# OPTIMIZING DOSE AND MODE OF ADMINISTRATION OF LUTEINIZING HORMONE RELEASING HORMONE ANALOG FOR INDUCED SPAWNING OF BLACK SEA BASS, *Centropristis striata*

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ABSTRACT

The black sea bass is a high-value marine serranid and a prime candidate for intensive cultivation. Reliable methods for controlled spawning are needed to develop cost-effective hatchery technologies for mass production of juveniles. Adult black sea bass (mean wt. = 1.84 kg; range = 0.61-3.75 kg) captured off Carolina Beach in Nov 2000 were held in 2.6-$m^3$ outdoor tanks with recirculating seawater (35 ppt) and under an ambient photoperiod and a temperature range of 12-27 °C until Apr, when photothermal conditions were held at 13 L: 11 D and 19-23 °C. Fish were fed a combination of non-living and commercially prepared feeds. Black sea bass females were induced to spawn volitionally using pelleted luteinizing hormone releasing hormone-analogue (LHRH-a) and gonadotropin releasing hormone-analog (GnRH-a) administered at different dose levels and release rates (slow and fast). From Apr-Aug 2002 and 2003, vitellogenic-stage females with mean oocyte diameter (MOD) $\geq$ 0.338 mm (range= 0.338-0.488) were implanted with a degradable pellet containing LHRH-a at dose levels of 0 (control), 5 slow, 50 slow, 50 fast, or 100 slow µg/kg body wt, or GnRH-a at a dose of 49-114 µg/kg body wt, with 6-21 individuals per treatment. Implanted females were held in spawning tanks with five running males.

A single LHRH-a or GnRH-a pellet implant successfully stimulated final oocyte maturation, ovulation and volitional spawning in female black sea bass. Volitional spawning was observed in treatment and control groups beginning 2.0-5.5 d post-implantation (dpi) and continuing intermittently up to 10 dpi. However, percentages of spawning females generally increased with increasing dose from 41% in the control

(placebo implanted) females, to 83% in L-5-slow and G-slow, 95% in L-50-slow and 100% in L-50-fast and L-100-slow. Mean numbers (x $10^3$) of eggs spawned (per female and per kg female body wt., respectively) also increased ($P < 0.05$) with increasing dose and was lowest in the control (10.2, 9.40) and L-5-slow (72.0, 85.3), intermediate in L-50-slow (197, 121), L-50-fast (223, 160), and G-slow (221, 210) and highest in L-100-slow (584, 382). The L-100-slow treatment produced the most eggs per female and per kg female body wt., while the L-5-slow treatment and the controls produced the least.

Within each treatment, high individual variability in spawning performance precluded statistical resolution of treatment effects. Mean fertilization success (range = 22.5-41.6%) did not differ significantly among treatments, while mean hatching success (range = 11.9–31.5%) was significantly ($P < 0.05$) higher in L-50-fast (31.5%) than in the control (19.6%). Numbers (x $10^3$) of yolksac stage larvae produced per female or per kg female body wt. did not differ significantly. However, mean and range values for yolksac larval production (per female and per kg female body wt., respectively) were highest in the L-50-fast (35.5, 23.4) and G-slow (34.3, 28.0) treatments, intermediate in L-100-slow (19.4, 12.7) and L-50-slow (14.0, 8.76), and lowest in L-5-slow (5.53, 5.82) and in the control (0.664, 0.068).

Survival to the first-feeding stage was relatively low in all treatments (range = 0.456–7.5%), with no significant differences. There were no significant differences among treatments in numbers of first-feeding larvae produced per female (0.151–4.16) and per kg female body wt. (range = 0.143–2.78). Overall low survival of yolksac larvae to first-feeding in all treatments may be related to incubation conditions.

The high dose level of L-100-slow resulted in a 100% female response, the highest number of spawns per female, greatest number of eggs and first-feeding stage larvae produced per female and per kg female body wt. than any other treatment. However, two of the nine females (22%) became egg-bound and died during the spawning period, suggesting hormone over-stimulation. The L-50-fast treatment also produced relatively high numbers of yolksac larvae per female and per kg body wt. These results suggest that further testing with slow and fast release LHRH-a or GnRH-a pellets at dose rates between 50 and 100 µg/kg (e.g. 75 µg/kg) may result in a high production of eggs and first-feeding stage larvae, without risk of overstimulation and mortality that was seen in L-100-slow treatment.

Group spawning, where 2 or more females were implanted with LHRH-a and held with 5–6 males in a communal spawning tank, yielded proportionally higher numbers of eggs and viable larvae than individual spawning. Group spawning is therefore an effective way to compensate for relatively low and variable fecundity of individual females.

Fatty acid compostion was determined in black sea bass eggs of low (< 20% hatching success) and high (> 20% hatching success) quality eggs. Low quality eggs contained greater PUFAs, *n*-3 fatty acids, *n*-3 HUFAs, DHA, and *n*-3/ *n*-6 ratio, while high quality eggs had greater lipid composition, SFAs, MUFAs, *n*-6 fatty acids, and *n*-6/ *n*-3 ratio. The low quality eggs had significantly lower SFAs and MUFAs than the high quality eggs which could mean the low quality eggs and larvae are deficient of SFAs and MUFAs which are needed for growth and development. The low *n*-6 and high *n*-3 in the low quality eggs decreased the *n*-6/ *n*-3 ratio, which a diet with a higher proportion of

vegetable matter could remedy. Low ARA/ EPA levels in high quality eggs suggest that broodstock diet should be supplemented with a higher proportion of ARA, with feed high in corn, soy, canola, or sunflower oils.

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# DEDICATION

I would like to dedicate this thesis to my parents and Chris Williams whose continued help, support and encouragement along the way have meant more to me than they will ever know. Thank you for convincing me that I would be finished soon.

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