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Culture of snubnose pompano, *Trachinotus blochii* (Lacepede, 1801) in indigenous re-circulatory aquaculture system using low cost fishmeal-based diet

D Linga Prabu*, S Ebeneezar, S Chandrasekar, K K Anikuttan, P Sayooj & P Vijayagopal
Marine Biotechnology Division, ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi – 682 018, India
*[E-mail: growelprabu@gmail.com]

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An experimental culture of snubnose pompano, *Trachinotus blochii* was conducted for 210 days in low saline water to understand the growth potential in small indigenous Re-circulatory Aquaculture Systems (iRAS) using low cost fishmeal-based diet developed for pompano. In the present study, snubnose pompano has reached the marketable size (287.32±4.84 g) during the culture period with excellent feed conversion ratio of 1.74±0.01 and average daily growth of 1.32±0.02 g/day. Harvested fish showed viscerosomatic index, hepatosomatic index and intra-peritoneal fat ratio of 4.98±0.21, 0.99±0.09 and 1.45±0.16 %, respectively which enhanced the head-on muscle yield (80.57±3.25 %) and fillet yield (52.22±2.27 %). The survival percentage of *T. blochii* reared in the iRAS was 88.89±3.51 %. The cost of the diet developed for snubnose pompano is well below the commercially available marine fish feeds. The present study suggested that snubnose pompano can be successfully cultured in low saline sea water iRAS using low cost fishmeal-based diet.

[**Keywords**: Amino acid profile, Body indices, Low cost fishmeal-based diet, Market size fish, Re-circulatory aquaculture, Snubnose pompano]

Introduction

Snubnose pompano (*Trachinotus blochii*) also known as silver pompano is one among the high value tropical marine fishes of aquaculture importance due to its faster growth, tolerance to wide range of salinity, adoptability to higher stocking density, better meat quality and availability of hatchery produced seeds[1,2]. Global aquaculture production of *T. blochii* is 0.11 mmt during 2014 with major production from China in sea cages, low saline ponds and re-circulatory aquaculture systems[3]. Farming of snubnose pompano is being practiced in off shore sea cages, brackish and backwater cages and coastal ponds in Indo-Pacific regions[3,4]. It can endure broad range of salinity (0 – 65 ppt) and temperature (25 to 29 °C)[5,6] that make it suitable candidate for farming in low and high saline coastal ponds and estuaries.

India possesses about 3.9 mha of coastal or estuarine area[7] and also accounts 1.2 mha of coastal salt affected areas that can be productively used for the culture of *T. blochii*. Thus, *T. blochi* can serve as an appropriate candidate for species diversification of routine brackishwater shrimp farming in the vast brackishwater resources available in the country. The existence of potential for pompano culture in off shore, coastal sea cages and coastal ponds, the applicability of Re-circulatory Aquaculture System (RAS) cannot be ignored in this context. Riche[8] detailed the culture of Florida pompano, *T. carolinus* in low saline re-circulatory aquaculture system for effective utilization of non-usable inland saline waters, to reduce pressure on marine resources and culture of marketable size fish in paltry amount of land.

Feed forms an important component of aquaculture and represents as much as 50 % recurring cost of aquaculture production[9]. Culture of *T. blochii* is being done with higher inclusion level of protein (42 – 45 %) and fat content (6 – 8 %) diets in many countries[10,11]. The requirement of higher dietary protein and lipid content of marine food fishes are generally obtained through higher inclusion level of fishmeal and fish oil. These marine source ingredients are rapidly depleting most indispensable components of marine fish feeds, which are produced from small pelagic fishes. Currently, about 10 % of the global fish production is devoted for fishmeal manufacturing process, in which 73 % is used by aquaculture industry alone[12] especially for rearing marine food fishes. At present, most of the aquafeed manufacturers have started reducing the inclusion of fishmeal at least by 5 – 10 % in almost all species under culture worldwide[13]. The utilization of fishmeal in fish feeds has been reduced to 19 % in 2005 to 13 % in 2008, and it has been anticipated that it will further decline in future[14] through the effective utilisation of alternative source ingredients. Total replacement of fishmeal and fish oil in fish feeds is being attempted globally; albeit, challenges in achieving growth identical to fishmeal and fish oil incorporated feeds, ensuring cost effectiveness. Or, minimising fishmeal and fish oil inclusion in the diet of marine fishes is the next best approach. With this backdrop, rearing of *T. blochii* using species specific low cost fishmeal-based diet is attempted in iRAS in the current study.

Material and Methods

Experimental fishes

Juveniles of *T. blochii* with the mean weight of 1.76±0.15 g were brought from ICAR-Mandapam Regional Centre of CMFRI at the density of 50 numbers in each oxygen filled polythene bags (20 L capacity) with the water volume of 7 L by road transportation without any anaesthesia. The fishes were stocked at fish rearing unit of ICAR-CMFRI, Kochi, India in 20 ppt salinity water and gradually acclimatized to 5 – 7 ppt salinity at the end of the acclimation period. The juveniles were grown to a size of 7.36±0.48 g in 30 days of acclimation period. During the period of acclimation, the fishes were fed with a 0.8 mm dia floating feed containing 45 % crude protein and 8 % crude lipid content and 94.3 % survival was achieved.

Formulation and preparation of low cost fishmeal based diet

A slow sinking low cost fishmeal-based diet was prepared with 40 % crude protein and 6 % crude lipid using a twin screw extruder of 25 kg/h production capacity (Basic Technologies Pvt. Ltd., India). Feed ingredients and additives were weighed accurately as per the feed formula (Table 1) and mixed with adequate water, steam cooked and cooled. After cooling, the feed mix was passed through an 8 mm dia die of the extruder and wet feed pellets of 8 mm dia and 3 cm length were produced[15]. The wet extrudates (pellets) were dried in hot air oven at 45 °C for 6 – 10 h to a final moisture level of 8 – 10 %. After drying, the pellets were crumbled and sieved using standard sieves to collect the required size of crumble feeds to feed the fishes[16].

Water quality parameters

The physico-chemical water quality indicators namely temperature, pH, Dissolved Oxygen (DO), ammonia, nitrite and nitrate levels were monitored on weekly basis during the study period of 7 months. Water temperature and DO in the experimental tanks were recorded using thermometer and digital DO meter (MERCK, Germany), respectively. The pH of the water from the experimental tanks was measured using a digital pH meter (LABINDIA, Bengaluru). The nitrate, nitrite and ammonia levels were determined through standard protocols of APHA[17].

Indigenous Re-circulatory Aquaculture System (iRAS) for experimental rearing

The indigenous re-circulatory filtration was set-up in rectangular Fibre Reinforced Plastic (FRP) tank (2×1×0.6 m) with the water volume of 1250 L which was partitioned into five compartments for the iRAS[18]. In the first chamber various pore sized bio-sponges were arranged for effective filtration of solid and suspended materials from the water. Second compartment was filled with plastic bio-balls and ceramic rings that harbour nitrifying and denitrifying bacterial flora which

Table 1 — Low cost fishmeal-based diet formula developed for *T. blochii*

Ingredients	Inclusion level (g/kg)	Price/kg† (Rs.)	Price (Rs.)
Wheat gluten[1]	25.00	160	4.0
Soybean meal[2]	240.00	35	8.4
Squid meal[3]	50.00	90	4.5
Meat and bone meal[4]	100.00	35	3.5
Maize gluten[5]	50.00	60	3.0
Shrimp meal[6]	80.00	40	3.2
Fish meal[7]	130.00	85	11.05
Wheat powder[8]	229.00	25	5.725
Fish oil[9]	30.00	105	3.15
Vitamin[10]	20.00	350	7.0
Mineral[11]	20.00	60	1.2
Sodium meta bisulphate[12]	1.00	400	0.4
Butylated hydroxyl toluene[13]	1.00	260	0.26
DL-Methionine[14]	4.00	300	1.2
Lysine[15]	5.50	125	0.6875
Vitamin C[16]	2.50	1200	3.0
Lecithin[17]	10.00	70	0.7
Choline chloride[19]	2.00	300	0.6
Total cost of feed formula			60.9725
Production cost, Bagging cost, Transportation cost, Manufacturer & Dealer margin (Rs/kg)			17.80
Total cost (Rs/kg)			78.77

1 - Viveka Essence Mart, Chennai; 2 - SakthiSoya, Coimbatore; 3 - King Fish Products Pvt Ltd., Veraval; 4 - Arogya Bio Proteins, Vellore, 5 - Sukhjit Starch and Chemicals Ltd, Phagwara; 6 - KhajaMohideen, Chennai; 7 - Raj Fishmeal and Oil Co., Mangalore; 8,18 - Local market, Kochi; 9 - Kiriyathan Trading Co., Narakkal, Kerala; 10 - Sarabhai Zydus Animal Health Pvt. Ltd, Vadodara; 11 - Vibrac Healthcare India Pvt. Ltd., Mumbai; 12,13,17,19 - Hi-Media, Mumbai; 14 - Evonik Degussa, Germany; 15 - BestAmino, CJ Corporation, South Korea; 16 - DSM Nutritional Technologies, Mumbai; † indicates the rice of ingredients in India during the month of January 2020; Dollar value against Indian Rupees during (INR) the month of January 2020 (1US$=71.75INR)

will minimize the harmful ammonia level in the iRAS. In the third compartment, coral sand and oyster shells were filled to maintain the pH level constantly and also supplement the functions of bio-balls. The fourth compartment was packed with charcoal that actively adsorbs chlorine, volatile organic compounds, removes odour and enhances the transparency of water. The fifth compartment serves as a filter water storage tank (500 L) and a submersible pump with an output capacity of 5000 L/h was installed for channelizing the filtered sea water through a UV sterilization unit to the culture tanks (Fig. S1). This system is a cost effective model (Rs. 85,000/-; Table S1) in comparison with the conventional RAS (Rs. 2,10,000/-) of same capacity. Water circulation was maintained at the rate of 5 L/min in each tank of iRAS using 5 – 7 ppt salinity sea water by the ball valve assembly that ensured the DO level of 5.5 – 6.0 mg/L throughout the study. The filter sponge bags and sponge mat were cleaned every week and other components of filtration unit were cleaned and replaced on monthly basis. Water exchange was carried out on weekly basis at the rate of 10 – 15 % of water volume using same salinity sea water (5 – 7 ppt).

Juveniles of snubnose pompano with an average body mass of 8.3 ±0.1 g were stocked in 6 numbers of iRAS tanks (60×60×60 cm with 200 L water capacity) each with 8 fishes. The fishes were fed at the rate of 9 % of body mass during the first 2 months, 7 % of body mass for the 3rd & 4th months, 6 % of body weight in 5th month, and 5 % of body weight during the remaining culture period of 2 months. The fishes were fed with 2 frequencies in a day with low cost fishmeal-based diet containing 40 % protein and 6 % lipid[19,20]. The experimental tanks were covered with 20 mm mesh nylon/HDPE fishing nets to avert the fishes from jumping out of water.

Sampling for growth parameters and body indices

The experimental fishes were bulk weighed at 0.1 g precision on monthly basis to determine the growth of the fish. Daily feed intake was recorded for each replicate tank and the feed utilization parameters were estimated from the recorded data. After completion of experimental period of 7 months, the fishes were starved for one day, prior to weigh the final body mass. The growth parameters were determined by the following formula:

$$\text{Weight gain percentage (WG\%)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100$$

$$\text{Specific Growth Rate (SGR) \%} = \frac{\text{Loge final weight} - \text{Loge initial weight}}{\text{Number of days}} \times 100$$

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed consumed by the fish (dry weight)}}{\text{Body weight increase (wet weight)}}$$

$$\text{Protein Efficiency Ratio (PER)} = \frac{\text{Net weight increase (wet weight)}}{\text{Protein fed (dry weight)}}$$

$$\text{Average Daily growth (ADG)(g)} = \frac{\text{Weight gain in grams (wet weight)}}{\text{Duration of culture (days)}}$$

$$\text{Protein Productive Value (PPV\%)} = \frac{\text{Retained protein (g)}}{\text{Protein fed (g)}} \times 100$$

$$\text{NRE (\%)} = \frac{(\text{Final body wt} \times \text{N content final}) - (\text{Initial body wt} \times \text{N content initial})}{\text{Digestible N intake}} \times 100$$

Where, NRE is Nitrogen Retention Efficiency and N is Nitrogen.

$$\text{Survival (\%)} = \frac{\text{Total number of fish harvested}}{\text{Total number of fish stocked}} \times 100$$

Two fishes from each tank were tranquillized using clove oil[15] at 50 mg/L water and were sacrificed to dissect out the organs for the estimation of Hepatosomatic Index (HSI), Viscerosomatic Index (VSI), Intra-Peritoneal Fat ratio (IPF ratio), condition factor (k) and meat yields[20] as follows:

$$\text{Hepatosomatic index (HSI)} = \frac{\text{Liver weight (g)}}{\text{Weight of fish (g)}} \times 100$$

$$\text{Viscerosomatic index (VSI)} = \frac{\text{Weight viscera (g)}}{\text{Weight of fish (g)}} \times 100$$

$$\text{Gastrosomatic index (GSI)} = \frac{\text{Weight of stomach (g)}}{\text{Weight of fish (g)}} \times 100$$

$$\text{Intra} - \text{peritoneal fat ratio} = \frac{\text{Intra} - \text{peritoneal fat weight (g)}}{\text{Fish weight (g)}} \times 100$$

$$\text{Condition Factor (k)} = \frac{\text{Body weight of fish}}{(\text{Body length})^3} \times 100$$

$$\text{Meat yield (MY)Head} - \text{on} (\%) = \frac{\text{Muscle weight with head (g)}}{\text{Fish weight (g)}} \times 100$$

$$\text{Meat yield (MY)Headless} (\%) = \frac{\text{Muscle weight without head (g)}}{\text{Fish weight (g)}} \times 100$$

$$\text{Fillet yield} (\%) = \frac{\text{Fillet weight (g)}}{\text{Fish weight (g)}} \times 100$$

Estimation of proximate composition and amino acid profile of experimental feed and fish

While starting the experiment, 10 fishes were sedated and sacrificed for initial carcass proximate analysis and amino acid profiling. After 7 months of rearing period, another two fish from each tank were tranquilized and euthanized for the determination of proximate composition and amino acid profiling. The proximate composition of feed (Table 2) and fish samples were done by AOAC method[21] and the amino acid profiling was performed by reverse-phase high-performance liquid chromatography[22].

Statistical analysis

The growth and feed utilization data were subjected to one-way ANOVA by SPSS version 16 statistical package. The statistical difference between the means of different treatments was carried out by Duncan's multiple range tests[23]. Student's *t*-test was performed to compare the significant difference among the initial and final nutritive profile[24]. All the comparisons in the present study were done at 5 % level of probability.

Results and Discussion

Pompanos are a group of marine fishes belonging to the family Carangidae considered as more suitable candidates for costal aquaculture due to their amenability to captivity, adaptability to fluctuations in environmental conditions and fast growth[2,25]. *T. blochii* is an excellent food fish with higher level of white meat which readily accepts formulated feeds, adapting quickly to intensive culture systems with rapid growth rate[2]. Therefore, it has been considered as an appropriate species for coastal aquaculture. The success of any aquaculture operation depends on several key factors especially the availability of suitable cost effective feed to support adequate growth and health of a fish[26]. The cost effective feed can be developed by reducing the inclusion rate of fishmeal in feeds using economically viable feed ingredient sources[27].

Table 2 — Proximate composition of low cost fishmeal-based diet developed for *T. blochii*

Proximate composition	As is basis (g/kg)	Dry matter basis (g/kg)
Moisture	69.3±2.3	-
Crude protein	404.5±10.3	434.6±3.5
Crude lipid	62.2±1.9	66.8±2.4
Crude fibre	29.7±1.1	31.9±2.2
Total ash	150.1±4.5	161.20±7.3
Nitrogen Free Extract	284.2 ±14.3	305.3 ±23.1

Data expressed as arithmetic mean of three replicates ±SE.

Water quality

T. blochii is able to tolerate moderate water quality than any other marine fishes. The favourable salinity for this species lies between 15 and 25 ppt for better growth performance. Even, it can be farmed at low saline water[5] and thrive well up to 5 ppt salinity and during the course of experiment the fishes were maintained at 5 – 7 ppt saline sea water. During the period of study, the Dissolved Oxygen (DO) level was maintained in the range of 5.5 – 6.0 mg/L which is sufficient for tropical fishes. The water temperature was in the range of 25 to 27 °C and pH between 8.0 and 8.2 in the experimental facility (Fig. S2). The ammonia, nitrite and nitrate levels were 0.2 – 0.25, 0.1 – 0.15 and 0.5 – 0.6 mg/L, respectively (Fig. S3). The present result on water quality is in accord with Riche[10] who reported similar range of water temperature, DO, ammonia and nitrite levels in the re-circulatory experimental tanks of 100 L capacity by maintaining the water circulation at the flow rate of 3 L/min for Florida pompano.

Rearing of snubnose pompano in iRAS

Juveniles of *T. blochii* fed with low cost fishmeal-based diet containing 40 % protein and 6 % lipid specifically developed for snubnose pompano[19,20]. *T. blochii* is an omnivorous feeder and can able to relish the diet with low fishmeal content and high level of plant protein source[11]. The cost of diet developed in the present study for snubnose pompano (Rs. 78.77/kg) was lower than the commercially available marine fish feeds in the market (Rs. 85 – 150/kg). The price cutback of the diet developed for this species will significantly reduce the total production cost, as the feed cost accounts more than 60 % of total production cost[15]. The preliminary economic analysis is given in Table S2 which would provide an insight on the profitability of the pompano culture in small iRAS.

Growth performance and body indices

The growth of fish in the experimental tanks was found to be satisfactory in terms of Specific Growth Rate (SGR), Average Daily Growth (ADG), Feed

Conversion Ratio (FCR) and Weight Gain Percentage (WGP) (Table 3). The growth parameters like weight of fish, biomass gain and feed intake on monthly basis is given in Figure 1A, B. In the present study, fishes reached an average weight of 287.32±4.84 g in 7 months culture duration in iRAS which was lower than the weight (375.32±8.07 g) of *T. blochii* cultured in large brackishwater pond (0.4 ha) at the same days of culture and reached the body weight of 464.65±10.25 g in 8 months of culture[28]. *T. blochii* cultured in 6 m dia (area 98.91 m^3) sea cage for 12 months period using commercial floating feed[2] indicated that the SGR and WGP was comparatively lower than the current study and the Protein Efficiency Ratio (PER) and ADG was higher than this study. The FCR in this study was 1.74 which was better than the earlier reports of 1.83 by Jayakumar *et al*.[28] for *T. blochii* under brackishwater pond condition fed with commercial feed for 8 months and 1.84 by Manomatitis & Cremer[29] for *T. blochii* in reared in cages fed using 30 % fishmeal incorporated commercial diet containing 43 % CP and 12 % CL. *T. blochii* being a fast moving actively swimming fish, may spend good amount of energy for swimming activity while reared under pond/large cages where as in smaller tanks with iRAS facility of this study, the swimming activity is minimized which would have channelized more energy towards growth. The protein productive value of this study was 25.20 % which was higher than the Protein Productive Value (PPV) of *T. carolinus* reared in RAS in a 10 week study[30]. The condition factor value in this study was 1.29 which indicates that the robustness and well being of fish as reported by Chandra & Jhan[31].

The VSI, HSI and Gastrosomatic Index (GSI) values obtained in the present study were 4.98, 0.99 and 0.39, respectively. The HSI in the present study was lower than the value reported by Groat[32] and Riche[30] in *T. carolinus*. The lower HSI indicates lower fat deposition in the liver of the experimental animal which may be due to optimal level of dietary lipid in the present study. Serrano *et al*.[33] revealed that higher inclusion of dietary lipid in red drum increased the HSI. The VSI in the present study was similar to value reported by Prabu *et al*.[20] in *T. blochii* and Belfranin[34] in *T. carolinus*. The intra-peritoneal fat ratio of 1.45 % noticed in the present study was comparatively higher than the report by Groat[32] in *T. carolinus* which was due to higher stocking density and small water volume in iRAS which apparently minimized the movement of fish which in turn reduced the energy loss. The muscle yield in terms of head-on and headless was 80.57 and 67.79 %,

Table 3 — Growth performance of *T. blochii* fed with low cost fishmeal-based diet in low saline water iRAS

Parameter	Response
Initial weight (g)	8.32±0.1
Final weight (g)	287.32±4.84
Feed intake/fish (g)	489.70±8.90
WGP (%)	3353.67±57.80
SGR (%)	1.68± 0.02
ADG (g)	1.32 ±0.02
FCR	1.74 ±0.01
PER	1.42 ±0.02
PPV (%)	25.20±1.24
NRE (%)	135.51±4.82
Survival (%)	88.89±3.51
HSI (%)	0.99±0.09
VSI (%)	4.98 ±0.21
GSI (%)	0.39 ±0.01
IPF ratio (%)	1.45 ±0.16
MY (Head-on) (%)	80.57±3.25
MY (Headless) (%)	67.79 ±3.42
FY (%)	52.22±2.27
Condition factor	1.29±0.11

Data expressed as arithmetic mean of six replicates ±SE.

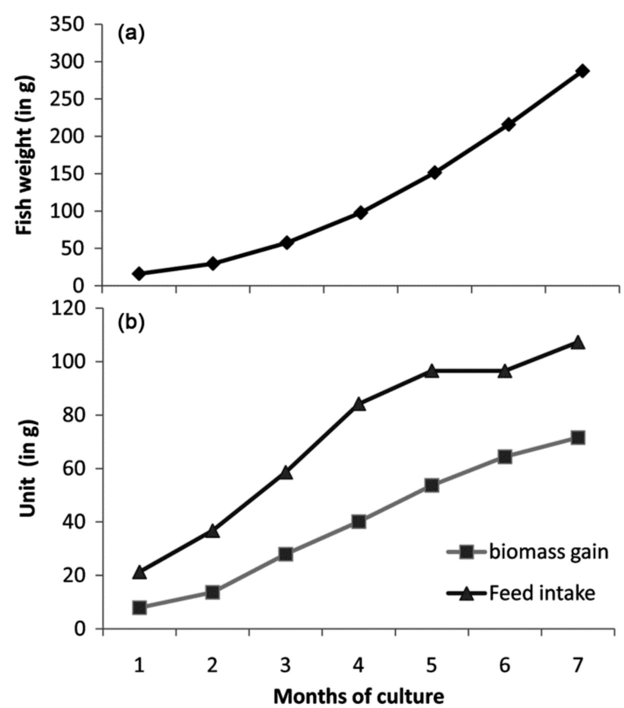

Fig. 1 — A) The growth of *T. blochii* in terms of weight is depicted in the graph during the period of culture; and B) The graph shows the biomass gain and feed intake of *T. blochii* during the experiment

respectively which was higher than the previously reported study that showed a carcass yield of 73 % in *T. carolinus*[32]. The fillets yield of the present study (52.22 %) was higher than the results of fillet yield (48.5 %) in *T. carolinus*[32].

The proximate composition and amino acid profile

The body proximate composition of snubnose pompano is depicted in Table 4. The initial and final carcass proximate composition of pompano was significantly different (P < 0.05). Higher crude protein and lipid composition was noticed in final carcass where as higher total ash and moisture content was recorded in initial body composition. This finding is in accordance with the results of Sarkar *et al*.[35] where a similar trend was reported in *Oreochromis niloticus* reared in net-cages.

Fishes fed with good quality feeds deposit between 25 and 55 % of the dietary intake of total amino acids[36]. Fish can synthesize their body proteins from amino acids in the diet or from body amino acid pool[37]. There was significant difference (P < 0.05) in the amino acid profile of initial and final fish whole body carcass (Table 5). The amino acid profile of feed developed for snubnose pompano was perfectly balanced which was better than the amino acid requirement of Florida pompano[38]. In this study, most of the essential amino acids including lysine and methionine content were significantly higher in whole body amino acid content of final fish than the initial fish which was due to adequate supply of essential amino acids through the diet. This result is comparable with Webster *et al*.[38] who opined that dietary amino acid levels influence the feed intake and in turn affects the body amino acid profile and growth.

Table 4 — The whole body proximate composition of *T. blochii* fed with low cost fishmeal-based diet and initial fish (as is basis)

Proximate composition	Initial fish (%)	Final fish (%)	*P*-value
Moisture	$69.34^{b} \pm 3.34$	$67.63^{a} \pm 4.02$	0.004
Crude protein	$18.42^{a} \pm 1.12$	$20.22^{b} \pm 1.07$	0.001
Crude lipid	$6.61^{a} \pm 0.32$	$7.38^{b} \pm 0.36$	0.006
Crude fibre	0.14 ± 0.01	0.11 ± 0.01	0.223
Total ash	$5.12^{b} \pm 0.24$	$4.34^{a} \pm 0.23$	0.002
Nitrogen Free Extract	0.37 ± 0.01	0.32 ± 0.01	0.228

Data expressed as arithmetic mean of three replicates ±SE.
The mean values in the same line with different superscripts differ significantly (P < 0.05)

Table 5 — The amino acid profile of diet developed and whole body sample of *T. blochii* reared in iRAS

Amino acid details	Feed (g/kg)	Fish whole body		*P*-value
		Initial fish (g/kg on dry basis)	Final fish (g/kg on dry basis)	
Essential amino acid composition				
Histidine	18.47 ± 0.32	$14.59^{a} \pm 0.45$	$15.35^{b} \pm 0.33$	0.023
Arginine	22.07 ± 0.43	20.68 ± 0.67	20.85 ± 0.52	0.172
Threonine	15.14 ± 0.18	$15.67^{b} \pm 0.38$	$14.53^{a} \pm 0.23$	0.03
Tyrosine	16.20 ± 0.32	$22.65^{b} \pm 0.56$	$19.89^{a} \pm 0.49$	0.010
Valine	15.20 ± 0.59	13.17 ± 0.33	13.28 ± 0.30	0.32
Methionine	11.65 ± 0.42	$15.56^{a} \pm 0.41$	$16.83^{b} \pm 0.48$	0.025
Isoleucine	14.85 ± 0.43	$15.47^{b} \pm 0.82$	$14.92^{a} \pm 0.61$	0.034
Leucine	25.50 ± 0.32	14.22 ± 0.22	14.34 ± 0.47	0.149
Phenylalanine	18.21 ± 0.68	$17.74^{a} \pm 0.41$	$18.61^{b} \pm 0.53$	0.015
Lysine	21.74 ± 0.62	$12.94^{a} \pm 0.53$	$17.71^{b} \pm 0.35$	0.001
Non-essential amino acid composition				
Asparagine	29.38 ± 0.28	$22.75^{a} \pm 0.44$	$23.40^{b} \pm 0.77$	0.034
Cystine	8.18 ± 0.24	11.24 ± 0.46	11.40 ±0.58	0.086
Glutamine*	57.84 ± 0.32	$35.98^{a} \pm 0.40$	$39.45^{b} \pm 0.37$	0.045
Serine	12.06 ± 0.46	11.69 ± 0.56	11.60 ± 0.49	0.074
Glycine*	21.69 ± 0.17	12.06 ± 0.66	12.19 ± 0.34	0.12
Alanine	10.74 ± 0.15	$11.15^{b} \pm 0.21$	$10.67^{a} \pm 0.41$	0.047
Proline*	44.50 ± 0.41	$31.54^{b} \pm 1.95$	$34.67^{a} \pm 1.73$	0.030

Values are reported as arithmetic mean of three replicates ±SE. *conditionally essential amino acids. The mean values of whole body amino acid profile in the same line with different superscripts differ significantly (P < 0.05)

Conclusion

Snubnose pompano is emerging as a candidate species for mariculture due to its tolerance to wide range of salinity; thus, this species can be adopted for culture in areas with low or high salinity. The study concludes that the FCR of *T. blochii* cultured in iRAS is better than pond culture. The low cost fishmeal-based diet developed for this species further reduces the operational cost and increases the profit to the farmers. Thus, it is evident from the present research that *T. blochii* can be cultured profitably in an intensive scale even in indoor RAS facilities wherever space and water is limited. This will facilitate for the generation of significant levels of income especially as food production start-ups.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at http://nopr.niscair.res.in/jinfo/ijms/IJMS_50(10)787-794_SupplData.pdf

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Conflict of Interest

All authors of this manuscript are declaring that no conflict of interest present in this manuscript.

Author Contributions

DLP: Conceptualization, investigation, and writing-original draft preparation; SE: Data curation, and supervision; SC: Visualization, and methodology; KKA: Methodology, and laboratory analysis; PS: Laboratory analysis, and software analysis; and PV: Writing-reviewing and editing MS.

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