

GROWTH CHARACTERISTICS OF TWO TILAPIA SPECIES

(*O. aureas* and *O. hornorum*)



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Content

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Background

Tilapia biological characteristics

- ❑ A tropical and subtropical fish
- ❑ Harvested widely around the world
- ❑ **Ranked fifth** in US top ten seafood consumption list since 2000
- ❑ Strong disease resistance
- ❑ Tolerate low dissolved oxygen concentration, high ammonia concentration
 - ❑ US is the single largest market for tilapia (import value reaching **US\$ 777,353,804 in 2010**)

Characteristics of *O. aurea* and *O. hornorum*



Blue tilapia
(*Oreochromis aurea*)



Hornorum tilapia
(*Oreochromis hornorum*)

- Be able to live and reproduce in both fresh and brackish waters

□ Crossing between blue tilapia and *Oreochromis* herbivores

➤ *mozambicus* results 70-80%
➤ Feed chiefly on phytoplankton

- male offspring, combined with zooplankton once in a while

- One of the most cold tolerant tilapia species
 - ✓ Could tolerate temperatures as low as 3 degrees C for short time period

- Can be grown in both fresh water and brackish water.

□ An important contributor of genetic material for the production of hybrids.

- From detritus (decomposing organic matter) to invertebrates

- F1 hybrid crosses with *Oreochromis mozambicus* result in nearly 100% male offspring (a female mozambicus and a male hornorum).

Objectives of study

1. To examine the growth characteristic of two tilapia species (blue and hornorum) in Hawaii
2. To investigate potential mechanisms affecting skeletal muscle growth
 - ❑ Histological analysis of muscle fiber size and number
 - ❑ Expression of genes involved in skeletal muscle growth and development

Animals care and sample collection



- ❑ Two species of tilapias: blue tilapia (*O. aurea*) and hornorum tilapia (*O. hornorum*) – WCC facility
- ❑ Fry fish were fed rotifer for a month, then commercial feed (50% protein) – WCC facility
- ❑ At 3 month, fish were moved to Hale Tuahine (Manoa)



- ✓ Rearing condition: green water, about 20% water change daily
- ✓ Feeding: commercial feed (40% protein), once a day
- ✓ Water environmental factors are measured weekly

Sample collections

- ❖ Samples collection : 1, 4, 7, 10 and 12 months.



- ❑ Weight and length: 30% fish for each group
- ❑ Muscle sample collection: histology and gene expression



- Histology: muscle fiber number and size
- Gene expression: muscle stem cell and myogenic regulatory factors

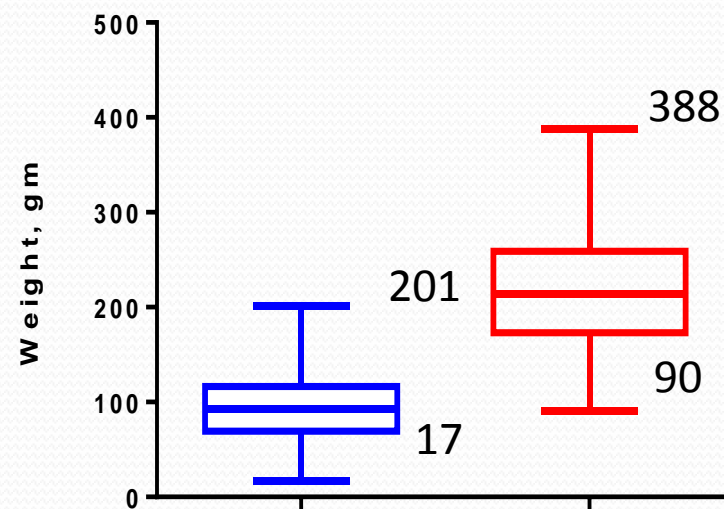
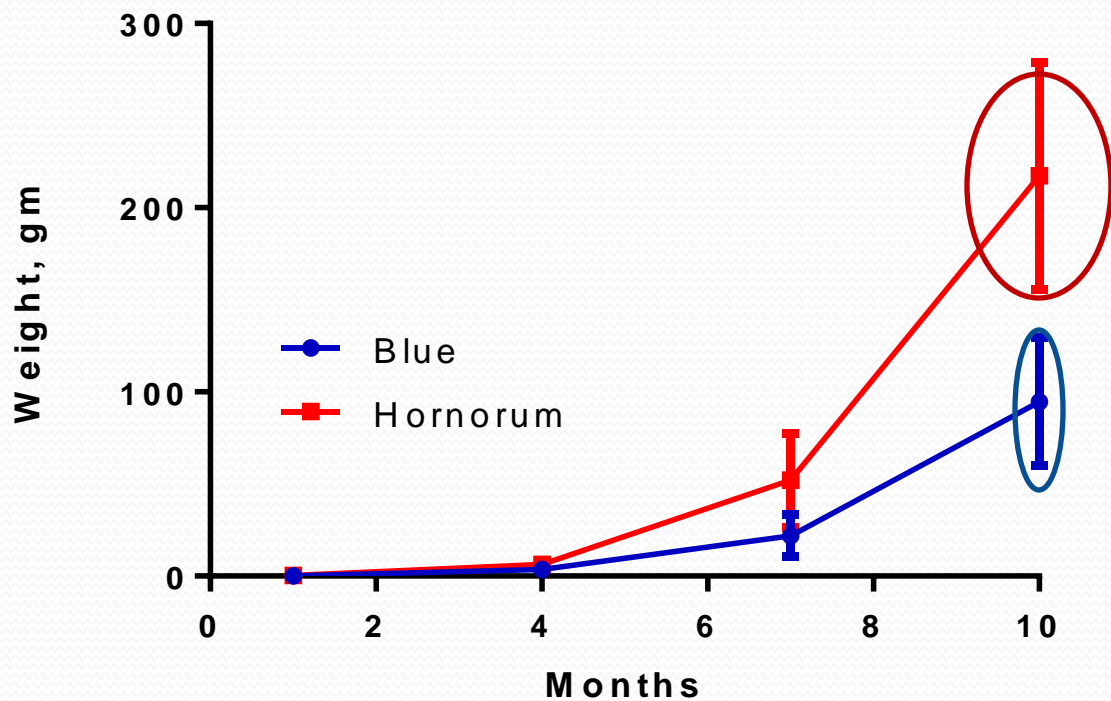
Result on growth

Months	Blue tilapia			Hornorum tilapia		
	Weight	Length	CF(K value)	Weight	Length	CF(K value)
1	0.17 (0.10)			0.29 (0.10)		
4	3.53 (0.87)	3.62 (0.73)	7.41 (3.37)	6.29 (2.03)	5.31 (0.88)	4.19 (1.07)
7	21.9 (11.4)	9.2 (1.7)	2.84 (0.51)	52.0 (25.5)	11.3 (2.2)	3.58 (0.44)
10	94.6 (34.9)	16.9 (2.3)	1.97 (0.15)	217.4 (61.5)	22.2 (2.2)	1.99 (0.20)

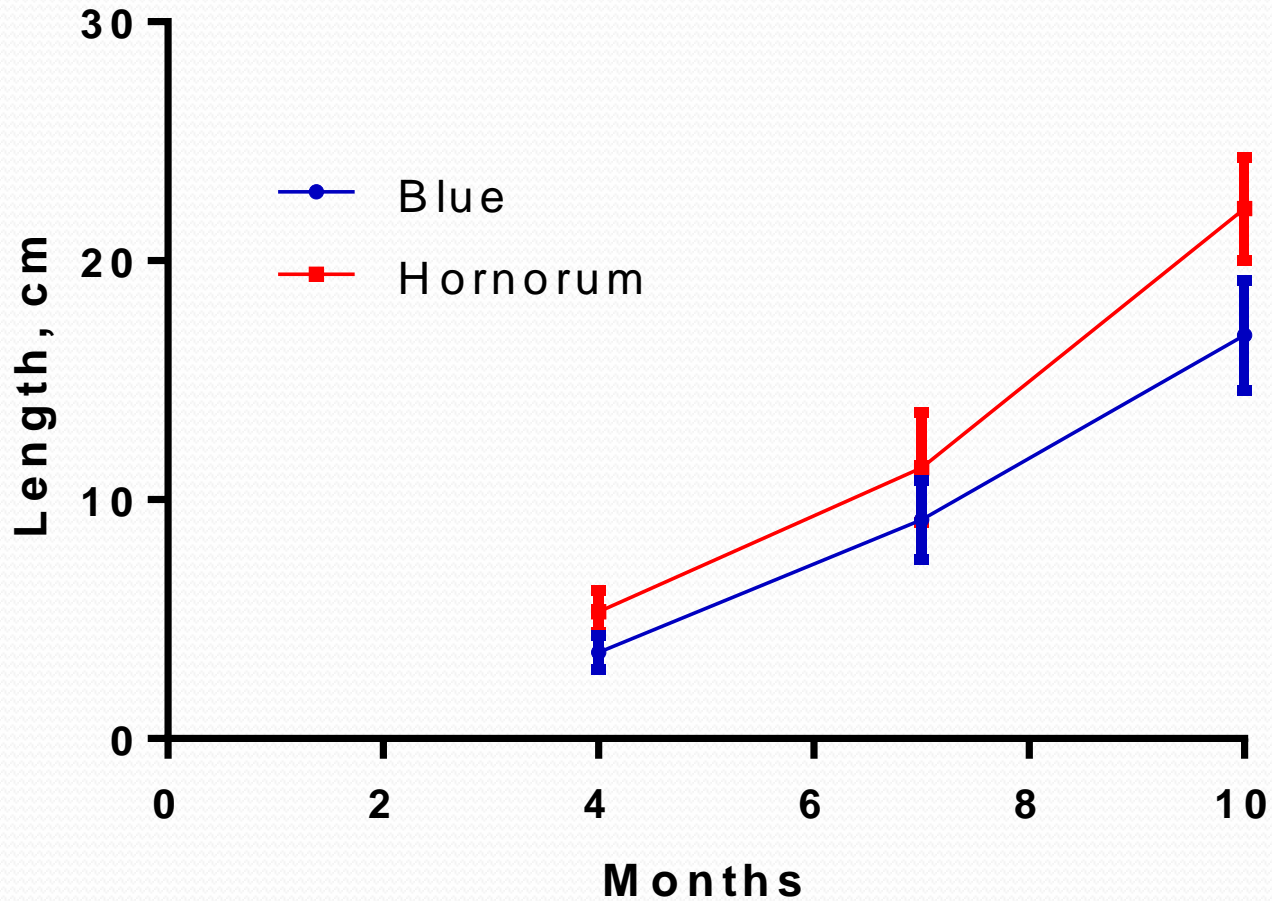
- **Condition Factor** - A measure of the plumpness or fatness of aquatic organisms. For fish, the condition factor is based on weight-length relationships.

$$K = (W/L^3) * 100$$

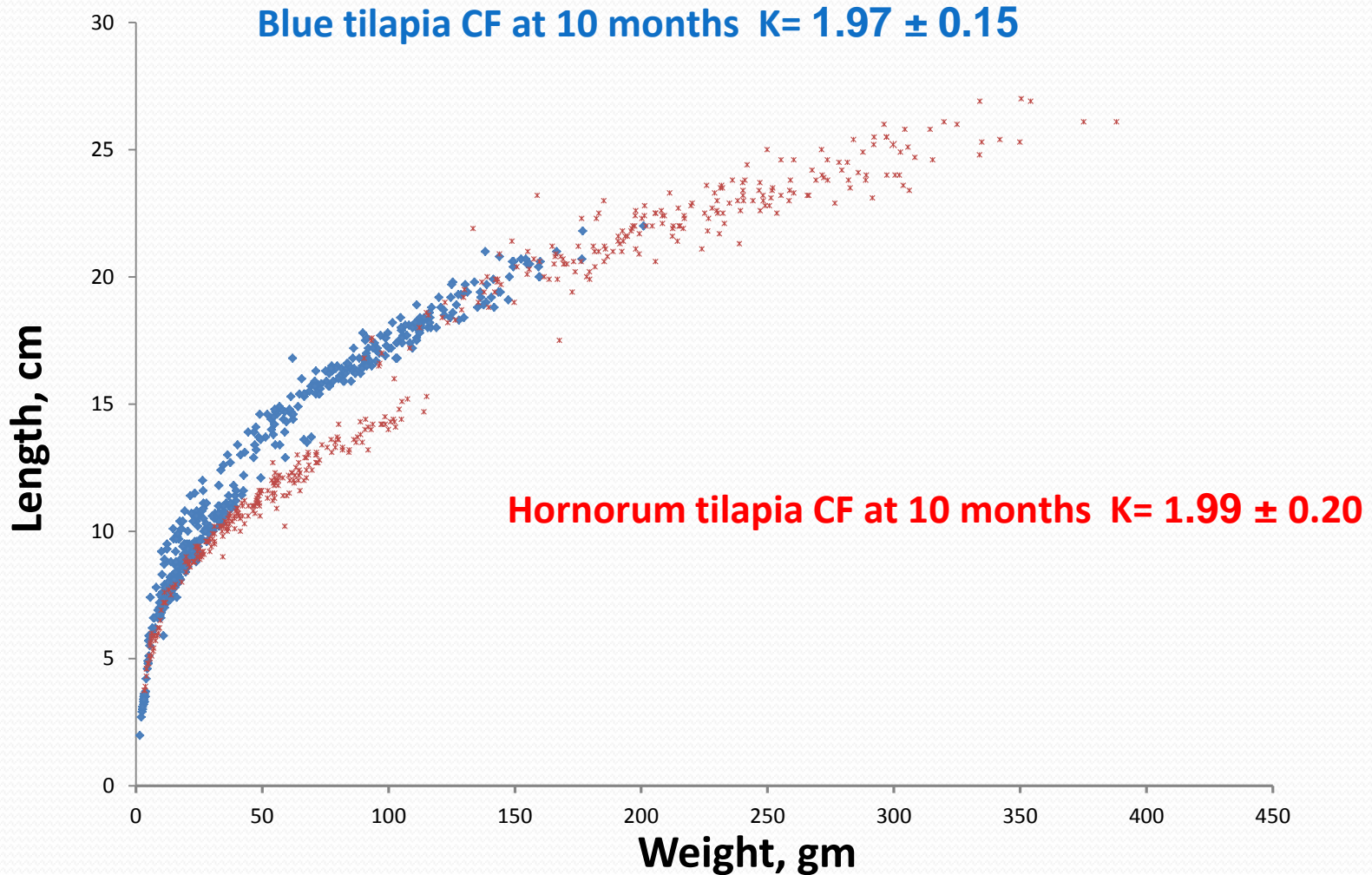
Body weight growth during 10 months



Body length growth during 10 months



Weight and length relationship



FCR: Feed Conversion Ratio

between two species from 7 months to 10 months

Blue tilapia	B1	B2	B3	Average
	1.05	1.09	0.96	1.03 ± 0.06
Hornorum Tilapia	H1	H2	H3	Average
	0.92	0.85	0.95	0.9 ± 0.05

FCR is the mass of the food eaten divided by the body mass gain, all over a specified period

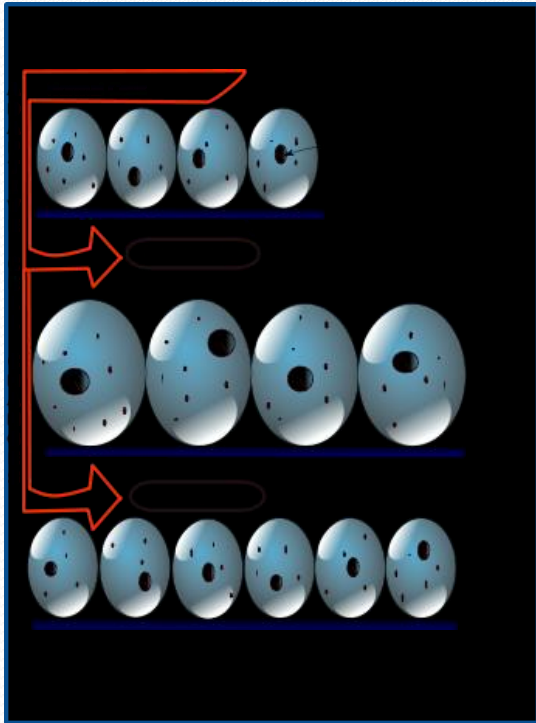
$$\text{FCR} = \text{total gram of fed feed} / \text{total grams of fish weight gain}$$

Current Conclusions

- ❑ *O. hornorum* grow faster than *O. aureus*
- ❑ Wide variation in growth rate in both species
- ❑ No significant difference in CF at 10 month
- ❑ *Hornorum* (FCR, 0.9) tends to be efficient users of feed than *aureas* (FCR, 1.03)

Future analysis

■ Muscle cell number and size



Fish muscle growth occurs by combination of two mechanisms: hypertrophy and hyperplasia of muscle fibres.

Hypertrophy: increase in the muscle fiber size.

Hyperplasia: increase in number of the muscle fibers.

■ Genes involved in the regulation of muscle growth

- Myogenic regulatory factors (MyoD, myf5, myogenin and MRF4)
- Pax7 (satellite cell marker)



THANK YOU VERY MUCH