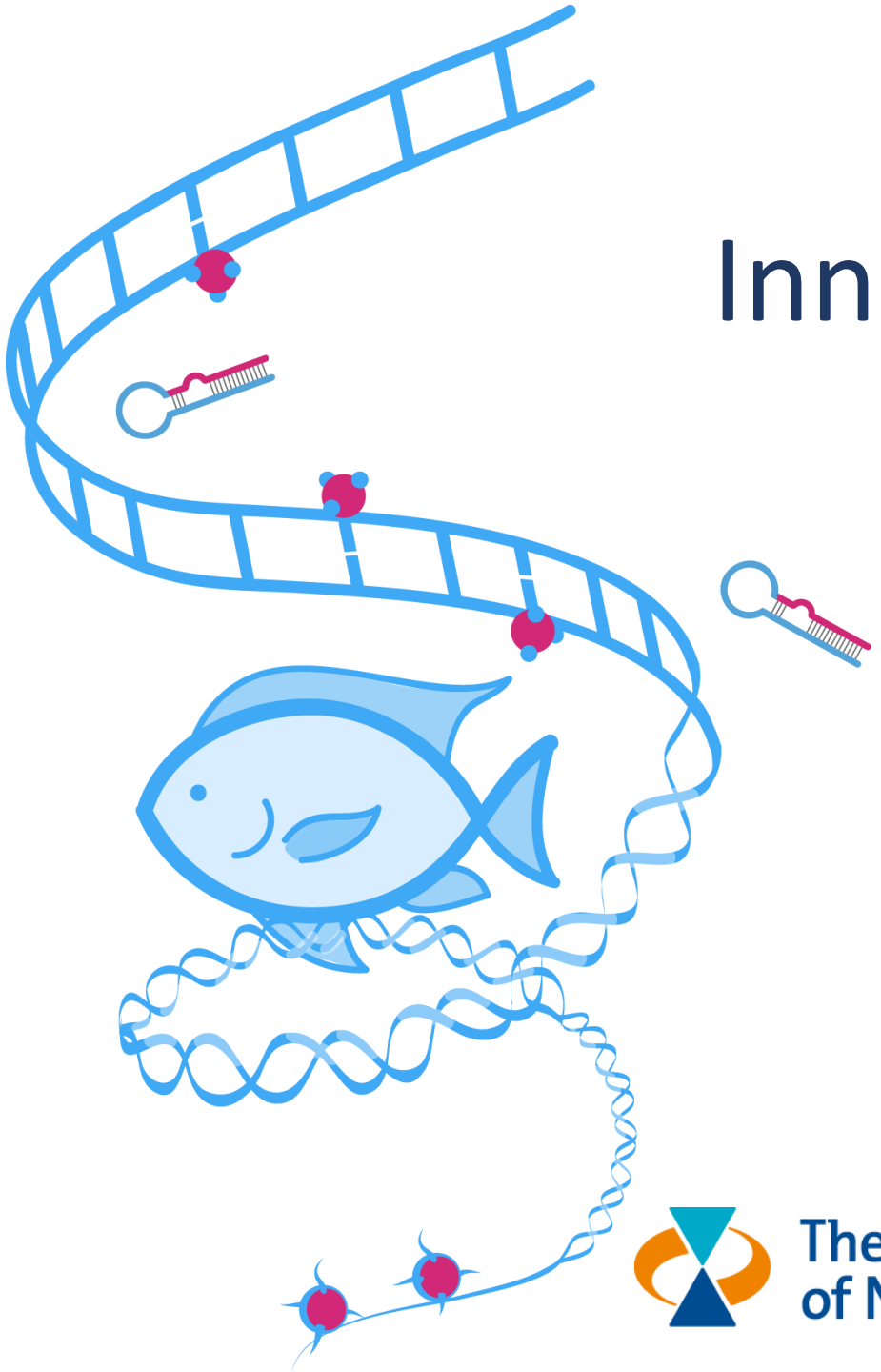


EPIFISH
Innovative Epigenetic Markers for Fish Domestication

Jorge Fernandes

Bioøkonomi i Nordland - seminar

11 Dec 2018

The Research Council of Norway

NORD University

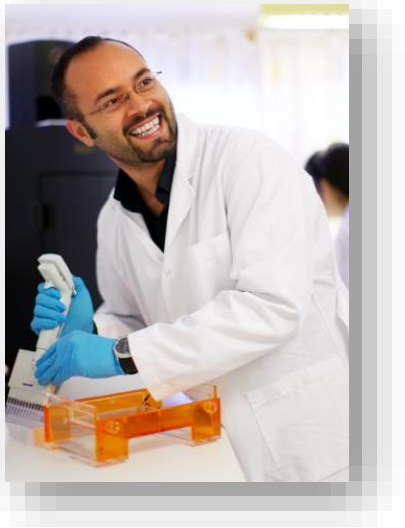
European Research Council
Established by the European Commission
Supporting top researchers from anywhere in the world

Nord University, Bodø

PhD in fish immunology (2003)

Post-doc in muscle development (2007)

BEng in chem. eng./ biotech. (1998)



Jorge Fernandes

Professor in genomics

Jorge.m.fernandes@nord.no

- ✓ Fish growth and muscle development
- ✓ Fish immunology
- ✓ Epigenetics and miRNAs

EPIFISH

Innovative Epigenetic Markers for Fish Domestication

European Research Council
Established by the European Commission
Supporting top researchers from anywhere in the world

ERC Consolidator grant
2,000,000 EUR
2016-2021

"OK, this domestication thing has gone too far!"

ERC funds new and exciting ideas

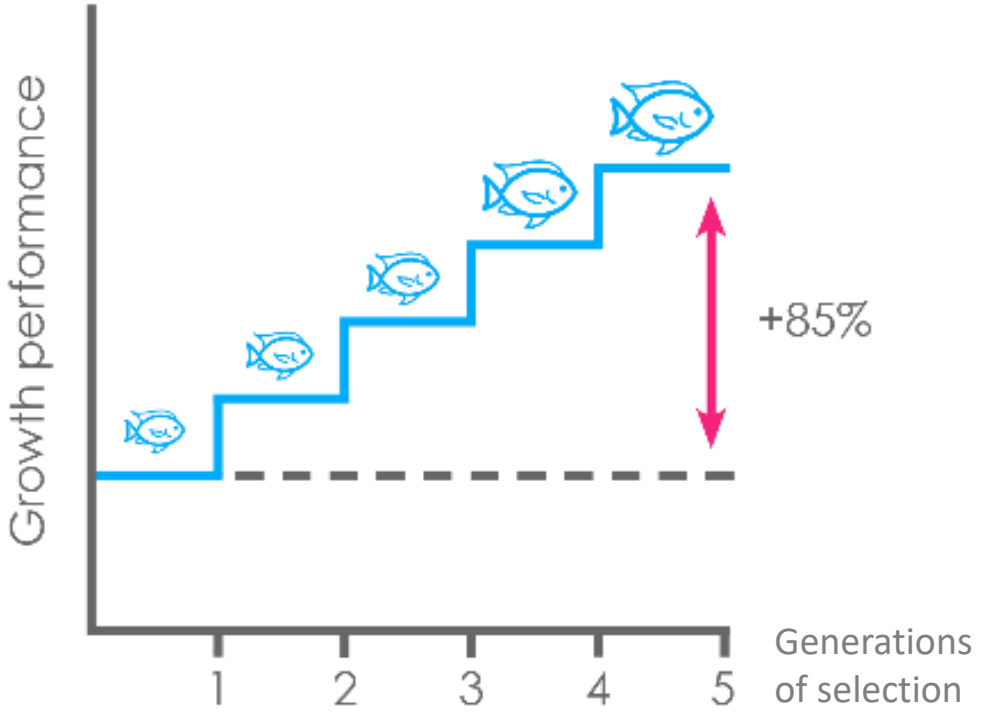
"The ERC's mission is to encourage the **highest quality research** in Europe through competitive funding and to support **investigator-driven frontier research** across all fields, on the basis of **scientific excellence**"

erc.europa.eu

Fish domestication and selective breeding are critical for sustainable aquaculture

Large phenotypic differences in body size after just a few generations of selection

Huge gain for the aquaculture industry but… only ~ 10% of farmed fish have been domesticated thus far



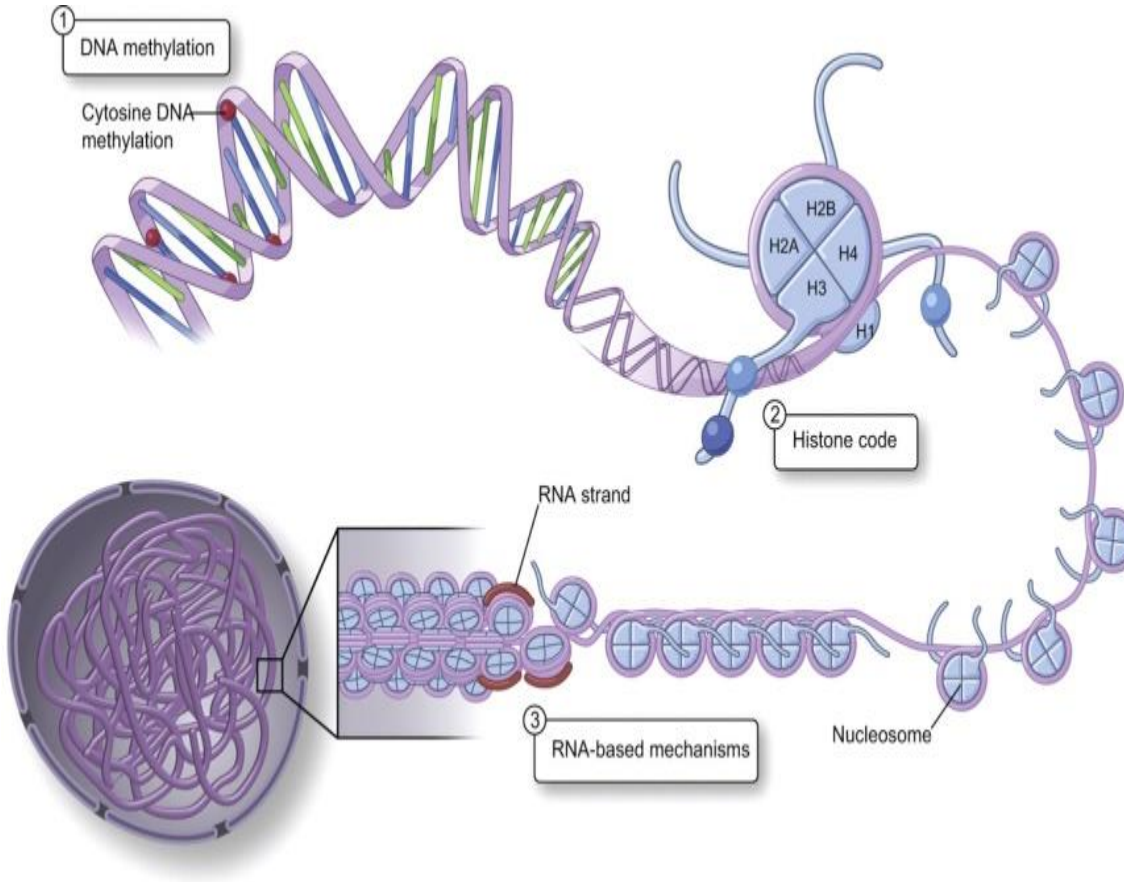
Recometa-Veasco & Ponzoni (2010). FAO

Hypothesis: epigenetics plays a key role in fish domestication

Rapid pace of phenotypic change

Selection is strongly affected by environmental conditions

Limitations of genetic markers to detect selection during domestication



www.intechopen.com

Epigenetics

LET'S EAT, GRANDMA

Inheritance of traits and changes in gene expression without changes in DNA sequence

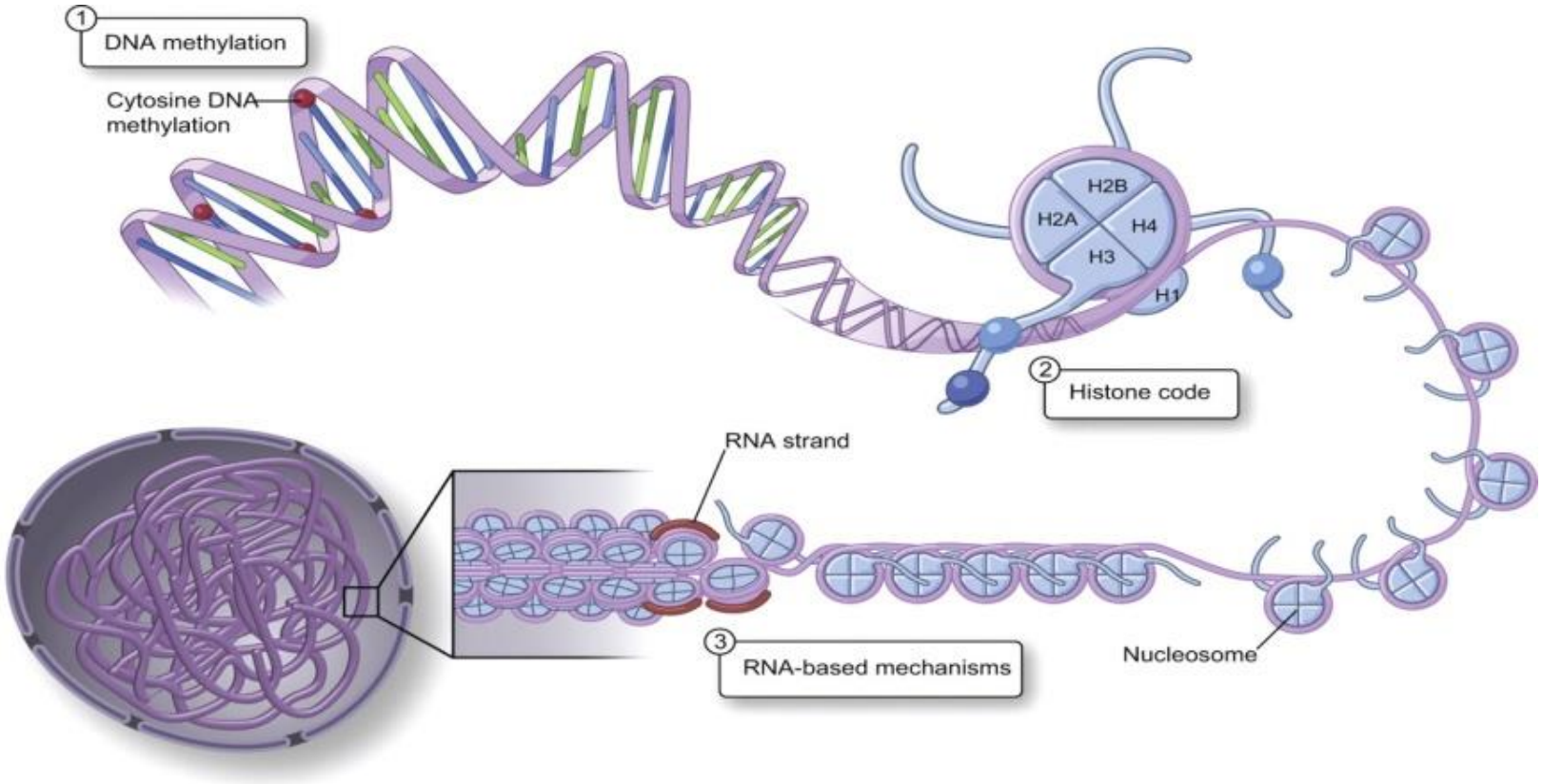
Differences in epigenetic "punctuation" marks in genes with the same DNA sequence determine when and how they are turned on, resulting in very different outcomes

Epigenetics

LET'S EAT GRANDMA

http://allisonconforti.weebly.com/the-wolf-eats-grandma.html

Epigenetic mechanisms

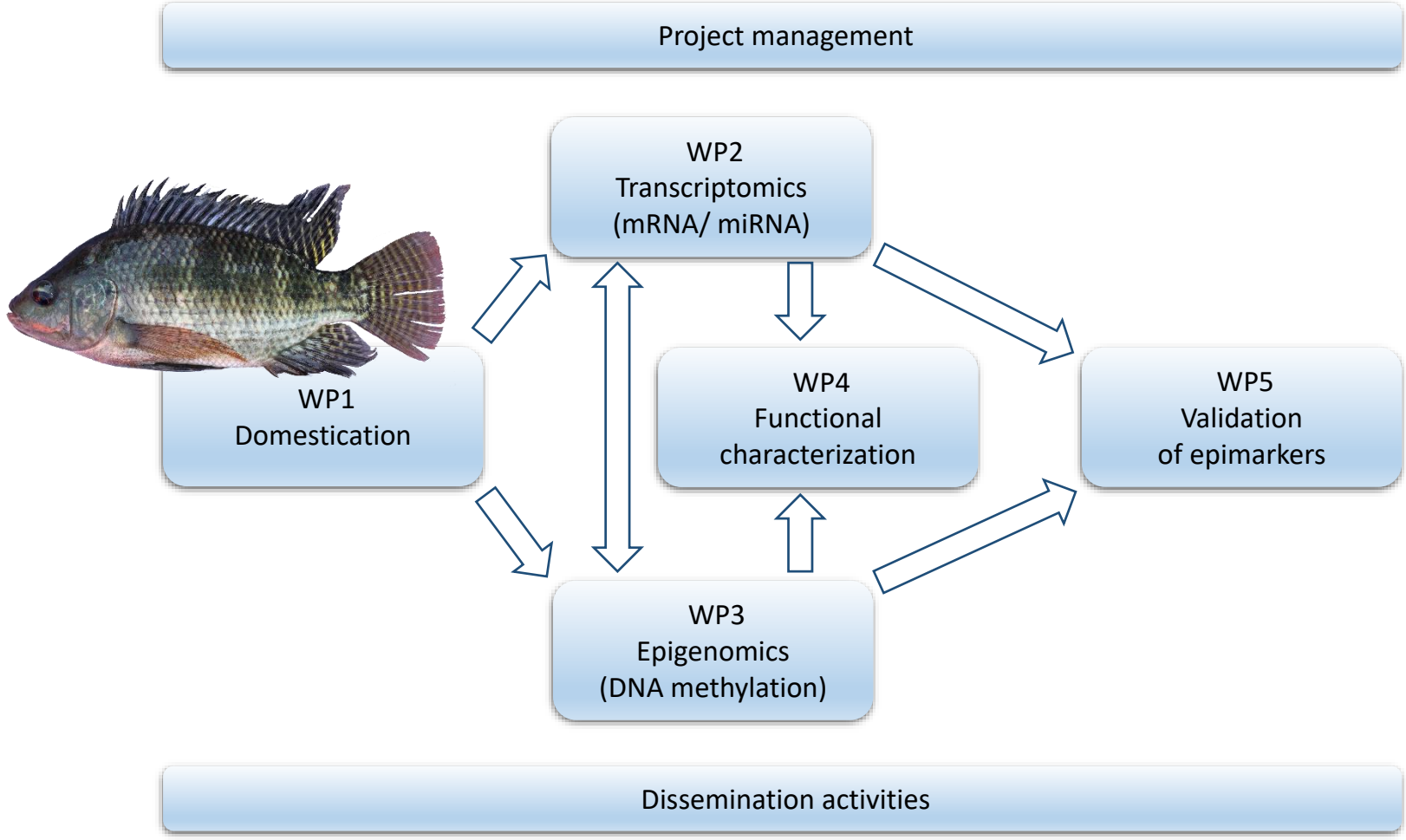


Environmental factors

Phenotype

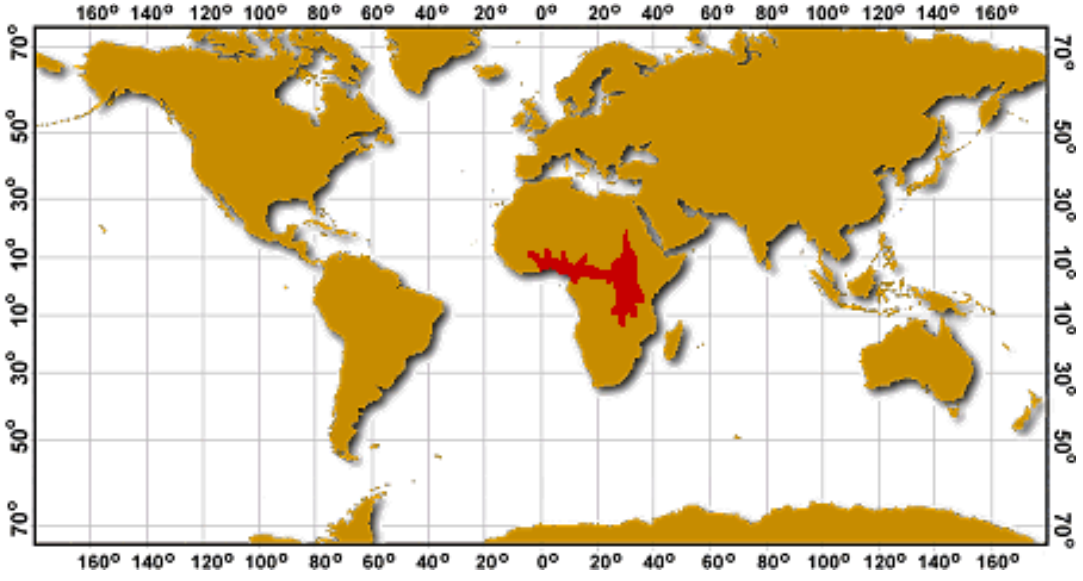
Lovrečić et al (2013) *InTech*

Multidisciplinary approach to determine the role of epigenetics in growth improvement during Nile tilapia domestication



Basic facts about Nile tilapia (*Oreochromis niloticus*)

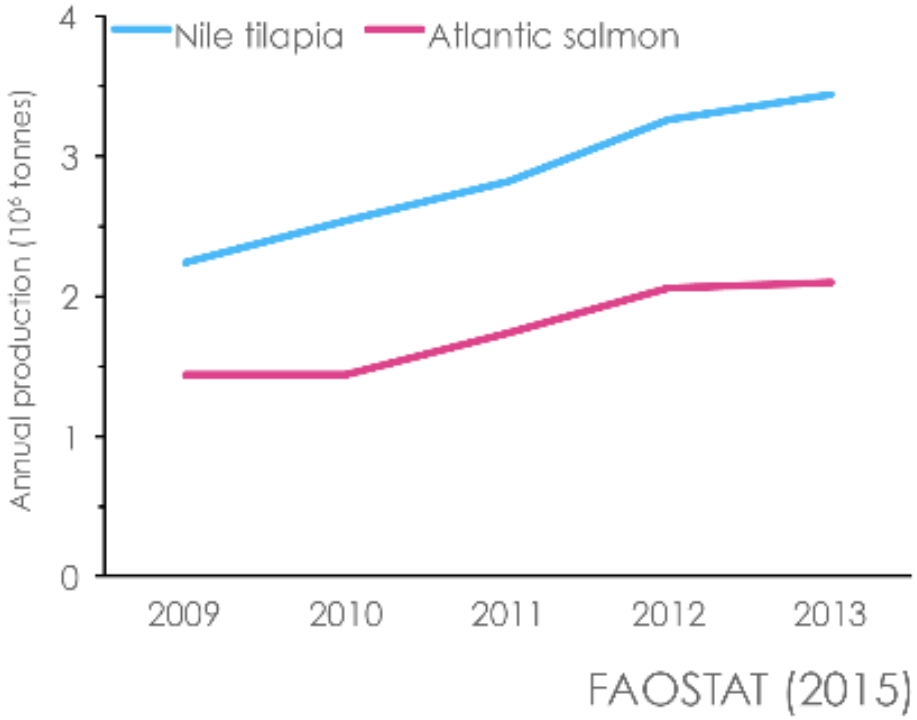
- ✓ Nile tilapia is a mouthbrooder cichlid that is native to rivers and lakes of Africa and Middle East
- ✓ Grows fast and up to > 4 kg
- ✓ Tolerates a wide range of environmental conditions
- ✓ Feeds mainly on phytoplankton and benthic algae



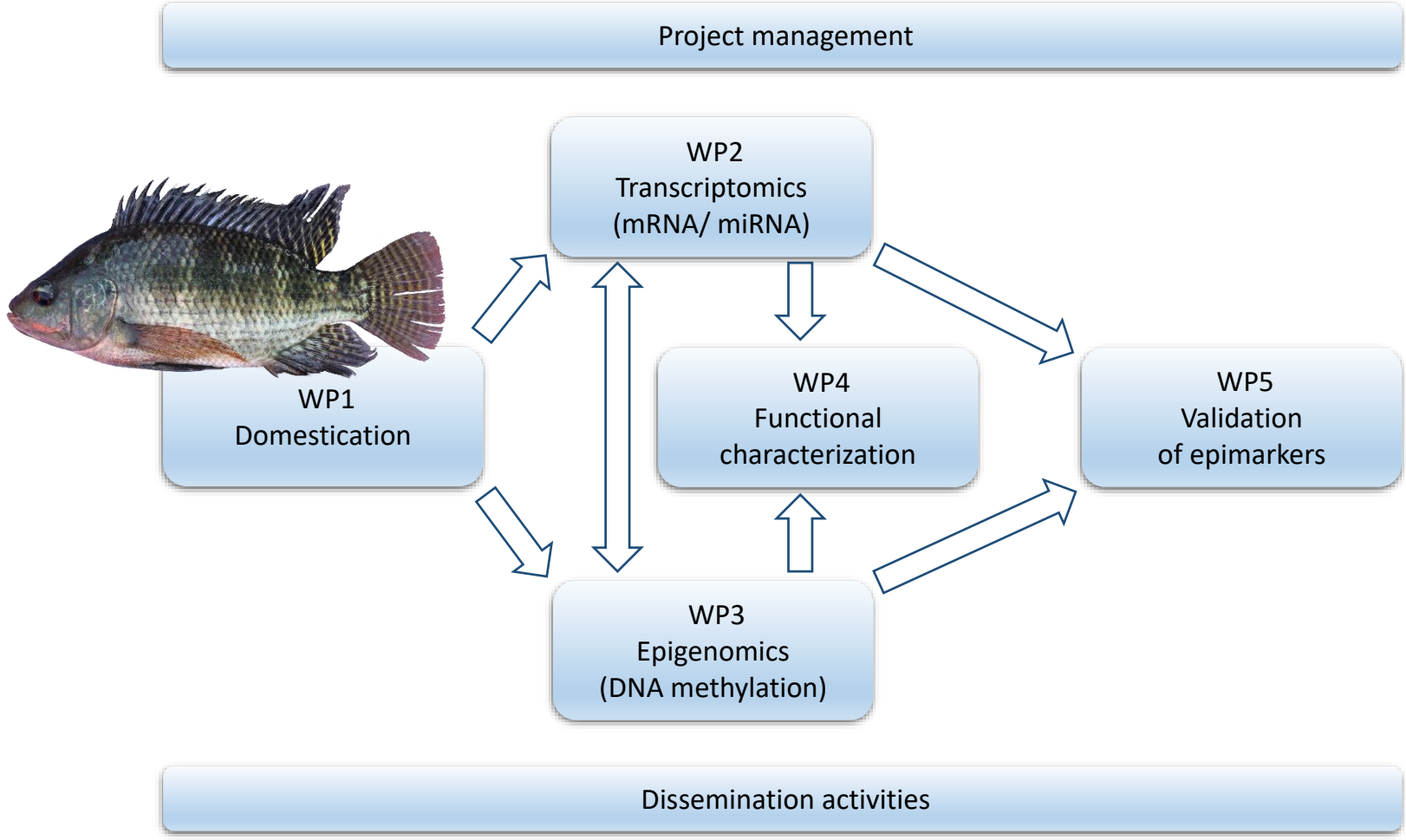
FAO Fisheries & Aquaculture, 2016

Nile tilapia is a major aquaculture species

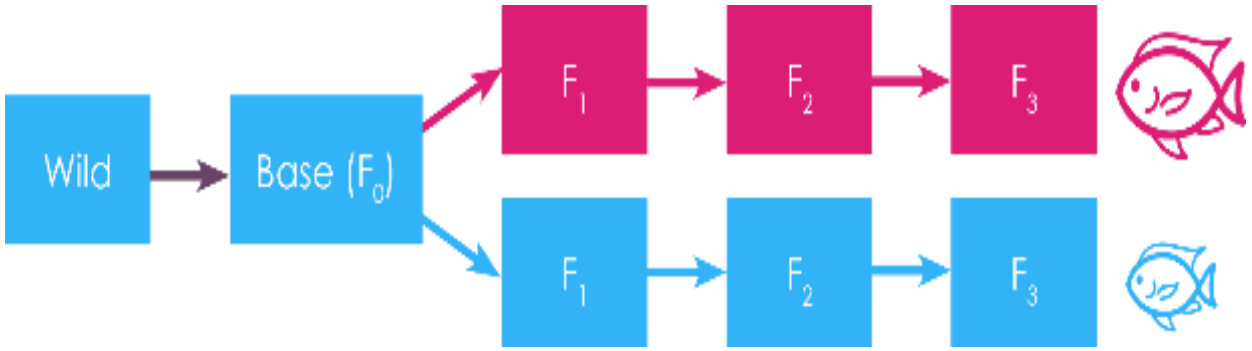
- ✓ Nile tilapia is the second most important farmed fish worldwide
- ✓Vertical integration in the industry
- ✓ Short generation time (5 months)
- ✓ Genome assembly available



Multidisciplinary approach to determine the role of epigenetics in growth improvement during Nile tilapia domestication

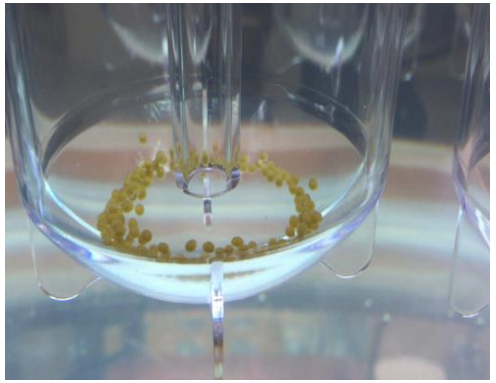


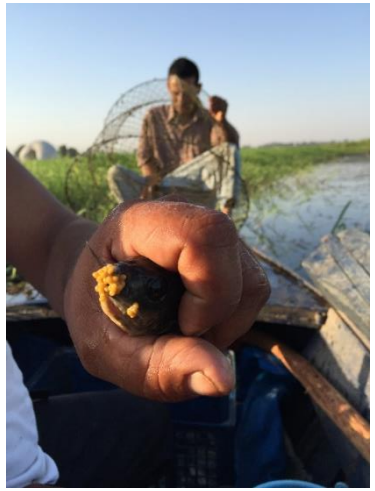
WP1. Domestication of wild Nile tilapia



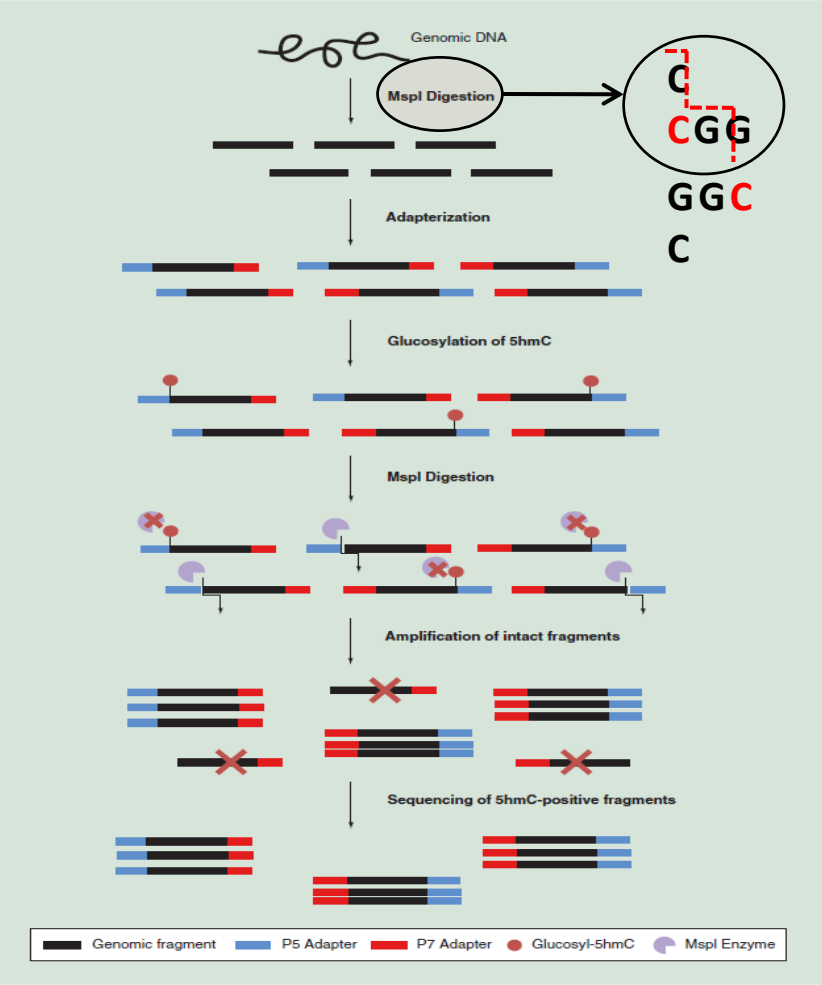
Main task: Collection of wild fish, establishment of a composite base population F_0 and selection for improved growth during domestication for three generations

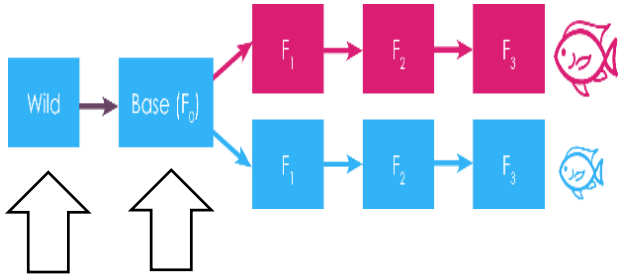
Wild eggs were collected from Egypt and transferred to Mørkvedbukta





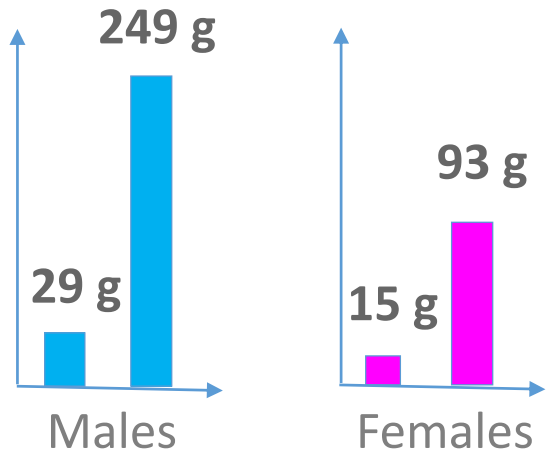
Comparison of hydroxymethylation profiles in muscle from wild and F0 tilapia





Selected

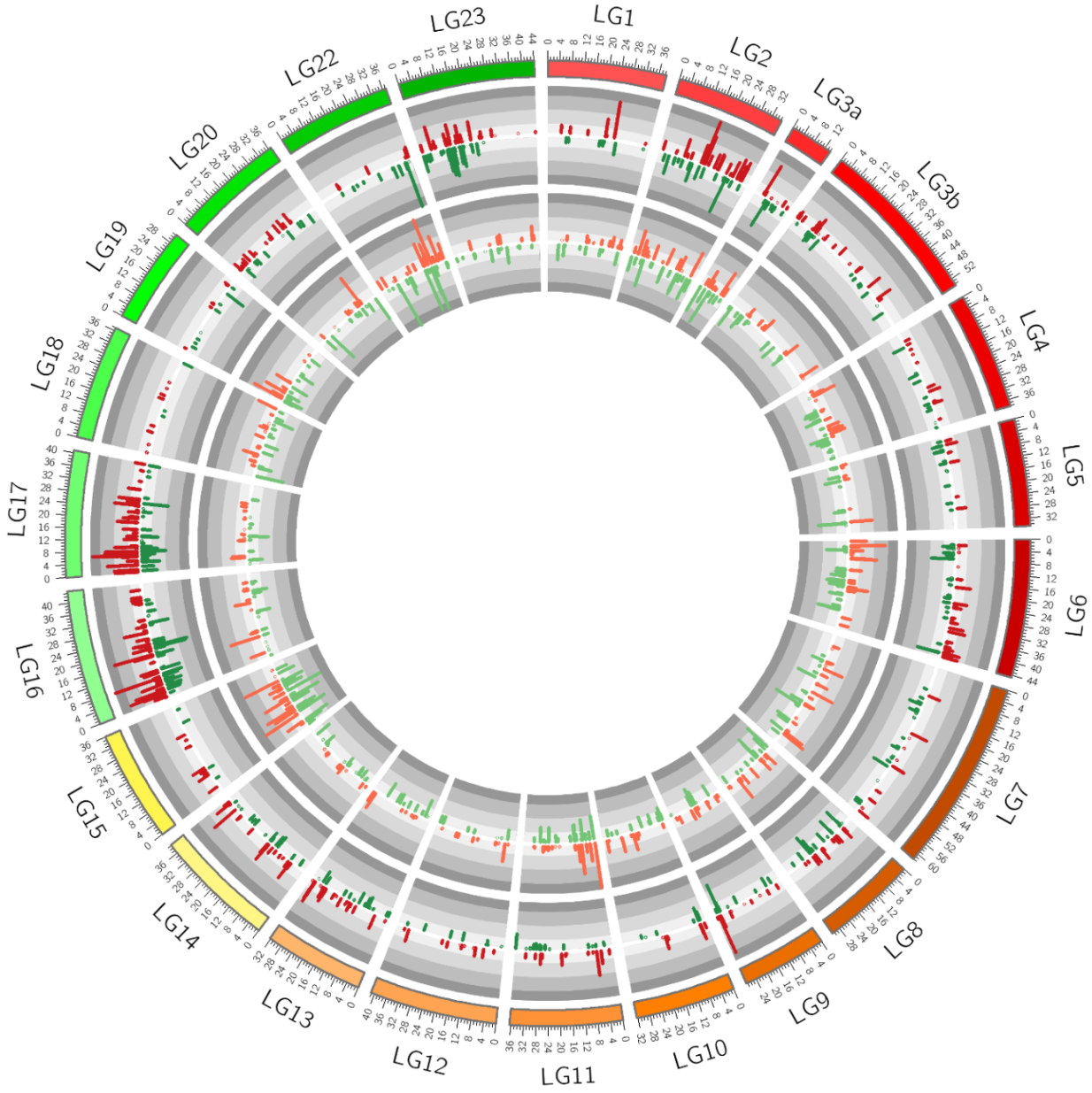
Control



5 months old

Sexually mature

Same cohort



There were differences in 5mC/5hmC levels between size groups and sex

Potential epigenetic markers of growth

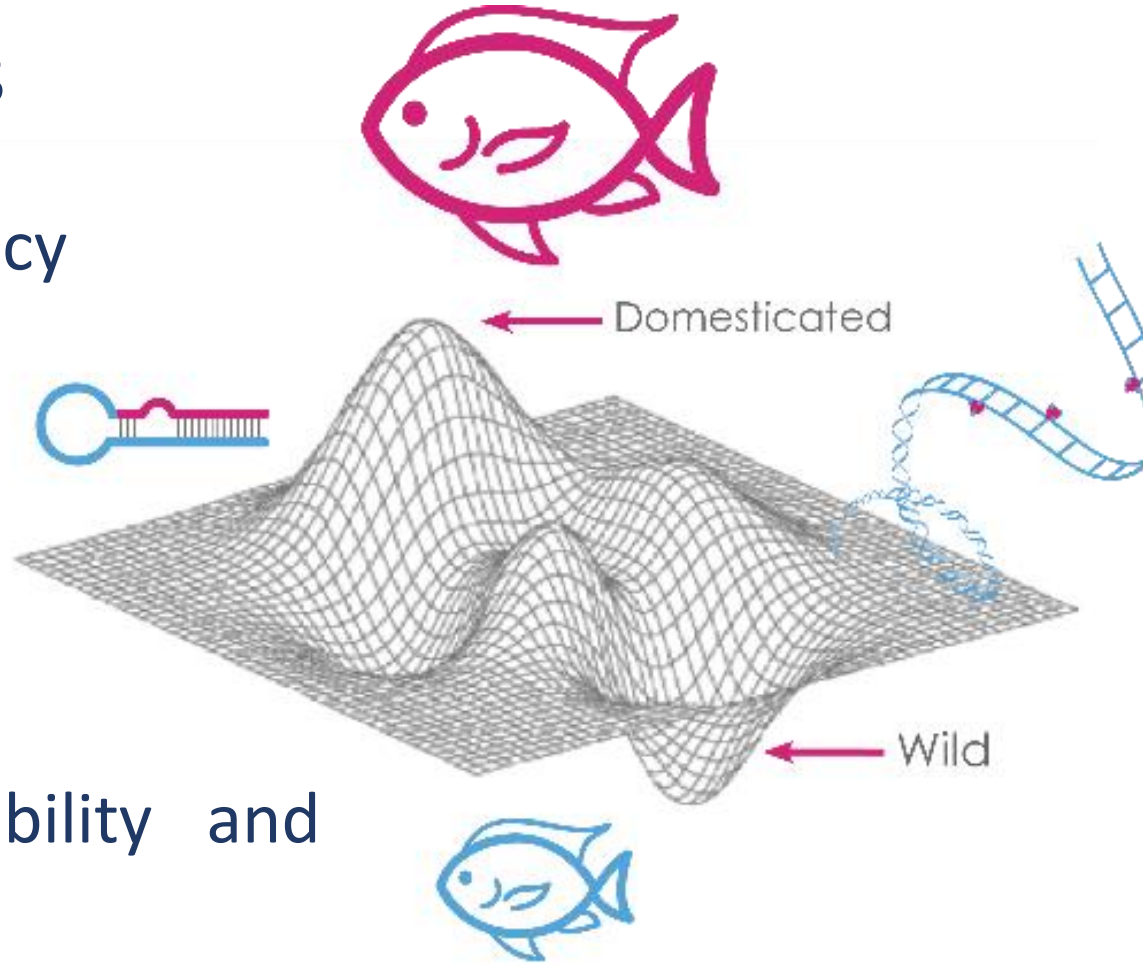
Challenges and future perspectives

Epigenetics in aquaculture is still in its infancy

Technical issues

Complex inheritance?

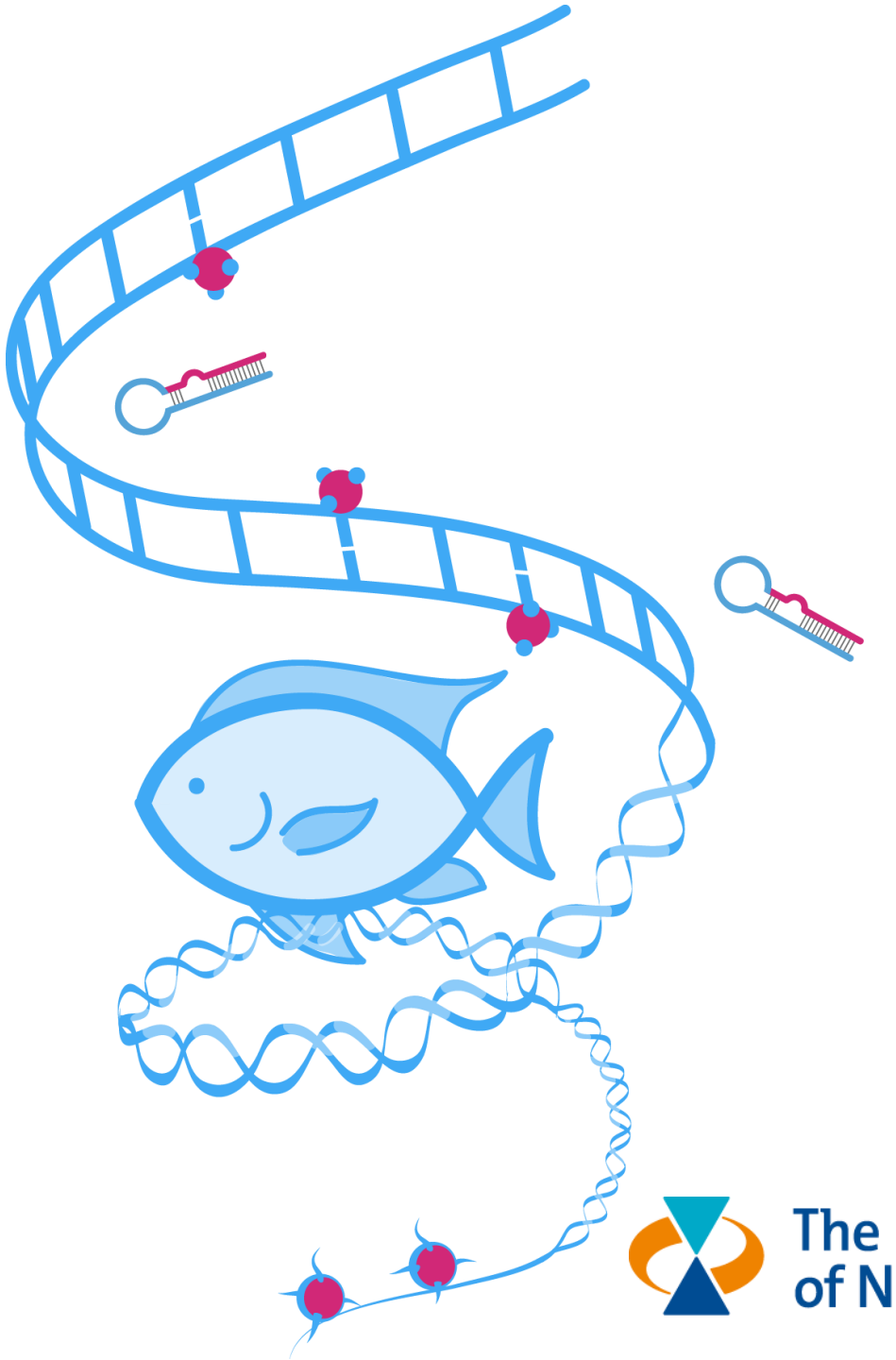
Stability?



Enormous potential to improve profitability and sustainability of the aquaculture sector

Development of novel genome-wide epigenetic markers

More efficient selection of robust fish (disease resistant, growth, …)



Tusen Takk!

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