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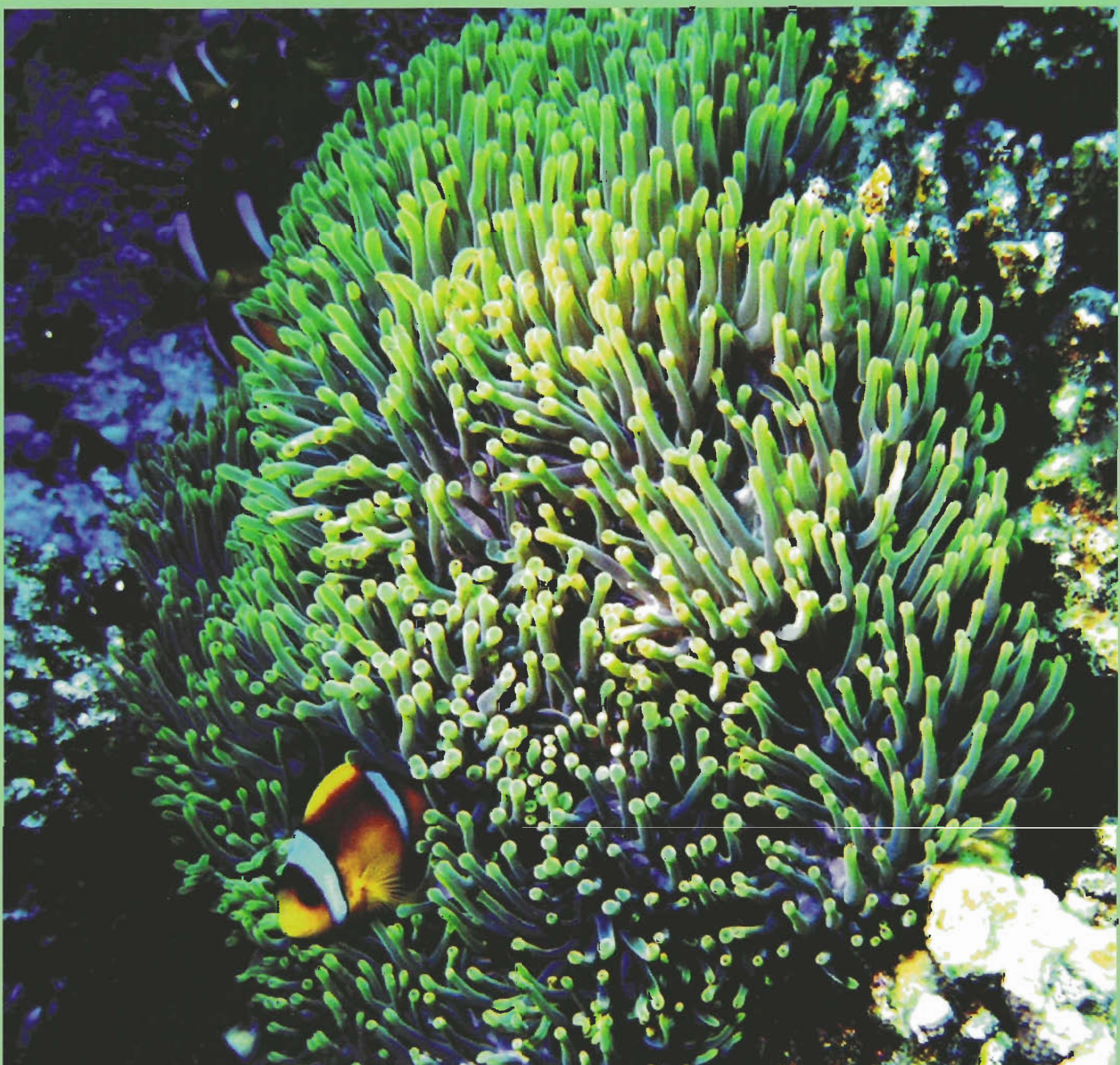

Rearing fish in a bucket ... successfully

Chemical composition of natural food from semi-intensively managed milkfish ponds in the Philippines

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Milkfish production is spread widely throughout the Asian-Pacific region. The importance of milkfish (*Chanos chanos*) to the livelihood and nutrition of the Asian-Pacific people is evidenced by the large amount of land, water and human resources involved in milkfish culture. Nearly 750,000 ha of ponds and inland waters are utilized for milkfish culture in that region (Bagarinao 1998). Most milkfish are produced in Southeast Asia by Indonesia, the Philippines and Taiwan.

In the Philippines, milkfish is the most important cultured finfish species in terms of quantity. In 2001, more than 225,000 t were produced here (FAO 2003), over 93 percent of which came from brackish water ponds. A significant part of the production was achieved on commercial fish farms of 1-30 ha total pond area. These usually are located in the tidal areas of rivers and streams or in former mangrove swamps. One of the management methods regularly used in milkfish pond culture is semi-intensive production, which includes the fertilization of ponds to enhance the growth of natural food and/or supplementation with artificial diets. Many studies have shown the growth promoting effects of supplemental feeding. However, the natural food present in semi-intensively managed milkfish ponds is also a major part of the total feed uptake of those milkfish. In recent decades, an increasing number of reports have been devoted to the chemical analysis of natural food for fish. However, in many cases the studies have been conducted only in the laboratory and, therefore, information on the chemical composition of natural food from the field is still limited. This holds true particularly for the important food complexes present in semi-intensive milkfish growout ponds. Until now, there has been little information available about the natural food types in such ponds (Bagarinao 1999). In general, two types of natural food can distinguished: a mat consisting of filamentous green algae (*lumut*) and a complex of filamentous and unicellular blue-green algae and diatoms (*lablab*). The chemical composition of both types of natural food, as well as their nutritive value for juvenile milkfish, is described here (Lückstädt 2004).

Natural Food Collection and Analysis

Two commercially operated fish farms using different semi-intensive management methods were monitored on Panay Island, Philippines. Natural food on one farm consisted mainly of *lumut*, while on the other *lablab* was the dominant type of natural food. Both types were collected from the shallow brackish water ponds (mean depth ca. 30 cm) using buckets. Sampled water was removed and the remaining algae was freeze-dried for later proximate analysis using semi-automated methods: ash (muffle furnace), crude protein (Kjeltec Auto Analyzer System), crude fat (Soxthec System), crude fiber (Fibertec System) and NFE (nitrogen free extract - calculated) following the standard methods of the Association of Analytical Chemists (AOAC 1984) as well as additional analyses of chemical composition, like amino acids (ionic exchange chromatograph), trypsin inhibitor (spectrophotometer), fatty acids (gas liquid chromatography), carotenoids (HPLC analysis) and mineral concentration (atomic absorption spectrometry). Results were compared with the known nutrient requirements of juvenile milkfish (Borlongan 1992, Borlongan and Coloso 1993, Miñoso 1999) and fish in general (Steffens 1989).

Nutritive Value of Present Natural Food Complexes

Fish feeding on *lablab* had a higher specific growth rate SGR (the logarithm of weight gained divided by the duration of the culture period in days expressed in percent) than fish relying on *lumut* only (SGR: 2.1 percent vs. 1.0 percent). The average crude protein content of *lumut* and *lablab* were 7.8 percent and 6.4 percent. However, the difference was not statistically significant. Non-protein nitrogen differed between *lablab* (1.2 percent) and *lumut* (22.7 percent). Consequently, true-protein showed significant differences between *lablab* and *lumut* with higher levels in *lablab*. Further, the amount of essential amino acids (EAA) tended to be higher in *lablab* (44.1 percent) than in *lumut* (42.6 percent), suggesting higher protein quality in the former. A significant difference was observed in histidine content with *lablab* showing higher levels. For *lumut*, deficiencies in the required amounts of EAA for milkfish, based on the percentage of dietary protein, were detected for arginine, isoleucine, methionine and threonine, while *lablab* was deficient for optimal growth of juvenile milkfish only in methionine.

Crude fat content was low in both natural food types (< 1 percent), but tended to be higher in *lablab*. The short-chain fatty acids, such as capric, lauric and tridecylic acid were present only in small concentrations. However, the major-

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ity of the total fatty acid composition was made up of three fatty acids: palmitic (16:0), palmitoleic (16:1n-7) and oleic acid (18:1 n-9). These fatty acids made up more than 60 percent of the total fatty acid content. On the other hand, the essential fatty acids (EFA) for milkfish (stearic, linoleic, linolenic, eicosapentaenoic and docosahexaenoic acid) did not differ significantly between the samples. Those fatty acids were observed in all monitored natural food samples. However, since the total dietary fat content of both types of natural food were well below 1.0 percent, the amount of EFA was very low and did not meet the requirements of milkfish.

Table 1. Nutritive value of natural food complexes compared to milkfish requirements.

	Lumut	Lablab
Amino acids	less than required	mainly meets requirement
Fatty acids	less than required	less than required
Trypsin inhibitor	present	not present
Carotenoids	exceeds requirement	greatly exceeds requirement
Minerals	exceeds requirement	greatly exceeds requirement

Measurements of trypsin inhibitor in *lumut* and *lablab* showed clear differences between the two. The average percent inhibition of trypsin was significantly higher in *lumut* while for *lablab* the same parameter was close to zero. That difference supports, once again, the higher quality of digestible protein in *lablab*.

Total carotenoid content was significantly higher in *lumut* (105 µg/g dry matter, DM) than in *lablab* (24 µg/g DM), but carotenoids with provitamin A activity (e.g.ß-carotene) were significantly higher in *lablab* (4.4 µg/g DM; *lumut*: 0.4 µg/g DM). However, it is postulated that the measured levels of carotenoids in both natural foods exceeded the required level of vitamin A for milkfish. Finally, the mineral concentration in both natural food complexes was at no point limiting for milkfish growth, but again differed significantly with higher levels of phosphorous in *lablab* (5 mg/g DM; *lumut*: 2 mg/g DM), sodium (46 mg/g DM; *lumut*: 24 mg/g DM) and manganese (0.5 mg/g DM; *lumut*: 0.4 mg/g DM).

Conclusions

The results suggest that *lablab* is metabolized at a higher rate and that the nutritional quality is better than that of *lumut* because of a higher quality of dietary protein, absence of trypsin inhibitors and higher content of retinol precursors. This is supported by the higher growth rate of juvenile milkfish feeding on *lablab* as the main natural food complex. Therefore, it is highly recommended that milkfish farmers focus on management methods, such as water exchange, salinity control and fertilizing, that sustain or enhance the growth of *lablab* as the main natural diet for juvenile milkfish in semi-intensively managed brackish water ponds in the Philippines. Further research is necessary to evaluate the present findings for more than just one growout period.

Notes

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