

**Research on utilizing the
traditional vegetable
"makuwa-uri" as feed for
cultured ayu fish.**

**Gifu Senior High School of Agriculture & Forestry
Department of Animal Science, Ayu Team**



Makuwa-uri (Oriental melon)

Makuwa, Motosu city, Gifu prefecture



**Makuwa-uri has been
cultivated for over 450 years**



香瓜



참외



WHAT'S

Fruit Fish

Fruit fish are bred by mixing local specialties in their feed to added value



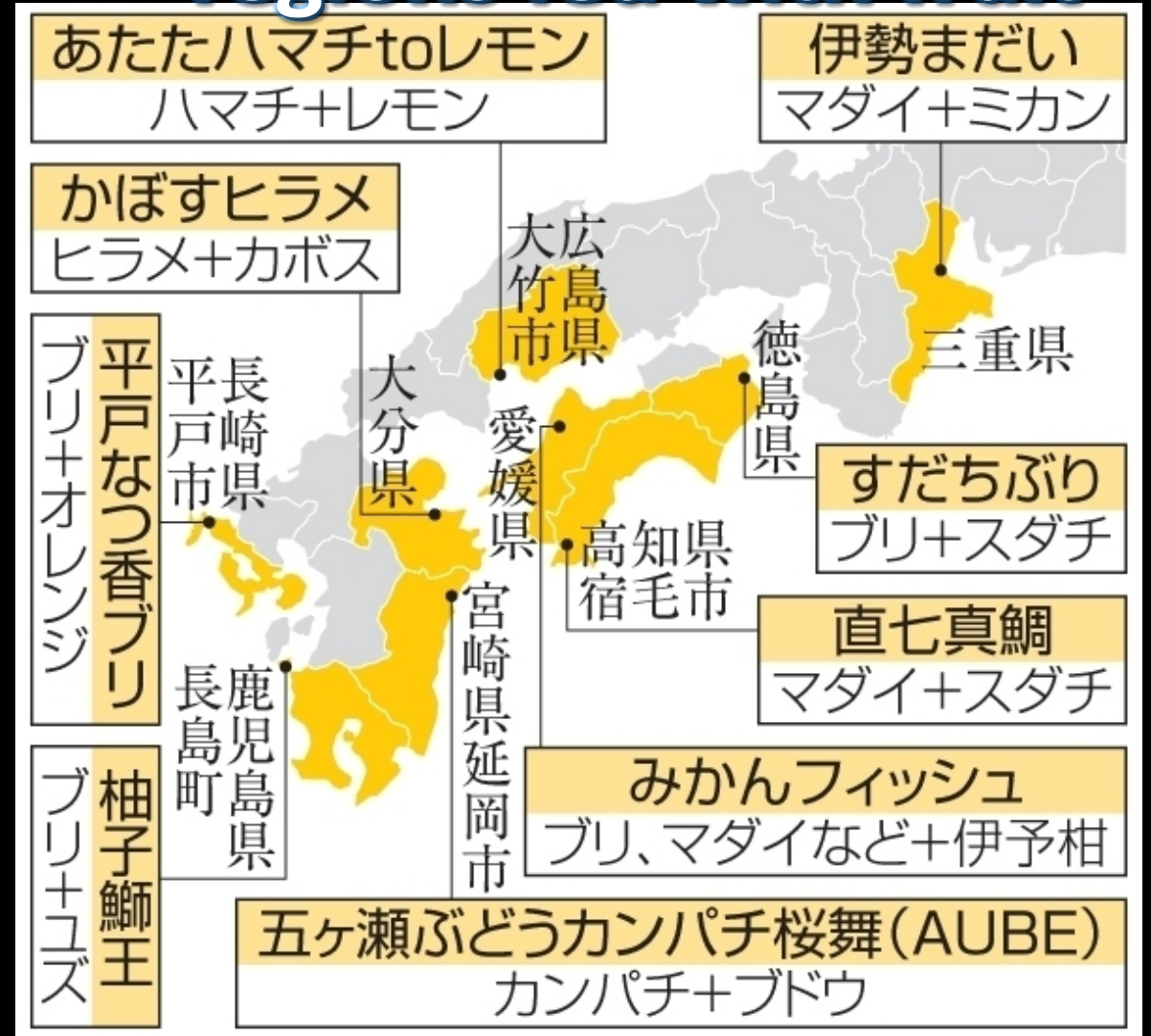
Ehime prefecture

Mikan-tai(Orange Red seabream)

WHAT'S

Fruit Fish

Main farm fish in various regions fed with fruit



From an article in THE NISHINIPPON SHIMBUN CO.,LTD

A photograph of two fresh Ayu fish (Kogyo) resting on a woven bamboo tray. The fish are dark green with a lighter belly. The tray is surrounded by several clear ice cubes and fresh green leaves, likely shiso, on a bamboo mat background.

Another name for **Ayu fish** is **Kogyo**(aromatic fish)

Ayu fish smells like watermelon.

A stainless steel tray containing several fresh, silver ayu fish. The fish are arranged in a row, showing their characteristic elongated bodies and silvery scales. The tray is set against a dark background.

**Farmed ayu fish in the
Gifu prefecture**

A woven basket filled with ripe, yellow-green melons (Makuwa-uri). The melons are arranged in a cluster, showing their characteristic yellow-green color and smooth texture. The basket is set against a background of green leaves and a yellow flower.

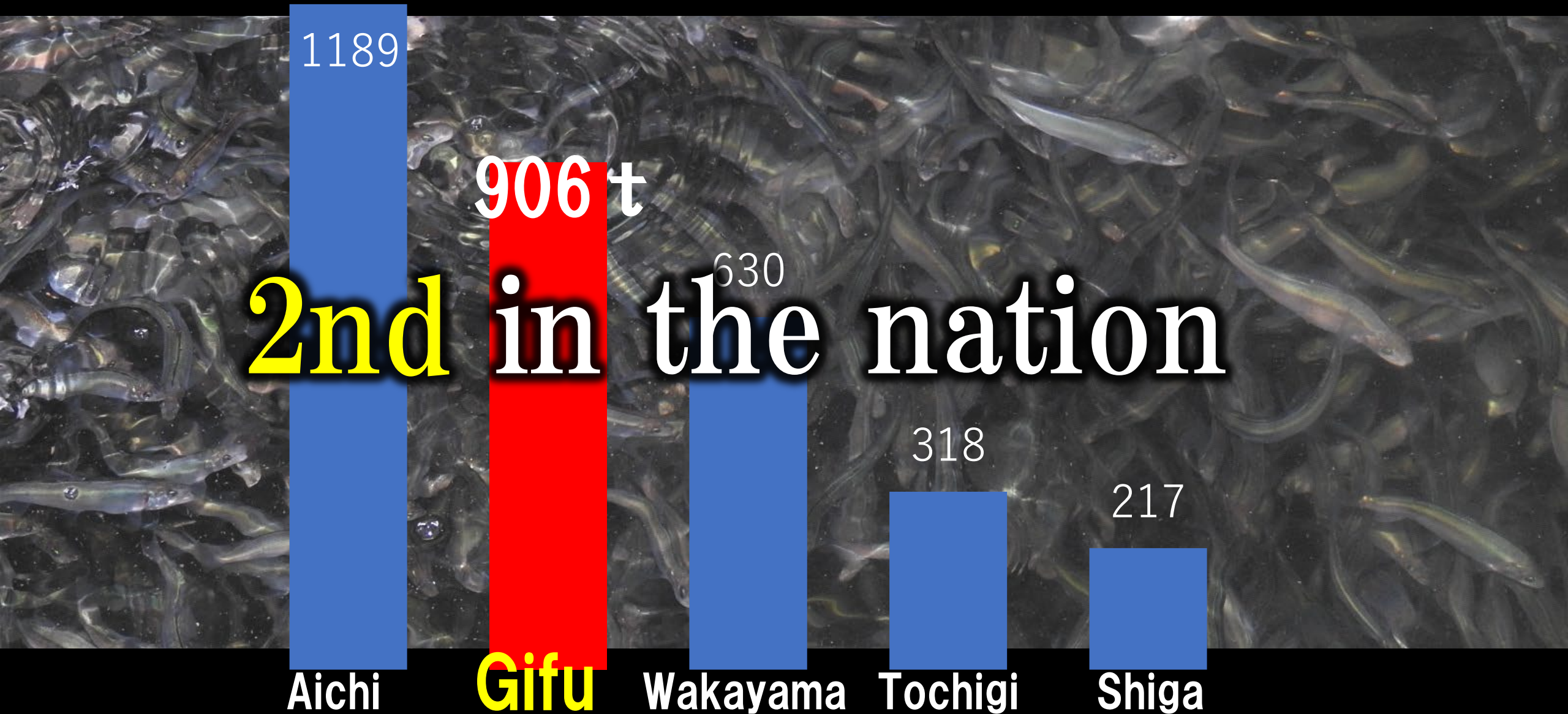
**Attractive Fragrance
Makuwa-uri**

Ayu of the Nagara River System



Recognized as Globally Important
Agricultural Heritage Systems in 2015

Farmed ayu production in 2020 (Statistics of MAFF)

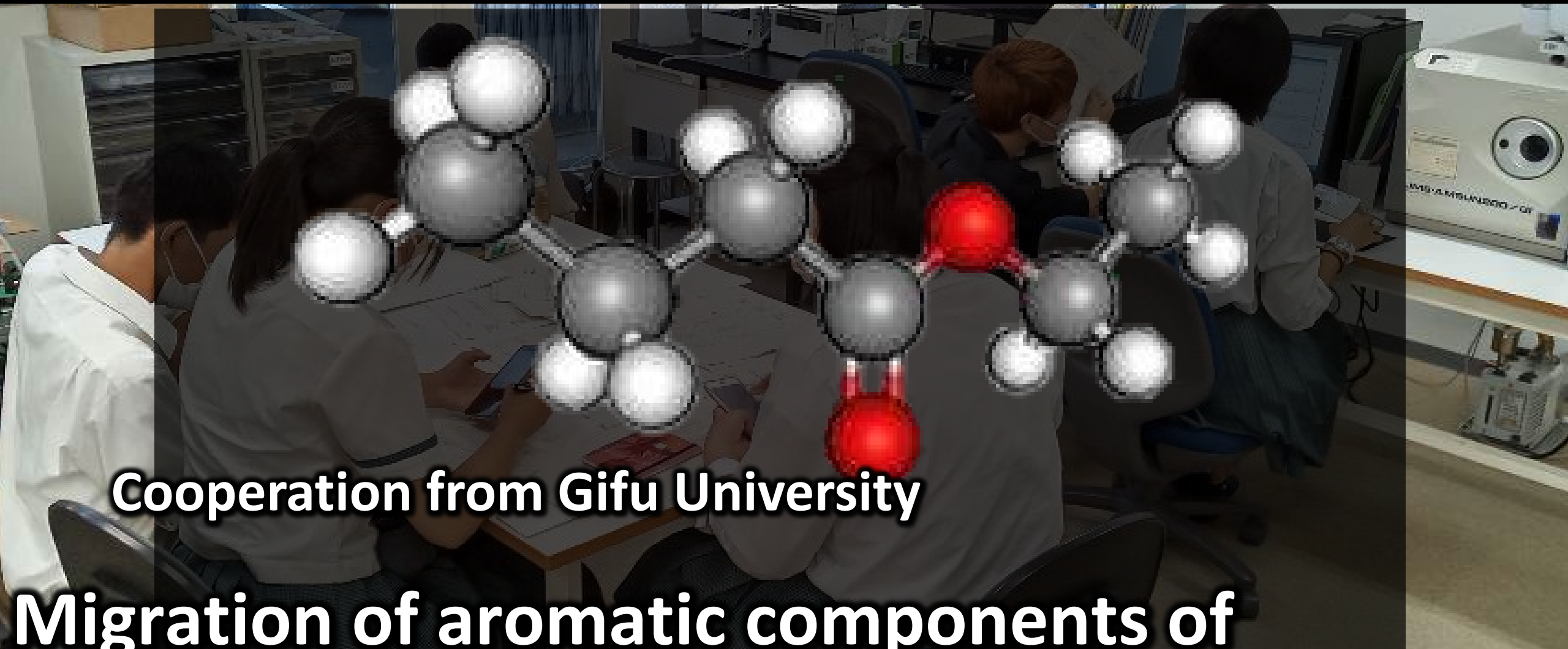




**Gifu Prefecture's new
brand of Ayu fish**

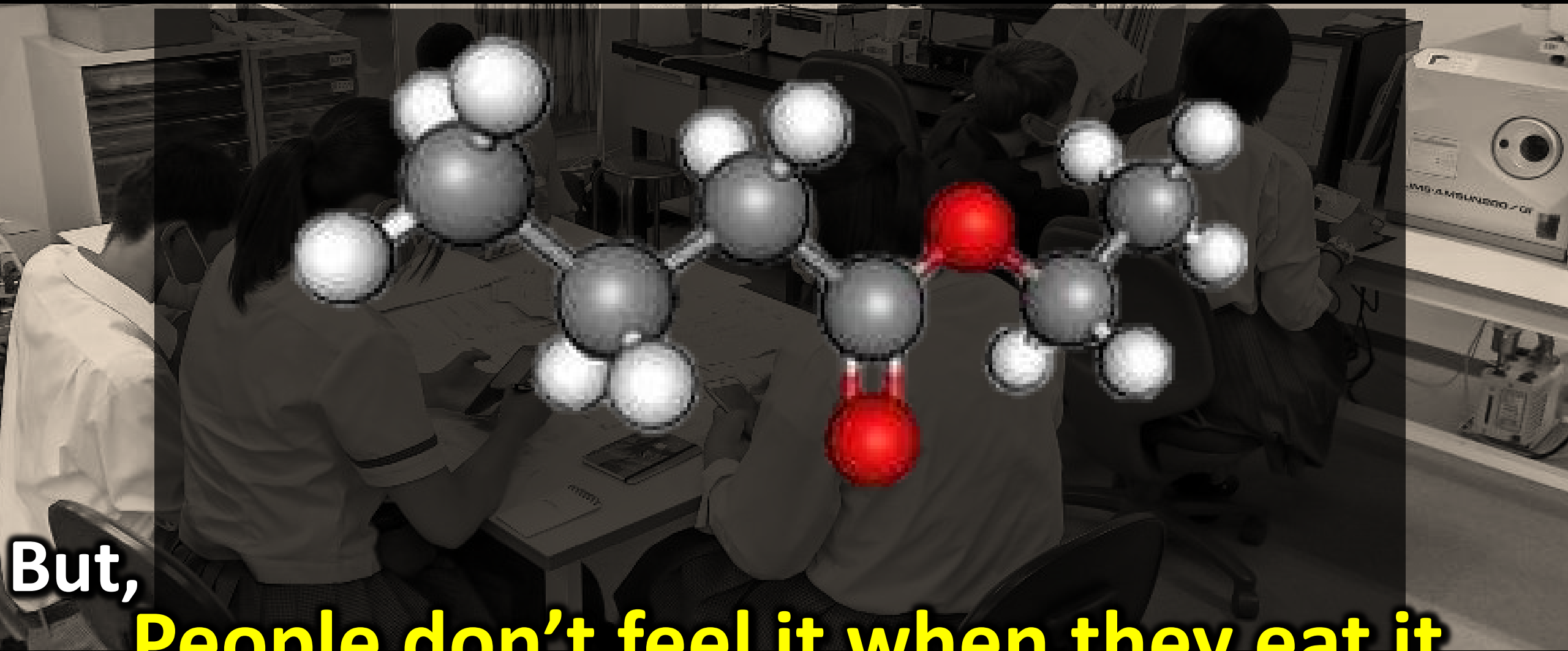


Fragrance migration failed.



Cooperation from Gifu University

**Migration of aromatic components of
Makuwa-uri was confirmed**



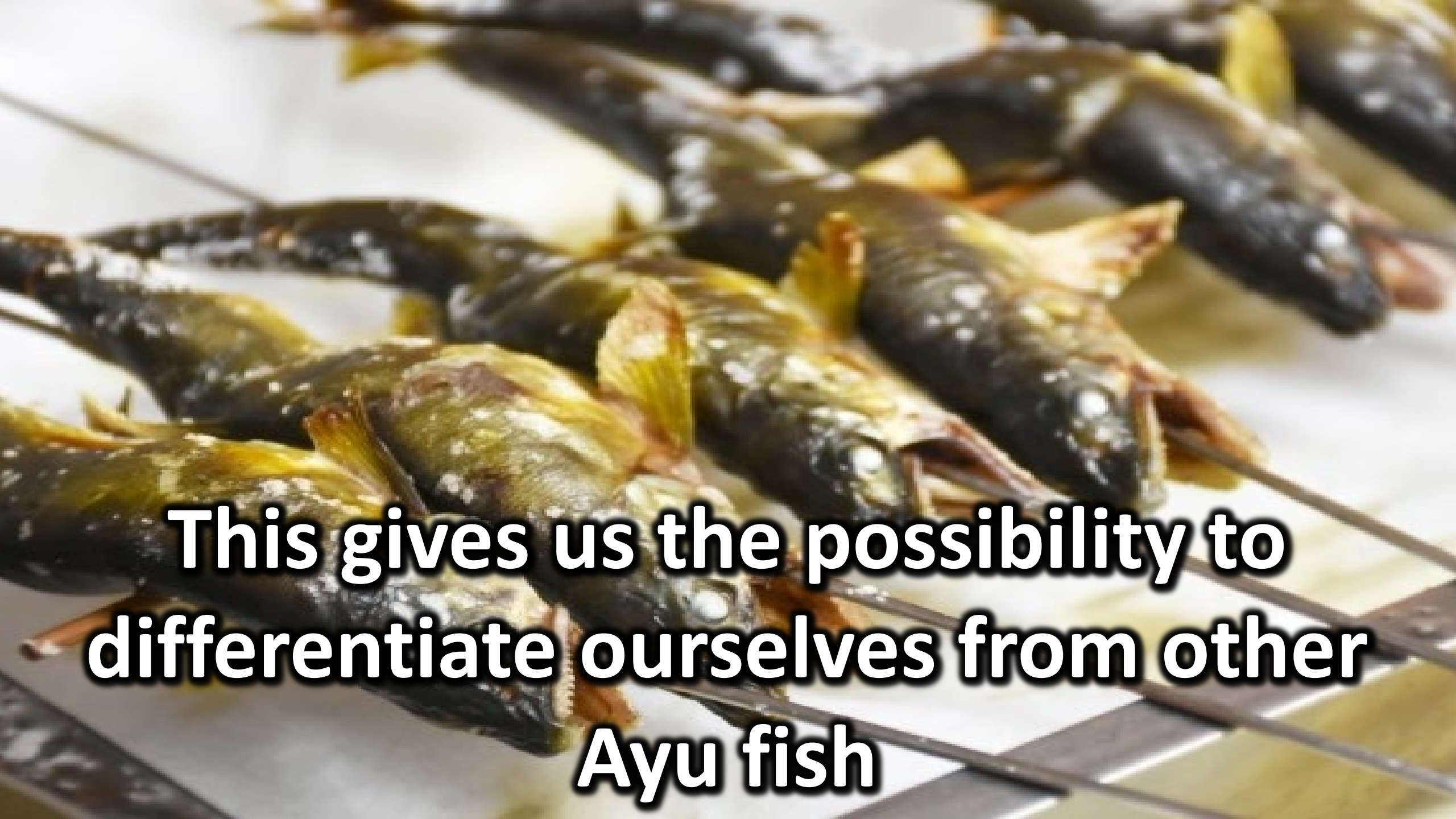
But,

People don't feel it when they eat it

Unexpected

**Bitter taste of
Ayu fish reduced**





**This gives us the possibility to
differentiate ourselves from other
Ayu fish**

This is our school's environment for raising ayu fish

φ1.4m water tank
(Water storage capacity 1t)

Each tank holds **135** ayu fish.

This is our school's environment for raising ayu fish

The key point in the breeding environment is

water

Our school is constantly running on
groundwater

It also maintains **water quality, water
temperature, and oxygen supply**

This is our school's environment for raising ayu fish

Feeding Method

27 times a day

Automatic feeding



Our school is equipped with automatic feeders.

**This is the same method used by
aguaculturists.**

How to add makuwa-uri to feed



1st



Press the makuwa-uri

How to add makuwa-uri to feed



2nd

5% of feed weight of fruit juice

weighed and added

How to add makuwa-uri to feed



mixing machine

2nd

5% of feed weight of fruit juice

weighed and added

How to add makuwa-uri to feed



mixing machine

3rd

Add the same amount of vegetable oil as the fruit juice to the feed and stir.

How to add makuwa-uri to feed



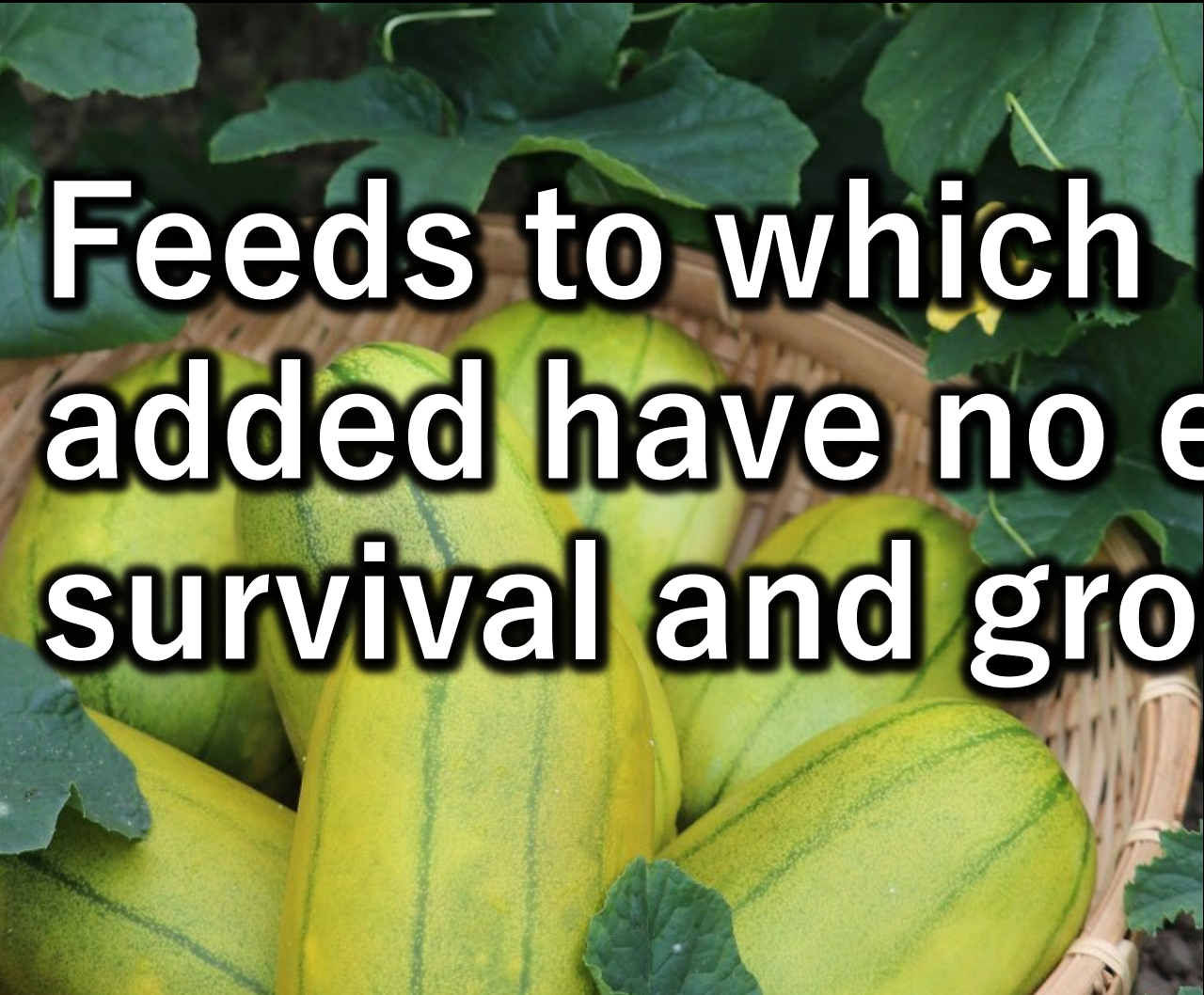
Completion

Previous Studies

- The ratio of feed and makuwa-uri juice
- With or without oil coating
- Feeding period etc



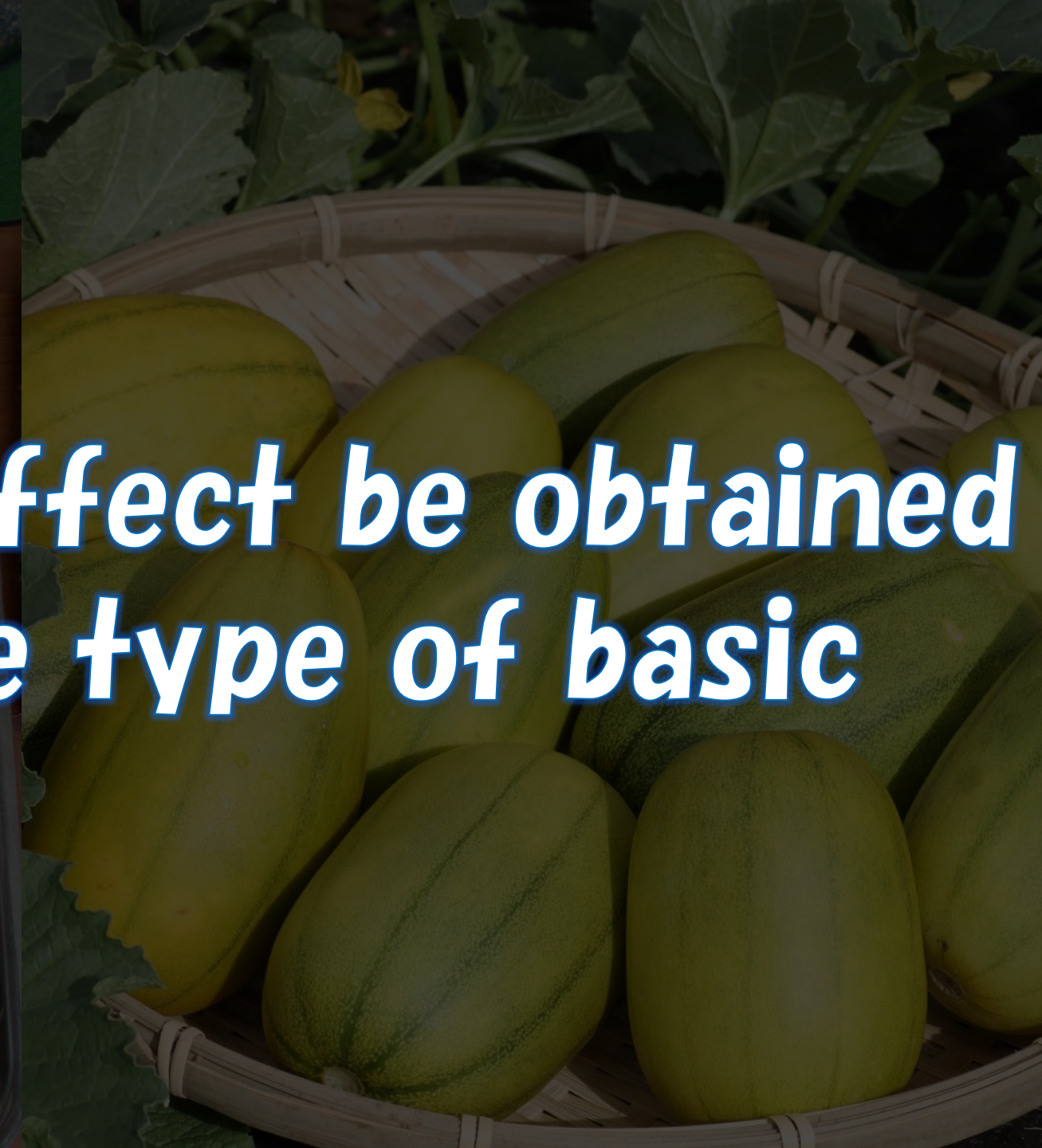
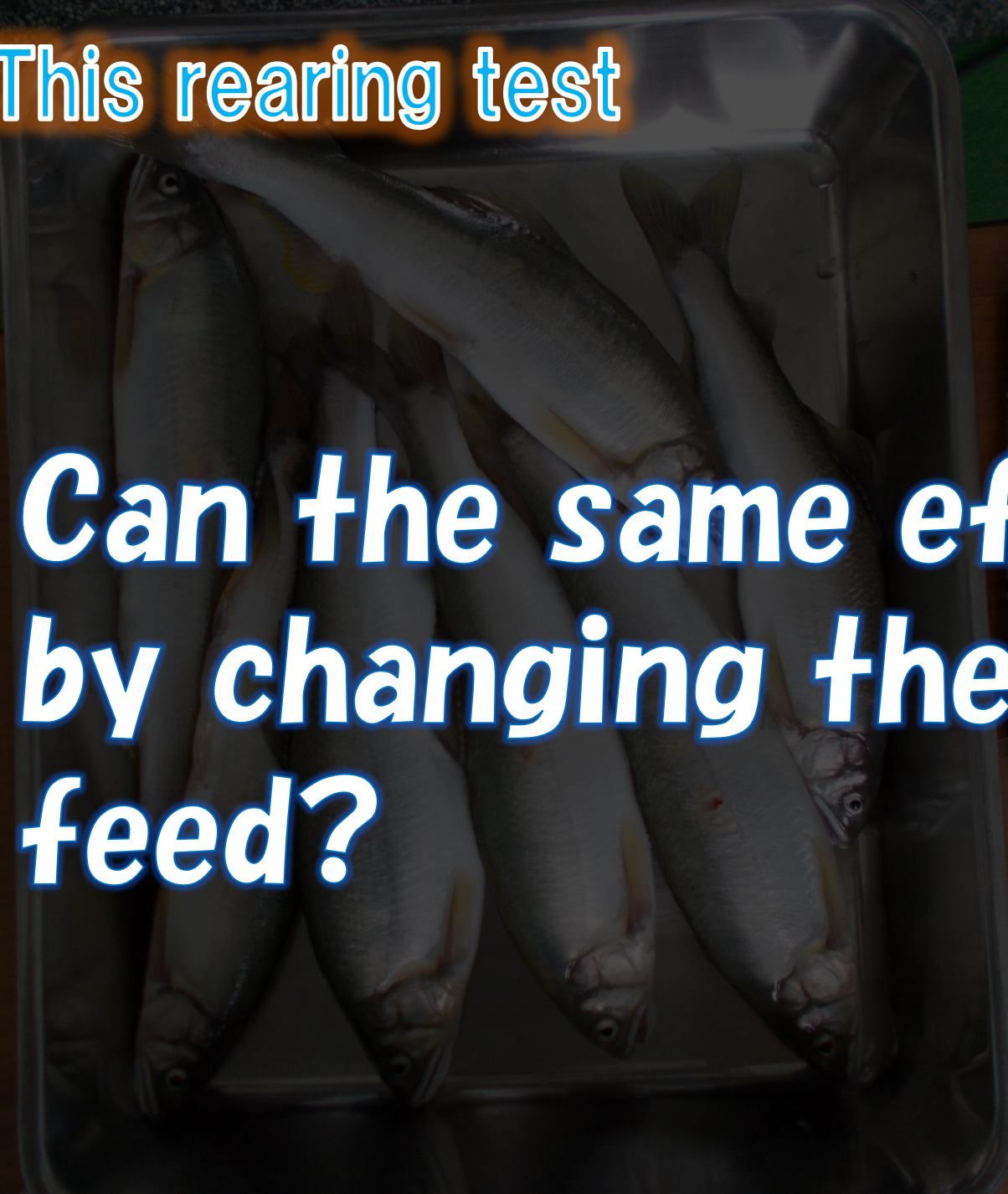
Previous Studies



Feeds to which Makawauri is added have no effect on survival and growth rates

This rearing test

**Can the same effect be obtained
by changing the type of basic
feed?**



Breeding test area setting



Conventional feed for control
Ayu-sofuto EPC



Other company's feed
for comparison
Ikuseiyo-PC3

Rearing test area setting

Rearing period

May 9 - July 31, 2023

Test period

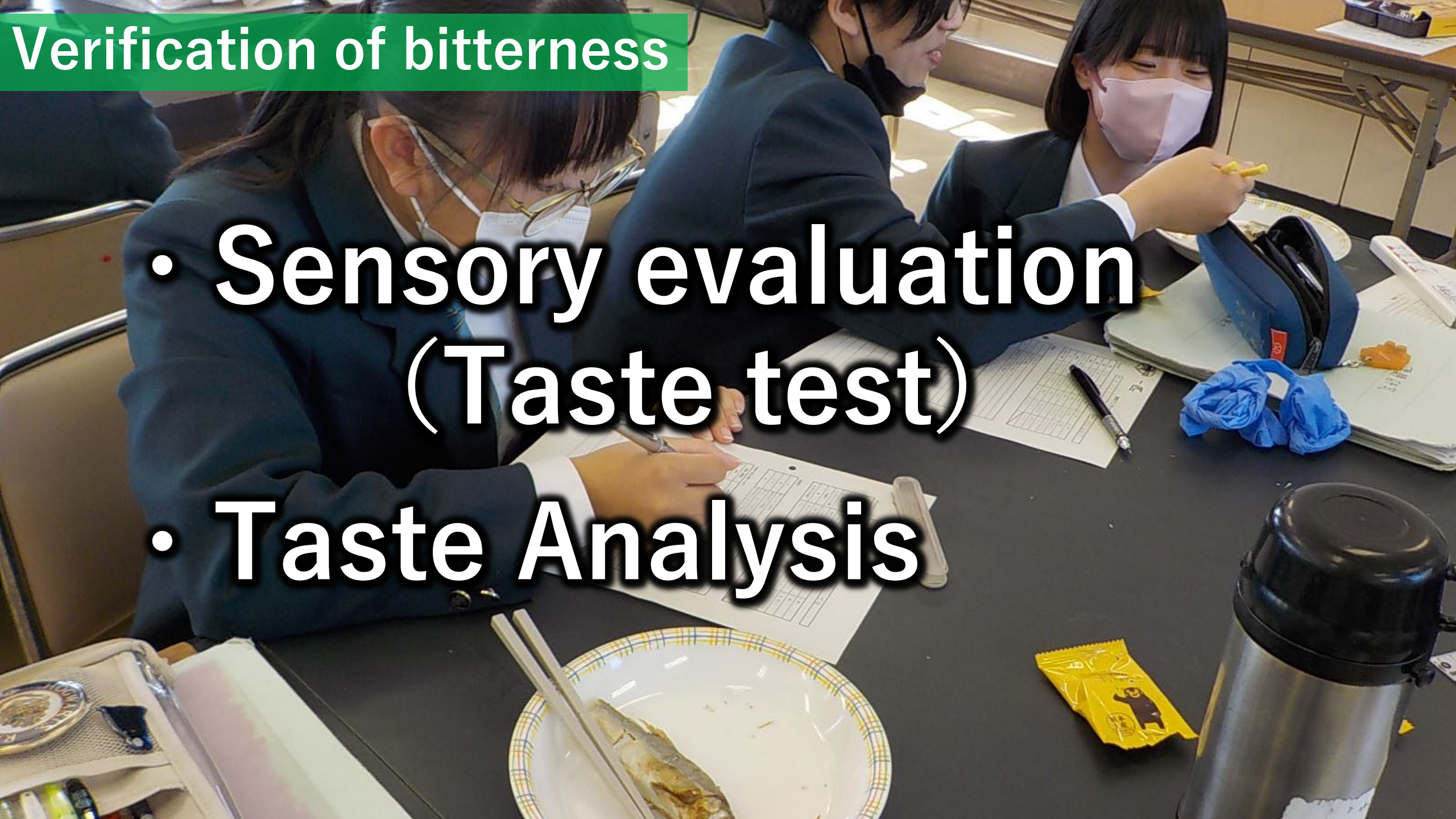
July 15 - July 29

Test case

A	B	C	D
Ayu-sofuto	Ikuseiyo-PC 3	Ayu-sofuto + Makuwauri fruit juice 5 %	Ikuseiyo-PC 3 + Makuwauri fruit juice 5 %

Verification of bitterness

- Sensory evaluation (Taste test)
- Taste Analysis



Sensory evaluation

The subject of this is four of four students and two staff.
Sample size is four

	Bitterness	Numerical difference	Bitterness	Numerical difference
Ayu	3.5	0.2	3.5	0.2
Ad	3.5	0.2	3.5	0.2
Makuwa-uri addition	3.3		Makuwa-uri addition	2.7

This allowed us to confirm the **reduction of bitterness** with conventional and separate feed. **-0.8**

Taste analysis

This is the result of tast sensor analysis

sample	Bitter taste	Umami	Salti-ness	Bitter-ness	Umami-koku
Ayu-sofuto	0.71	8.93	20.25	-0.74	2.87
Ikuseiyo-PC3	0.68	8.32	18.03	-0.69	3.91
Ayu-sohuto + fruit juice	0.11	9.12	20.52	-0.63	4.55
Ikuseiyo-PC3 + fruit juice	0.27	8.83	21.63	-0.63	3.19

※This is an excerpt of the detected values.

Taste analysis

Bitter taste

This is **the bitter first taste** you get when you put it in your mouth.

入れた時に感じる苦味の先味

Bitterness

This is **the bitter aftertaste** that lingers in the mouth for a short time after putting it in.



Taste analysis

Bitter taste

This is **the bitter first taste** you get when you put it in your mouth.

Ayu-sofuto	Bitter taste	Numerical difference	Ikuseiyo PC3	Bitterness	Numerical difference
Additive-free	0.71	-0.6	Additive-free	0.68	-0.41
Makuwa-uri addition	0.11		Makuwa-uri addition	0.27	



We could see a **reducation in bitterness** not limited to the type of feed.



Summary

Easy-to-eat ayu fish
with reduced bitterness

Helping to **increase**
ayu fish consumption



**Production of cultured ayu fish
No food is fed to farmed ayu
fish prior to shipment.**

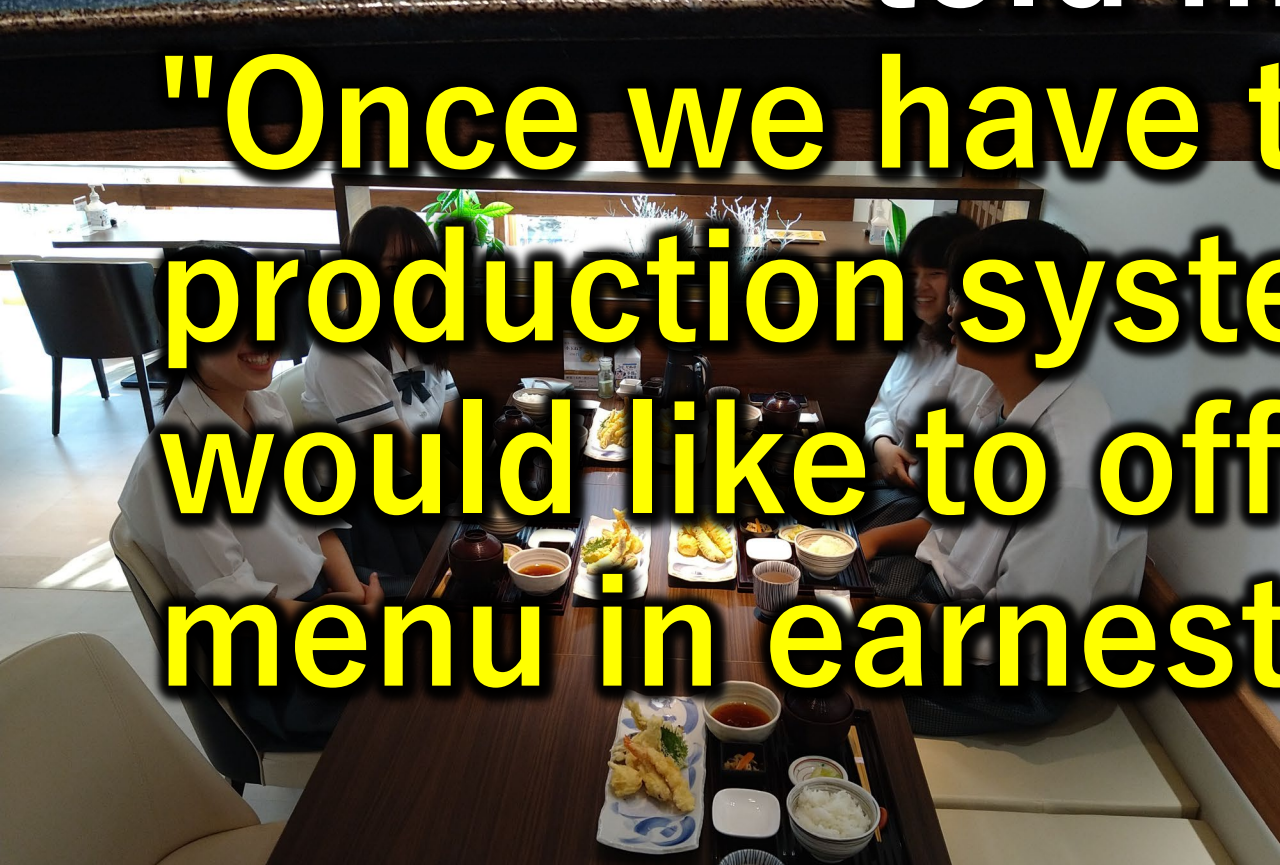


Strongly bitter taste

**This phenomenon is troubling
producers and processors**



Ayu fish raised on food supplemented with makuwa-uri were served at restaurants in the area on a trial basis.



The owner of the restaurant told me, "Once we have this ayu fish production system in place, we would like to offer it on the menu in earnest."

A close-up photograph of several ayu fish (Salvelinus leucomaenis) being grilled on a metal skewer. The fish are positioned horizontally, with their heads facing right. The skin is dark and charred, while the flesh is a lighter, golden-brown color. The background is slightly blurred, showing more fish on the grill and a white surface.

**We want to make the
results of our research into
a new brand of ayu fish in
Gifu Prefecture.**