

**AGRICULTURAL RESEARCH FOUNDATION  
FINAL REPORT  
FUNDING CYCLE 2019 – 2021**

**TITLE:** Sablefish study: Influences of selected herbal supplements and probiotics on innate immunity of marine sablefish in Oregon

**RESEARCH LEADER:** Schubiger, Carla

**COOPERATORS:** NOAA Northwest Fisheries Science Center: Mary Arkoosh (Hatfield office), Joe Dietrich (Hatfield office), Ron Johnson (Seattle office)

**EXECUTIVE SUMMARY:** Sablefish is a species fairly new to culturing. There is a general lack of knowledge concerning stressors in aquaculture settings of this groundfish species that is of high importance to Oregon's fishery. Also, alternative diets that do not rely on fishmeals are urgently needed as the wild-catch fishery of the species processed to fishmeals/oils is at its limit, and these fish might be increasingly needed to feed the growing world population. Our trials incorporated marine macroalgae into a sablefish diet and also tested a variety of supplements such as beta-glucan, curcuma, and *Echinacea purpurea*. Macroalgae supplemented diets did generally very well and did not seem to have any negative effects. Echinacea was able to significantly boost the survival of fish, likely via an increased innate immune response. Due to the pandemic, data analysis has been slow and results are preliminary, though we expect to publish several manuscripts in 2021 and 2022 pertaining to this project. One associated manuscript is currently in NOAA review and can be requested from the PI.

**OBJECTIVES and PROCEDURES:** Because there were not enough fish available, our objectives changed a little bit, but still followed the original idea that we had submitted, and some aspects of the project were more sophisticated (integration of supplements at the pellet extrusion stage, rather than post-production top-coating). We were able to travel to Seattle and help produce the diets with a commercial scale extruder. This also meant that including probiotics in the trials was not feasible as we could not bring biological material into the facility. It would have required a second large scale trial, but more fish were not available in 2019, and the NOAA facilities were closed most of 2020 because of the pandemic. Therefore we decided to test the herbal supplements (phytotherapeutics) only. The infection trial was conducted with a pathogen recovered from diseased sablefish in the past.

We tested the following objectives:

- 1) Determine the growth, survival, and state of the innate immune response of juvenile sablefish over the course of 6-week a plant-based feeding trial.
  - a. Sub-objective: Compare plant-based diets supplemented with the phytotherapeutic *Echinacea purpurea* and Curcuma.
  - b. Establish how the fish microbiome changes with the different diets.

- 2) Determine the survival of juvenile sablefish fed the different diets and infected with an atypical strain of *Aeromonas salmonicida*.
- 3) Establish the blood reference ranges of adult sablefish feed conventional diets.

**SIGNIFICANT ACCOMPLISHMENTS:**

Turkish towel was used as the macroalgae component in the sablefish diet, and it showed a significant health benefit to fish. *Echinacea purpurea* supplementation yielded in the highest survival of fish after infection. Similarly, some innate immune response parameters were increased upon *Echinacea purpurea* supplementation. Overall the project was a success, though we are still evaluating some of the data, including the microbiome.

One manuscript is currently in NOAA review, much delayed because of the pandemic. 1-2 more publications should be achieved, though the COVID-19 has slowed the progress significantly. Two undergraduates, 2 professional DVM students, and one graduate student were involved in this project. And to date, 3 poster presentations resulted from this research.

**BENEFITS & IMPACT:** Our research indicates that macroalgae are a beneficial alternative to the less sustainable fishmeals used in conventional aquadiets fed to sablefish. Also, increased survival in sablefish culturing systems can be achieved by boosting the immune response by *Echinacea purpurea*.

We also delivered a blood analysis baseline for future research and aquatic medicine in this species. Having these values will enable future comparison of fish fed different diets and during infection trials. We established hematology and blood chemistry parameters for future health analysis. This objective was supported by an additional grant award.

**ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:** We received a \$10,000 Oregon Sea Grant Program Development grant to extend the scope of this research.

**FUTURE FUNDING POSSIBILITIES:** These results were used to apply for a 2020 NOAA SK grant that received high marks but was not recommended for funding. We improved upon the reviewer's comments and hope for a favorable decision in the 2021 NOAA SK decision that should be announced this spring. The funding also helps the junior faculty leading this project to establish her research program in functional aquatic diets and expand her professional network. Many thanks to the Agricultural Research Foundation for their support.