1997

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Aldon, E. T. (1997). A feed for seabass. SEAFDEC Asian Aquaculture, 19(4), 23–24, 34.

http://hdl.handle.net/10862/1620

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By **ET Aldon**

One of the major constraints in seabass culture is feed supply. Trashfish (for grow-out culture) is expensive and its supply is limited. *Artemia* (for larval rearing) is also expensive.

This problem led AQD researchers to formulate a "standard" feed suitable for carnivorous species like seabass and grouper. Their success would be good news to consumers and entrepreneurs. Reduction of feed cost will consequently lower the price of seabass.

FEED FOR SEABASS GROW-OUT

Available data on nutrient requirements of seabass were used to formulate the seabass diets. AQD scientists Mae Catacutan and Dr. Relicardo Coloso determined the optimum levels of protein, lipid and carbohydrate. Dr. Coloso worked out the essential amino acids required by seabass. Scientist Ilda Borlongan determined the lipid sources and fatty acid composition.

To formulate a practical diet for seabass (see table), Dr. Coloso first tested 11 formulations and a control diet in 500-liter tanks for 8 weeks to screen for the most cost-effective diet to be used in cages and in ponds. Locally available protein sources were used: fish meal, shrimp head meal, scrap squid meal, blood meal, poultry feather meal, leaf meals, soybean meal, and mung bean meal. The diets which contained combinations of animal and vegetable protein sources had essential amino acid compositions similar or close to that of seabass muscle tissue. Crude protein was 43% and fat was 10%.

Based on the results of the tank experiments, 2 of the 11 diet formulations were chosen to be tested in cages (at AQD's Igang Marine Substation) and in brackishwater ponds (at the Iloilo State College of Fisheries in Barotac Nuevo, Iloilo). These 2 diets contain *kangkong* or ipil-ipil leaf meals.

In floating netcages, seabass with initial average body weight of 5 g were stocked at 10 or 15 fish per m^3. Four formulated diets containing *kangkong* and ipil-ipil leaf meals and a control diet were fed *ad libitum* to seabass for 16 weeks. It seems that the control diet promotes the best growth, survival and feed efficiency ratio (FER), but the diets containing *kangkong* or ipil-ipil are more cost-effective.

Practical diet formula for juvenile seabass (grow-out)

Ingredients	*Amount (g/100 g dry diet)*
Fish meal	42.0
Soybean meal	9.0
Shrimp meal *(Acetes* sp.)	10.0
Squid meal	5.0
Breadflour	7.7
Cod liver oil	2.9
Soybean oil	2.9
Vitamin mix	4.0
Mineral mix	2.0
Rice bran	14.5
Proximate composition	*(% dry matter)*
Crude protein	43
Crude fat	9
Crude fiber	12
Nitrogen-free extract	25
Ash	11

The same diets were tested in brackishwater ponds (10 ppt). Seabass were initially stocked at 4 fish per m^2. Stocking density was reduced to 1 per m^2 when the fish became bigger. The same feeding regime was applied. Results indicate that seabass generally grow better in floating netcages than in ponds. Dr. Coloso, however, recommends further economic analysis. He also noted that protein digestibility of these feeds be determined and then improved.

Results of his experiments showed that:

- locally available agricultural and marine by-products may be used in feeds for juvenile seabass
- seabass reared in floating netcages and in brackishwater ponds may require lower amounts of added vitamins and minerals in the feed
- seabass growth was generally better in floating netcages than in ponds as environmental conditions (e.g., dissolved oxygen and ammonia levels) in ponds were sub-optimal
- in floating netcages and ponds, the control diet seems to promote the best growth, survival and FER, but the diets containing *kangkong* or ipil-ipil are more cost-effective.

next page

Almost all seabass growers still use trashfish as feeds.

Meanwhile, AQD researchers Perla Eusebio and Dr. Coloso evaluated some leguminous seeds as protein and energy sources for seabass. They determined the effect of processing on the nutritive value of different legumes using growth, survival and digestibility coefficient as indices. Preliminary results showed that soybean protein was the most digestible to seabass whereas ricebran was the least digestible regardless of the processing method used. The dehulling process gave the highest protein digestibility followed by solvent extraction and boiling. Roasting gave the lowest digestibility.

In another study, Eusebio and Dr. Coloso showed that leguminous seed (cowpea and mungbean) can be potential sources of protein that can replace the fishmeal component at 18% of the seabass diet without affecting their growth. Specific growth rates of fish fed leguminous seed meal-based diets were comparable with that of control diet containing defatted soybean meal. Feed conversion ratio for leguminous seed-based diet was 1.17-1.20 while control diet was 1.12. Leguminous seed meal can also be a good source of energy because of its high carbohydrates content.

FEED FOR LARVAL REARING

In larval rearing of seabass, AQD scientist Armando Fermin (1991) demonstrated that *Moina* can partially replace *Artemia* as live food. *Moina* are sieved to obtain smaller-sized individuals for younger larvae (day 15) while unsieved *Moina* can be fed to older larvae to ensure efficient utilization. *Moina* is an inexpensive yet excellent food source for hatchery rearing of freshwater and brackishwater fishes.

In Fermin's experiment, 15-day old seabass larvae were acclimated and fed to satiation with *Moina, Artemia,* or *Moina+ Artemia.* After 20 days, specific growth rates of fish ranged from 9-13% per day and did not differ significantly among the treatments. Fish fed *Artemia* or *Artemia* and *Moina* had a higher survival rate than fish fed *Moina* alone.

Fermin determined the amount of *Moina* ingested in the presence of *Artemia* by 15-, 20-, 30-, and 35-day old seabass. Thirty-day old seabass fry ingested the highest number of *Moina* with or without the addition of *Artemia,*

☞ page 34

AQD farm-tested the feed developed for carnivorous fishes at the Iloilo State College of Fisheries.

stamps ... from page 12

other natural objects—which requires that people go outdoors—makes people conservation oriented. However, stamps can be used in information dissemination—when little messages and striking images on them pass among people through letters and postcards.

Though Babes and Doris think that collecting fish and marine life stamps does not directly lead one to take active interest in resources conservation and the field of aquaculture science, it is still worth one's while to take up the craft as it is a joy to leaf through the pages of a stamp album and see the rewards of effort.

If by the benefit of an odd chance, one has grown up to be a prominent taxonomist from leafing through an heirloom album as a kid, then stamps would have served its purpose doubly well.

a feed for seabass ... from page 24

than did the other age groups. There was a low feeding incidence on *Moina* by 15-day old seabass. The number of ingested *Moina* by the same age group was not influenced by the length of time after feed introduction.

Moina is a freshwater cladoceran (flea) which thrives in ponds and reservoirs but primarily inhabits temporary ponds or ditches.

In another experiment, AQD researcher Milagros dela Peña showed that seabass larvae fed *Diaphanosoma* either alone or combined with *Artemia* gave a comparable growth and survival with those fed *Artemia* alone.

Seabass attained total length of 20.3 mm in 13 days from the initial length of 8.8 mm. Specific growth rate was 16% per day while survival rate was 98%. *Diaphanosoma celebensis* is a transparent/whitish marine cladoceran that inhabit nearshore estuarine waters.

Seabass larvae needs sufficient amounts of unsaturated fatty acids as an essential component of the diet for proper growth and development. Fermin reported that the young seabass larvae hardly ingest the large freshwater cladoceran if given unsieved to fish compared with *Artemia.*

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SEAFDEC / AQD Report 1992-94, 1994-95