Finding a Sustainable Feed Alternative for the Farming of Cobia (*Rachycentron Canadum*) at the Cape Eleuthera Institute

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Introduction

Aquaculture raises many issues that have required extensive research to overcome. Among these is the use of fishmeal and fish oil from wild fish to produce commercial feed. Studies show that, on average, the ten most commonly farmed fish require 1.9 kgs of wild fish for every kg of fish raised on compound feeds (Naylor et al. 2000). Scientists predict a collapse of all species of wild seafood by the year 2050, and consequently aquaculture must be a sustainable industry to make up for this consequential loss (Turchini et al. 2009). Research to overcome this has included the replacement of fishmeal with organic, yeast-based protein, and the replacement of fish oil with alternative lipid sources (Lunger et al. 2005; Turchini et al. 2009). Debate exists over the farming of carnivorous fish because of their high food conversion ratios (FCR's). Naylor (2000) argues that the farming of fish from lower trophic levels will be necessary in order to reduce dependence on wild fish stocks. Another method to reduce dependence is to find a sustainable alternative feed that does not fish meal or fish oil from wild fish stocks. include

The hypothesis investigated by this CEI aquaculture team was: *if juvenile Cobia are fed with, Tilapia raised in an aquaponics system, then the final weights and lengths will have no significant difference to those of juvenile cobia fed commercial feed, and the FCR's will be similar.* The research was conducted with the purpose of making a sustainable aquaculture system, proving to the global aquaculture industry that carnivorous fish can be farmed with alternative sustainable feed.

Figure 5. *R.canadum* in the cape Eleuthera offshore aquaculture cage.

Figure 4. Observing the *R.canadum* experimentation tanks.

Methods

Set up included three tanks with fifteen, seven-month-old, cobia in each tank. The two commercial feeds tested were: Ziegler (control) and Alicorp, and the non-commercial feed tested was homemade tilapia pellets made from tilapia cultured in Cape Eleuthera Institute's aquaponics system. This tilapia feed was made by grinding tilapia in a fish grinder, drying the meal in a solar dehydrator, blending it, and finally mixing it with a small amount of egg white as a binding agent to either make pellets by hand or in a pellitizer. The fish were fed twice a day (8:45am and 6:45pm), and the amount fed was measured and recorded. The water quality of the three tanks was also monitored at each feeding. For the five-week period from 4/3/2009 to 5/8/2009 of the experiment the fish were weighed and total lengths were measured every Friday.

Figure 6. Clipping and measuring the juvenile *R. canadum*.

Figure 7. Collecting measurements of juvenile *R.canadum*.

Figure 8. Catching and transporting juvenile *R. canadum*.

Figure 9. Fishmeal made at the Cape Eleuthera Institute from Tilapia raised in the institute's aquaponics system.

Figure 11. Juvenile *R. canadum* in experiment tank.

Results

During the first few weeks of the experiment, there was a much lower food consumption rate than that of the final two weeks of the experiment. Throughout the experiment, the Alicorp tank had the highest growth rates, while Tilapia had the lowest growth rate until the final week. In the final two weeks of the experiment, there was a spike in growth rates in each tank. During this time, the three tanks altogether had a biomass gain of 319 grams. Of this growth spike, the fish in the Tilapia tank had the highest.

The FCR of the Tilapia tank (2.5:1) was less efficient than the final FCR of the Zeigler tank (1.7:1) and the final FCR of the Alicorp tank (1.4:1) In the Tilapia tank, it is predicted that the FCR would continue to improve to due a spike in recent growth rates and a more consistent feed consumption trend. There was no significant difference in the final weights of the *R. canadum* between the three tanks (pval=0.826). These results support the hypothesis and demonstrate that the *R. canadum* fed Tilapia meal had similar growth rates to *R. canadum* fed with the commercial feeds, Ziegler and Alicorp.

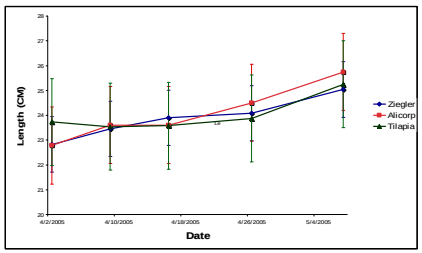

Figure 1. The mean lengths of the *R. canadum* in the Zeigler, Alicorp, and Tilapia tanks measured once a week over a five week period at the Cape Eleuthera Institute from 3/ 10/ 09 to 4/ 8/ 09.

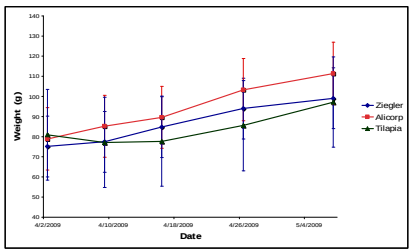

Figure 2. The mean weights of the *R. canadum* in the Zeigler, Alicorp, and Tilapia tanks measured once a week over a five week period at the Cape Eleuthera Institute from 3/ 10/ 09 to 4/ 8/ 09.

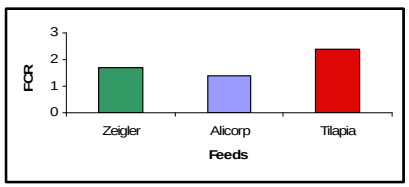

Figure 3. The food conversion ratio (FCR's) of 3 tanks of 15 cobia fed Zeigler, Alicorp, and Tilapia over a six week period. Data was collected at the Cape Eleuthera Institute from 3/ 10/ 09 to 4/ 8/ 09.

Discussion

The goal of aquaculture is to grow fish efficiently to meet the global seafood demand when commercial fisheries cannot. Given the need to develop palatable alternatives to fishmeal the research being done here pertains to finding a sustainable and cost-efficient feed. The hypothesis of the CEI Cobia Aquaculture Research Team is if juvenile cobia (*Rachycentron canadum*) are fed with tilapia raised in an aquaponics system, then the final weights and lengths will have no significant difference to those of juvenile *R. canadum* fed commercial feed, and the food conversion ratios (FCR's) will be similar. The *R. canadum* with the fed the tilapia meal had similar growth trends and feed conversion ratios to the two commercial feed treatments even though commercial feeds are designed to maximize fish growth. This proves that carnivorous fish can be fed feed without additives and enhanced protein levels and still grow sufficiently. Our results demonstrate that tilapia fishmeal is a viable fishmeal alternative in the farming of *R. canadum*, and the fish still grow more efficiently then fish in the wild, as wild fish have an average FCR of 6:1(Naylor *et al*. 2000).

These results could end the Island School's reliance on commercial fishmeal, because the tilapia feed is produced on-site. This research provides a good baseline for future research in alternatives to commercial fishmeal, however the diets of carnivorous fish are difficult to alter because they require high protein levels and omega-three fatty acids most commonly found in other fish (Turchini *et al*. 2009). Future Research needs to include individually tracking the *R. canadum* to acquire more accurate weight and length measurements, as well as experimenting with other protein replacements because this alternative system is not ideal for all aquaculture systems. This research can provide an example to global aquaculture industries of a closed aquaculture system and demonstrate that sustainable alternatives of fishmeal for carnivorous fish are under experimentation.

Figure 12. Measuring the length of a juvenile *R. canadum*.

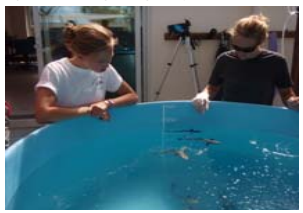

Figure 13. Observing juvenile *Rachycentron canadum* in experimentation tank.

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