Project Number:	1640-512-5261-NE
Project Title:	Testing replacement of fishmeal and fish oil in *Seriola rivoliana* diets with soy-based protein and oil
Organization:	University of Nebraska-Lincoln
Principal Investigator Name:	Tom Clemente

Project Status - What key activities were undertaken and what were the key accomplishments during the life of this project? Please use this field to clearly and concisely report on project progress. The information included should reflect quantifiable results (expand upon the KPIs) that can be used to evaluate and measure project success. Technical reports, no longer than 4 pages, may be included in this section.

• Conduct a pre-commercial Kampachi grow-out validation trial comparing 40% SPC and 48.5% SPC diets from two commercial feed mills with fishmeal-based EWOS commercial feed.

Ongoing efforts to develop and test aquafeed diets formulated with terrestrial-based ingredients (protein and oil) from soybean have made significant progress. In order to translate these studies onto the marketplace requires buy-in from commercial feed formulators to ensure the soybean-based diets meet the specifications for their clients. The 40% SPC formulation, displaces approximately 80% of the fishmeal and 50% of the fish oil components of the feed with soybean-based protein and oil. This diet we have shown results in no compromise in FGR, nutritional quality and taste of the harvested fish, and is a formulation that is cost comparable with commercial diet. The 40% SPC formulation and sourced ingredients was handed off to a commercial feed mill, Zeigler Brothers. The feed was shipped to Kona, HI and this pre-commercial grow-out trial was initiated on August 27, 2016.

The 48.5% SPC diet is a formulation that is devoid of marine ingredients (no fishmeal or fish oil), with an inclusion rate of 15% algal paste. This formulation we have shown does not compromise FGR, or nutritional quality of the harvested product. One hurdle that remains that will impede this formulation to get utilized by commercial feed mills, is cost, algal paste is expensive. To address this issue we aligned with an algae company Heliae of Gilbert, AZ. Heliae has isolated a novel algal strain, which produces high levels of oil (app 30%), with 10% of the oil as DHA, the polyunsaturated fatty acid found is fish oil. We are in the process of preparing feed with this new algal strain. The feed being prepared is based off our formulation we designed that has a 15% inclusion rate of the alga *Tetraselmis*. If this 48.5% SPC formulation with the new alga strain is successfully utilized by Kampachi the next steps will be a cost analysis and commercial feed mill involvement.

• Explore avenues towards FDA approval of STA-rich soy in marine fish diets

This component of the project was on hold given the merger talks with Monsanto/Bayer. It is noteworthy that this soybean, Soy-Mega is approved within the US for food uses, not feed to date.

• Evaluate a genetic strategy for the synthesis of two aquafeed co-products, taurine and EPA oil, in an algal-based feedstock.

This effort addresses the capacity to get a cost effective algal past that can be utilized in the marine-free formulation that has a inclusion level of 48.5% of SPC. We are extending our results from a model algae to Tetraselmis, and now will investigate these genetic strategies with the new algae from Heliae. The goal is to get cost of the algae product down, by maximizing co-products.

Did this project meet the intended Key Performance Indicators (KPIs)? List each KPI and describe progress made (or not made) toward addressing it, including metrics where appropriate.

• Made connections with a commercial feed mill to get familiar with high soy inclusion aquafeed diets formulated with SPC. This is a critical step if these high SPC inclusion rate diets are to get incorporated into the aquaculture industry in a meaningful fashion.

• Aligned ourselves with a algal company that provides the opportunity to get a cost effective, marine-free formulation with an SPC inclusion rate of approximately 50% of the feed

Expected Outputs/Deliverables - List each deliverable identified in the project, indicate whether or not it was supplied and if not supplied, please provide an explanation as to why.

Publications:

Park et al 2016. Towards the development of a sustainable soya bean-based feedstock for aquaculture. The Plant Biotechnology Journal doi: 10.1111/pbi.12608

Bairagi et al. 2016. Economic feasibility of high omega-3 soybean oil in mariculture diets: A sustainable replacement for fish oil. Aquaculture Economics and Management. Doi:10.1080/13657305.2016.1228711

Blog post: Building a better bean story: http://www.forbes.com/sites/gmoanswers/2016/10/31/building-better-bean-story/#427035b61392

Describe any unforeseen events or circumstances that may have affected project timeline, costs, or deliverables (if applicable.)

N/A

What, if any, follow-up steps are required to capture benefits for all US soybean farmers? Describe in a few sentences how the results of this project will be or should be used.

The key to expanding soybean product inclusion in aquaculture is getting the aquafeed industry at the table. Commercial feed mill formulators need to get buy in, if the needle is to move significantly beyond the approximate 1% of soybean product being utilized by the aquaculture industry.

List any relevant performance metrics not captured in KPI's.

N/A