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**REDUCING DEPENDENCY ON FISH-BASED FEED IN  
MARINE FISH FARMING**

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## Synopsis

Three different experiments were conducted in the effort to develop practical feeds for farming the tiger grouper, *Epinephelus fascoguttatus* using alternative feed ingredients. In the first experiment, the dietary protein and lipid requirement of tiger grouper was determined in a 3 x 3 factorial dietary design with 45 to 55% crude protein in 5% increments and 8 to 16% crude lipid in 4% increments for 8 weeks. The finding indicates that dietary protein and lipid can significantly affect the growth performance, feed utilization and survival of tiger grouper juveniles. The fish fed diet containing 50 % crude protein and 16% crude lipid had the highest weight gain, specific growth rate (SGR) and the best feed conversion ratio (FCR) among all the treatments. Apparently, increasing protein level to 55% did not promote better growth of the fish. It was noted that increasing the amount of lipid in the experimental diets to 16% has resulted in significantly higher body lipid. Therefore, careful consideration on the lipid level in practical diet of this species is needed if lean fish is to be produced. In the second experiment, a 16-week feeding trial was done to evaluate the possibility to replace fish meal (FM) with poultry by-product meal (PBM) at high inclusion levels (50 – 100%) in the feeds of juvenile tiger grouper. Replacement of fish meal with 50% PBM had produced the best growth performance and FCR and feeding with trash fish had resulted in significantly poorer FCR. Survival were not significantly different ( $P>0.05$ ) among all treatments. Similarly, apparent digestibility coefficients (ADCs) for dry matter were not significantly different among dietary treatments. However, ADCs for crude protein and lipid were affected by the dietary inclusion level of PBM. It can be concluded that PBM can be successfully used as a protein source in the diets for tiger grouper. In the third experiment, the performance of vegetable oils-based diet was evaluated in tiger grouper in a ten-week feeding trial. Fish fed diets with vegetable oils (refined, bleached and deodorized palm olein, RBDPO; canola, CNO; soybean oil, SBO; mixed vegetable oils, MIX) performed better in term of fish weight gain than those in control treatment (fish oil, FO). FCRs were not affected by dietary treatments and these values were not significantly different among all diets. Therefore, it can be concluded that the dependency of marine fish farming on fish-based feeds can be reduced when diets are carefully formulated to meet the nutrient requirement of the target species.

## Sinopsis

Tige eksperimen berbeza telah dijalankan dalam usaha untuk menghasilkan diet praktikal untuk penternakan kerapu harimau, *Epinephelus fascoguttatus* menggunakan ramuan makanan alternatif. Dalam eksperimen yang pertama, keperluan protein dan lipid ditentukan dalam rekabentuk eksperimen faktorial 3 x 3 menggunakan 45 hingga 55 % protein mentah dengan kenaikan 5% dan 8 hingga 16% lipid mentah dengan kenaikan 4% selama 8 minggu. Penemuan kajian menunjukkan protein dan lipid boleh memberi kesan signifikan ke atas pertumbuhan, penggunaan makanan dan kemandirian juvenil kerapu harimau. Ikan yang diberi makan 50% protein mentah dan 16% lipid mentah mempunyai penambahan berat, kadar tumbesaran spesifik tertinggi dan kadar penukaran makanan (FCR) terbaik di antara semua rawatan. Walaubagaimanapun, peningkatan kandungan lipid dalam diet pada 16% telah menyebabkan peningkatan signifikan kandungan lipid badan. Oleh itu, kandungan lipid dalam diet praktikal ikan ini haruslah dipertimbangkan dengan berhati-hati sekiranya ingin menghasilkan ikan yang kurang berlemak. Dalam eksperimen yang kedua, satu percubaan 16 minggu telah dijalankan untuk menilai kemungkinan menggantikan tepung ikan dengan tepung hasil sampingan ternakan ayam (PBM) pada kadar penambahan yang tinggi (50 – 100%) dalam makanan juvenil kerapu harimau. Penggantian tepung ikan dengan 50% PBM telah menghasilkan pertumbuhan dan FCR terbaik dan pemberian makanan menggunakan ikan baja telah mengakibatkan FCR yang terburuk. Kemandirian tidak mempunyai perbezaan bererti ( $P > 0.05$ ) di antara semua rawatan. Koeffisyen penghadaman nyata (ADC) untuk bahan kering juga tidak menunjukkan perbezaan bererti untuk semua rawatan. Walaubagaimanapun, ADC untuk protein dan lipid mentah dipengaruhi oleh tahap kandungan PBM dalam diet. Sebagai kesimpulan, PBM boleh digunakan dengan jayanya sebagai sumber protein dalam diet kerapu harimau. Dalam eksperimen yang ketiga, prestasi diet berasaskan minyak sayuran telah dinilai pada kerapu harimau dalam satu percubaan pemakanan 10 minggu. Ikan yang diberi makan makanan dengan minyak sayuran (minyak masak kelapa sawit, RBDPO; minyak kanola, CNO; minyak kacang soya, SBO; minyak sayur campuran, MIX) mempunyai prestasi yang lebih baik dari segi pertambahan berat badan ikan berbanding rawatan kawalan (minyak ikan, FO). FCR tidak terjejas oleh rawatan makanan dan nilainya tidak mempunyai perbezaan bererti diantara semua diet. Oleh itu, disimpulkan bahawa kebergantungan penternakan ikan marin terhadap diet berasaskan ikan boleh dikurangkan apabila diet diformulasi dengan berhati-hati dengan memenuhi keperluan nutrien ikan yang ingin diternak.