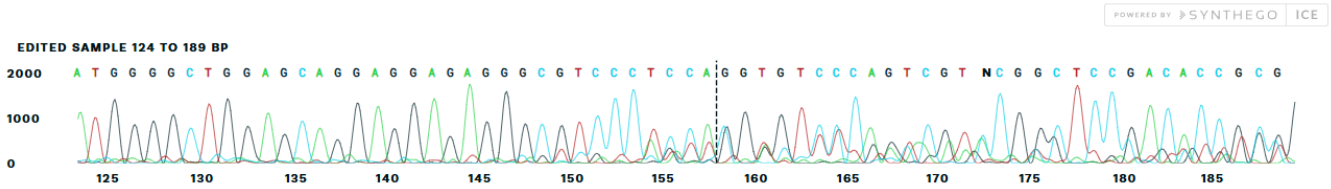
Sterility+® delivers 100% sterility in aquatic species. It addresses the ecological challenge of shrimp escapes and improves growth and performance by reallocating reproductive energy.

- Enhances growth by preventing sexual maturation.
- Guarantees biocontainment by blocking reproduction of escapees.
- Secures genetic investments by safeguarding the proprietary genetics of broodstock.
- Protects the distinctive traits of wild populations, helping them thrive in their native habitat.
- Addresses regulatory concerns about the potential environmental impact of genome edited organisms.
- Paves the way for advancements in biotechnology applications.

Sterility+® allows propagation in the hatchery and sterility on the farm.

Eye Phenotype with Scarlett Gene KO

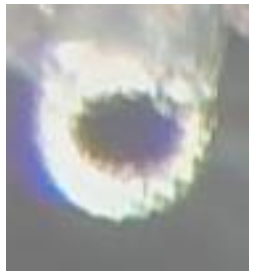
Status	Guide Target	PAM Sequence	Indel %	Model Fit (R^2)	Knockout-Score	Nuclease
Succeeded	CGTACTGTTGAGAGCCCAGG	AGG	53	0.79	41	spcas9



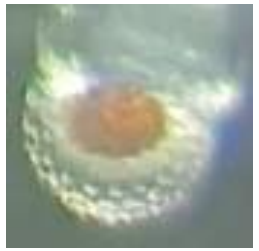
- ✓ Visual Marker of Gene Editing Success
- ✓ Demonstrating our ability to create and grow the edited shrimp past PL20+

Early Larva

NORMAL



“RED EYE”



PL 20+

LOW **HIGH**

AQUA array®

NEW
Product
Announced
May 2025

Low Density tool for Black Tiger Shrimp (*P.monodon*)

Providing critical insight to accelerate genetic improvement

Designed for value and adaptability, this LD panel allows producers to align their genotyping strategies with specific breeding objectives and budget.

Striking the right balance between marker density, sample size, and cost.

- Population structure
- Genetic diversity
- Parentage assignment
- Sex determination
- Marker discovery
- And more ...

Picture at Mr. Ravi Kumar Yellanki's hatchery, circa 2008

Suksma Dahat

THE CENTER FOR AQUACULTURE TECHNOLOGIES

Suksma Dahat

LEARN MORE ABOUT CAT AND THE SERVICES WE OFFER >

CHECK OUT OUR BREEDING PAGE AND FIND THE SOLUTION THAT WORKS FOR YOU >

HAVE MORE QUESTIONS?
DON'T HESITATE TO REACH OUT.

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