PREPARATION OF FISH FEED

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General Rules;

Do we know the feeding characteristics and habits of the fish we would formulate / produce feed for?

1. Where will we grow the fish? (in ponds, net cages, tanks, raceways)
2. Nutritional requirements of the fish?
3. Nutritional values of the ingredients?
4. The prices of ingredients? Import or sales conditions?
5. Are there any nutritional limitation for any ingredient?

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Where will we grow the fish?

- **Ponds:**
- Pond culture is known extensive or semi intensive production fields. You don't feed your fish or you give very small amounts of feed to your fish while you are producing fish in ponds. Because;
- Especially earthen ponds give us some advantages; they are rich for organic matters so the fish can feed naturally (can consume live foods- *Dapnia sp.*, *Artemia sp.*, krill, bivalve, shrimp...). Mainly; we can reduce our feed costs...(Please remember it is 60% of the total annual cost of the fish farm).

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Where will we grow the fish?

- **Ponds:**
- **If you formulate feed for pond farm you can reduce the levels of crude protein and crude fat (not much than 3-5%); because there is live food in the ponds.**
- **Feed producers; You can save money while you produce the feed and fish farmers; you pay less money**
- **This is a kind of fish feed plant policy. If you produce according to the requirements of fish, you win...**

Some Examples of Pond Culture Fields

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- **Net cages:** are one of the intensive systems in aquaculture, because of the stocking density and feed / feeding intensity.
- If you produce fish in net cages, you have two advantages;
- 1. You don't pay for field construction,
- 2. If you place your net cages in a dam lake, you can also save money; because of the eutrofication, there is a great possibility to have live food source in the lake. That's why, you can formulate the feed that include less crude protein and crude fat than the requirement of the fish.
- This advantage gives us to use environment as a semi-intensive system.
- It means saving money for both side...Fish feed producers and fish farmers

Examples of Net Cage Culture

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- **Tanks and raceways:** both of them are intensive aquaculture systems. You can stock your fishes in high density (it starts from 20 kg/m3 and goes 80 kg/m3 with liquid oxygen support).
- In tanks and raceways feeding is under control of fish farmer; so there is no available live food was consumed by fish.
- That's why the nutritional requirements of the fish should be met completely.

Some Examples for Tank Culture

Utilizations of Raceways for Trout culture

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- **Nutritional Value of Ingredients:** is very important as nutritional requirements of the fishes. The only connection between fish farmer and fish is feed – ingredients.
- We **must** know the nutritional value of ingredients.
- There are a lot of ingredient sources all over the world; but some of them are very determined,
- Fish meal from: Peru, Chile, Norway, Denmark...
- Soybean meal from: China, U.S.A., Argentina, Brasil...
- Corn / corn gluten meal: China, Brasil...
- Wheat meal: generally every country has wheat sources...
- Every ingredient source may have different nutritional value, that's why we **must** analyse them in our laboratory and if needed we **must** modify the formulations.

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- **Examples for changes of nutritional value (especially crude protein) of ingredients according to exported / imported countries**
- **Fish meal and soybean meal are the main protein sources of the fish feed**

- **Fish meal:** 65-67% from Peru, 65% from Chile, 67-72% from Norway, 68-70% from Denmark, 71-72% from Turkey.
- **Soybean meal:** 43-45% from USA and China, 41-43% Argentina, 40-42% from Brasil

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- **Prices:**
- Always remember that you are not a kind of official institution who produce fish and then release them to lakes, rivers etc.
- To fish farmers and feed producers;
- Always remember that we produce fish to make money.
- What is the main idea?
- **Produce cheaper, sell best price...**
- Search best price of highest quality ingredients.
- Follow daily price changes for ingredients
- (Fish meal: 1050 USD/mt FOB from Peru-best price. If you find it for 600 USD/mt from China, it's incredible but; possibly it's a kind of mixed product with urea or land based animal protein. We do not want to use that kind of ingredient for fish feed against to risk of contamination).
- So you **must** know which price is **possible** and which one is **impossible.**

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- **Prices:**
- Another example;
- Squid meal is more valuable ingredient than fish meal (according to nutritional value-amino acid balance, fatty acid composition etc). Can we use it?
- After explanation of nutritional value, your first question **must** be **"How can I buy it and how much will I pay for that?"**
- The price of the squid meal is 2250 USD/mt FOB. No, we can not; because we can buy fish meal cheaper than squid meal.
- Lets go on with fish meal

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- **Availability:**

- There is a continuous production circle in the fish feed plant. It is hard to say "Today I produce, tomorrow no". That's why you should supply ingredients when ever you need.

- The imported ingredients such as fish meal and soybean meal can create a problem; but if you plan your production circle well, you will not meet any surprise. The other ingredients also should be supplied easily at least they should be far away just for a phone call.

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- **Antinutritional factors of ingredients:** Tripsin Inhibitor
- We generally meet them in plant based ingredients. Soybean meal that includes high crude protein, is the most critical ingredient about it.
- It contains trypsin inhibitor, it means this inhibitor reduces the benefit of the ingredient. Because; the fish cannot use the trypsin amino acid in its metabolism.
- Imagine fish metabolism works like a dam; if there is a blank on any space of the dam, the water starts to flow from that blank. Then the water level reduces until the level of the blank.
- In fish nutrition we can say the same, if any amino acid level is lower than the requirement of fish, the utilization of the total amino acid calibrates itself according to lowest level of the amino acid.

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- **Antinutritional factors of ingredients:** Gossypol
- Gossypol is another kind of inhibitor that prevents the utilization of fatty acids in fish metabolism. Plant origin ingredients such as sunflower meal that we can commonly use it in carp feeds, contains it.
- **What is the method to reduce or eliminate them?**
- Extruder is the best way...because;
- There are high temperature and high pressure applications in the extruder. It increases gelatinization (starch is converted to gelatinize starch; so the fish can digest it easier) and then the effect of inhibitor also reduces.
- For soybean meal, before extruder, it is usable 65%, after extruder it is increased until 90%.
- For sunflower meal, the usability is 40% before extruder, 80% after extruder.

Maybe they find it still complicated