

# EGG QUALITY OF GROUPER *EPINEPHELUS COIOIDES* FED DIFFERENT FATTY ACID SOURCES

Gerald F. Qunitio, Relicardo M. Coloso, Nora B. Caberoy, Joebert D. Toledo,  
and Deogracias M. Reyes, Jr.

Aquaculture Department  
Southeast Asian Fisheries Development Center  
5021 Tigbauan, Iloilo, Philippines

Tel. No.: (33)3351009, Fax No.: (33)3351008, E-mail: TMS-SEAFDEC@PHIL.GN.APC.org

## Abstract

Quality of eggs spawned by *Epinephelus coioides* fed fish bycatch (control), cod liver oil-enriched fish bycatch (TFC), and commercial HUFA-enriched fish bycatch (TFS) was monitored. Monthly egg production, spawning frequency, fertilization rate, egg viability, and hatching rates of the control were significantly higher compared to TFS. Egg production, spawning frequency, and hatching rate of TFC and TFS were not significantly different. Results suggests that varying the species of fish bycatch could provide the requirements of *E. coioides* broodstock so as to provide quality eggs.

## Introduction

There is a high demand for groupers in Asia. However, production of cultured fishes is hampered by inadequate supply of seeds for stocking. Several workers have conducted research on seed production of various species of grouper. Some of these species are *Epinephelus tauvina* (Chen et al. 1977, Hussain et al. 1980, Chao and Lim 1991), *E. salmoides* (Kunvankij et al. 1986), *E. malabaricus* (Ruanganit et al. 1986, Maneewong et al. 1986), *E. akaara* (for review, see Fukuhara 1989), *E. fuscoguttatus* (Lim et al. 1990, Chao and Lim 1991), and *E. suillus* (Doi et al. 1991). Despite advances in technology, these reports have shown low or inconsistent larval survival.

Toledo et al. (1993) have shown that the grouper *Epinephelus suillus* (= *E. coioides*) can spontaneously spawn year-round in tanks. Despite this, varying egg quality may be one of the limiting factors for successful mass production of fry (Kjorsvik et al. 1990). It may cause changes in recruitment and may decrease the survival potential of larvae. Supplementing the fat intake of the broodstock, therefore, could help in solving this problem (Dhert et al. 1991). Thus, this study was conducted in an attempt to improve the quality of spawned eggs by adding different sources of fat to the feed of grouper broodstock.

## Materials and methods

Grouper (*E. coioides*) broodstock (females: 2.5-6.5 kg; males: 8.3-11.0 kg body weight, BW) were stocked in three 50-t concrete tanks, each containing 1 male and 3 females. A flow-through water system with aeration was used. The tanks were shaded by a black plastic straw mat to minimize growth of algae and diatoms. From 1 November 1991 to 28 October 1992, the fish were fed fish bycatch (trash fish) only (Control), fish bycatch enriched with cod liver oil (TFC), and fish bycatch enriched with a commercial highly unsaturated fatty acid (SELCO) (TFS). Broodstock were fed to satiation every other day.

Naturally spawned eggs were collected the following morning after spawning. This was done by shutting off the aeration for about 15 min. Floating eggs were seined with a fine mesh net while sinking eggs were collected by draining the tank. Seined and drained eggs were stocked separately in incubation tanks filled with 200 l filtered seawater. Parameters such as total eggs spawned, fertilization rate, percentage of viable eggs, hatching rate, percentage of normal larvae, and

survival of larvae without feeding were determined based on some criteria cited by Kjorsvik et al. (1990).

The crude protein and crude fat of floating and sinking spawned eggs and fish bycatch enriched with different sources of fatty acids were analyzed. Crude protein was determined using Semi-automated Method utilizing a Kjeltec Auto analyzer while the Soxhlet Method was used for crude fat.

Water temperature and salinity were monitored daily at about 15.00 h. Monthly mean water temperature and salinity ranges were 26.8-29.6 °C and 30.6-34.1 ppt, respectively.

Analysis of variance on a randomized complete block design was used for statistical analysis. Log and square root transformations of egg count and spawning frequency values, respectively, were made before analysis. All values expressed in percent were arcsin transformed before analysis.

## Results

Spawning commenced between the last quarter and new moon of the lunar cycle and in most cases 1-3 days after the last quarter moon. The total egg production from January to October 1992 in the control fish was about 77.9 million eggs, 40.0 million in TFC fish, and 36.4 million in TFS (Fig. 1). Range of monthly egg production on a per weight basis in the control was from 0.18 to 0.45 million eggs/kg BW, while in TFC and TFS the range were 0.06-0.36 and 0.01-0.41 million eggs/kg BW, respectively. Analysis of variance showed that mean monthly egg production in the control (0.34 million eggs/kg BW) and TFC (0.21 million eggs/kg BW) were not significantly different while both are significantly different ( $P < 0.05$ ) from that of TFS (0.15 million eggs/kg BW). Mean monthly spawning frequency was highest in the control (6.0 days, Table 1) but was not significantly different from TFC fish (5.2 days). TFS fish significantly gave the lowest monthly spawning frequency (3.4 days).

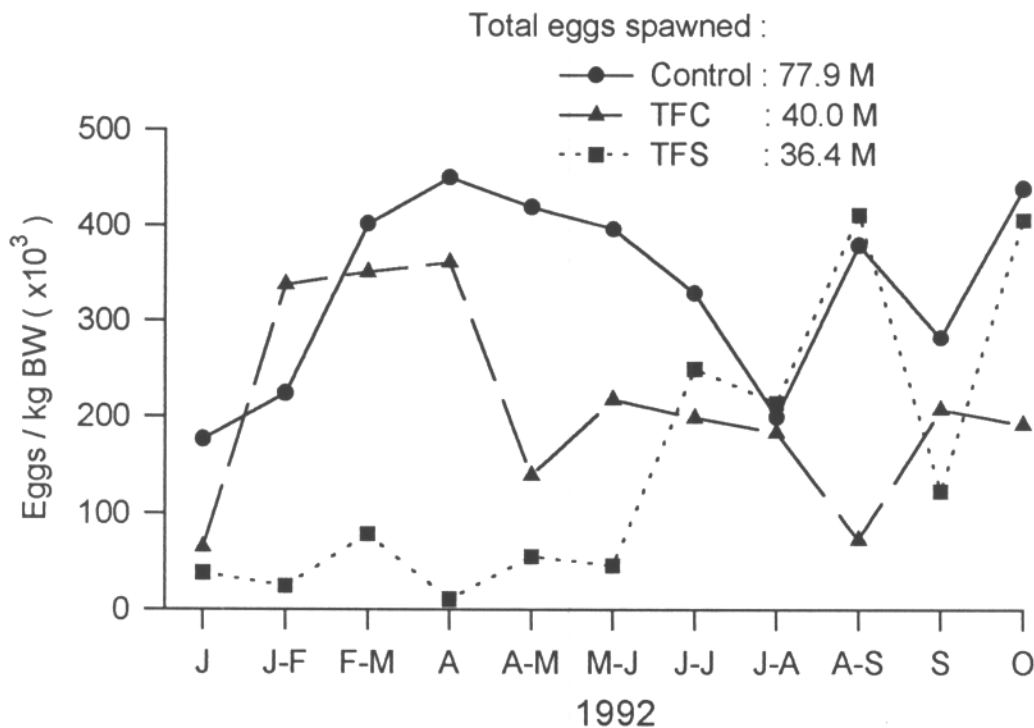


Figure 1. Egg production of grouper broodstock fed different sources of fatty acids. Control - fish bycatch only; TFC - cod liver oil-enriched fish bycatch; TFS - SELCO-enriched fish bycatch.

Fertilization rate, egg viability, and hatching rate (Table 1) showed significant differences ( $P < 0.01$ ) among the three groups. The control gave the highest values but hatching rate was not different to that of TFC. TFS values were lowest but the mean fertilization rate was not different

to that of TFC. No significant differences were detected in the oil globule (0.18-0.21 mm) and egg (0.78-0.89 mm) diameters. Moreover, percentage of normal larvae among the treatments were not significantly different (Table 1).

Table 1. Spawning frequency, fertilization rate, hatching rate, and percentage of normal larvae of grouper broodstock fed different sources of fatty acid. Control - fish bycatch only; TFC - cod liver oil-enriched fish bycatch; TFS - SELCO-enriched fish bycatch. Values are expressed as mean  $\pm$  SEM. Values with the same superscript in a column are not significantly different ( $P < 0.05$ ).

Diet	Spawning frequency (days)	Fertilization Rate (%)	Egg Viability (%)	Hatching Rate (%)	% Normal larvae
Control	6.0 $\pm$ 0.6 <sup>a</sup>	70.94 $\pm$ 3.45 <sup>a</sup>	32.28 $\pm$ 6.98 <sup>a</sup>	52.80 $\pm$ 5.04 <sup>a</sup>	79.39 $\pm$ 2.66 <sup>a</sup>
TFC	5.2 $\pm$ 0.1 <sup>a</sup>	48.12 $\pm$ 5.44 <sup>b</sup>	24.37 $\pm$ 5.31 <sup>a</sup>	34.55 $\pm$ 3.46 <sup>b</sup>	81.37 $\pm$ 3.20 <sup>a</sup>
TFS	3.4 $\pm$ 0.7 <sup>b</sup>	41.99 $\pm$ 6.49 <sup>b</sup>	12.43 $\pm$ 4.96 <sup>b</sup>	23.85 $\pm$ 5.90 <sup>c</sup>	61.69 $\pm$ 11.48 <sup>a</sup>

The survival of unfed newly-hatched larvae from every spawning day in the different treatments was monitored during the 24 July-1 August, 24 August-2 September, and 21-29 September 1992 spawning months. Larvae from the TFC group survived until the fifth day after hatching while those from control and TFS groups lasted only until the third day. However, no significant difference was observed among treatments.

Crude protein (46.00-55.20%) and fat (16.79-24.65%) of floating and sinking eggs collected in February to March 1992, and August to September 1992 were similar in all treatments (Table 2).

Table 2. Mean crude protein and crude fat of floating and sinking eggs of grouper broodstock fed different sources of fatty acid spawned from 27 February to 9 March 1992 and 24 August to 2 September 1992. Control - fish bycatch only; TFC - cod liver oil-enriched fish bycatch; TFS - SELCO-enriched fish bycatch.

Diet	Floating eggs		Sinking eggs	
	Crude Protein	Crude Fat	Crude Protein	Crude Fat
Control	53.22	18.76	50.86	23.02
TFC	55.20*	16.79	47.76	22.56
TFS	50.00	23.24	46.00	24.65

\*Value of eggs spawned from 27 February to 9 March 1992 only.

The species of fish bycatch given to the broodstock depended on the available fish in the market. These composed of *Selaroides* sp., *Nemipterus* sp., *Rastrelliger* sp., and *Decapterus* sp. (Table 3). Results showed that crude protein decreased ( $P < 0.01$ ) when cod liver oil or SELCO (59.51-71.20%) was added in all the fish bycatch species given while crude fat increased (12.62-23.15%).

## Discussion

In this study, spawning of *E. coioides* broodstock was similar to the observations of Toledo et al. (1993). In most cases, spawning commenced 1-3 days after the last quarter moon phase.

The results of this study indicate that supplementation of cod liver oil and SELCO in the fish bycatch of *E. coioides* broodstock did not improve egg production and other parameters determined. In some cases, these fatty acid sources even gave negative results. Dhert et al. (1991) showed that *E. tauvina* broodstock given fish bycatch injected the emulsified enrichment diet Marila diet significantly increased oil globule diameter, total lipids, eicosapentaenoic acid, docosahexaenoic acid, and larval survival at day 7. However, the species of fish bycatch given was not identified. Watanabe (1985) indicated that there is a need for a careful balance of essential fatty acid (EFA) in the diet of broodstock. It may be possible that feeding varied fish bycatch to *E. coioides* broodstock was able to provide the EFA requirement while addition of CLO and SELCO affected the EFA levels.

Levels of crude protein and crude fat of floating and sinking eggs were similar in all the treatments. This indicates that proximate analysis could not show differences of spawned eggs. Determination of the fatty acid profile would have been the more appropriate technique to actually see differences.

Nevertheless, our results have shown that giving varied species of fish bycatch to grouper broodstock is able to provide the dietary requirement which could give quality eggs. It may also be worthwhile conditioning the fish to feed on artificial diet so that the actual lipid source and requirements for improving egg quality could be determined.

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Table 3. Mean crude protein and crude fat of the different species of fish bycatch fed to the grouper broodstock. Means with the same superscript in a column of a species are not significantly different ( $P < 0.01$ ).

Species	Crude Protein(%)	Crude Fat(%)
<i>Selaroides</i> sp.		
Control	67.57a	13.24c
TFC	59.96c	22.48a
TFS	65.20b	19.60b
<i>Decapterus</i> sp.		
Control	65.95a	19.11c
TFC	63.00c	23.15a
TFS	64.40b	21.50b
<i>Nemipterus</i> sp.		
Control	67.08a	11.38b
TFC	63.52b	18.69a
TFS	59.51c	19.33a
<i>Rastrilleger</i> sp.		
Control	74.86a	8.68c
TFC	69.32c	17.23a
TFS	71.20b	12.62b

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