Acta Nat. Sci. (2026) 7(1): 43-53
DOI: 10.61326/actanatsci.v7i1.430
e-ISSN: 2718-0638

Original Research Paper
info@actanatsci.com
www.actanatsci.com

ACTA NATURA ET SCIENTIA PRENSIP

Growth Performance and Feed Utilization of Snubnose Pompano (*Trachinotus blochii*) Fed with *Pirenella* sp. as a Dietary Supplement

Edgar F. Somblingo[1,2] • Dan D. Baliao[1] • Roger Edward P. Mamauag[1] • Albert B. Ciacico[1] • Roy C. Villanueva[2]✉

[1] Southeast Asian Fisheries Development Center-Aquaculture Department, Dumangas Brackishwater Station, Dumangas 5006, Iloilo, Philippines; esomblingo@seafdec.org.ph; dbaliao@seafdec.org.ph, ermamauag@seafdec.org.ph; albertciacico@gmail.com
[2] Iloilo State University of Fisheries Science and Technology, College of Fisheries and Aquatic Sciences, Tiwi, Barotac Nuevo, Iloilo 5007, Philippines; esomblingo@seafdec.org.ph; roycvillanueva1978@isufst.edu.ph

✉ Corresponding Author: roycvillanueva1978@isufst.edu.ph

Please cite this paper as follows:
Somblingo, E. F., Baliao, D. D., Mamauag, R. E. P., Ciacico, A. B., & Villanueva, R. C. (2026). Growth Performance and Feed Utilization of Snubnose Pompano (*Trachinotus blochii*) Fed with *Pirenella* sp. as a Dietary Supplement. *Acta Natura et Scientia*, 7(1), 43-53. https://doi.org/10.61326/actanatsci.v7i1.430

ARTICLE INFO

Article History
Received: 03.11.2025
Revised: 09.01.2026
Accepted: 26.01.2026
Available online: 06.03.2026

Keywords:
Growth
Survival
Trachinotus blochii
Sea snail
Pirenella sp.

ABSTRACT

Sustainable aquaculture requires the exploration of alternative, eco-friendly feed sources that can reduce production costs and dependence on commercial feeds. *Pirenella* sp., a common brackish water snail often considered a pest in aquaculture ponds, has potential as a natural feed ingredient for carnivorous fish species such as the snubnose pompano (*Trachinotus blochii*). This study assessed the growth performance, survival rate, and feed conversion ratio (FCR) of snubnose pompano fed with *Pirenella* sp. as a dietary supplement. Nine hapa nets (5 × 5 × 1.5 m) were installed in a brackish water pond and assigned to three treatments with three replicates each: 100% commercial feed (T1), 50% commercial feed + 50% snails (T2), and 100% snails (T3). Results showed that Treatment I achieved the highest growth performance, while Treatment II exhibited comparable outcomes, indicating that partial replacement of commercial feeds with *Pirenella* sp. did not significantly affect growth. Treatment III, which used only snails, produced markedly lower growth metrics ($p<0.05$). Survival rate remained at 100% across all treatments ($P > 0.05$). The lowest FCR (0.34) was recorded in Treatment II, suggesting optimal feed utilization. Although Treatment III had lower growth performance, it was the most cost-efficient due to the natural availability of snails. Overall, the incorporation of *Pirenella* sp. as a supplemental feed demonstrates potential for enhancing sustainability and reducing feed costs in pompano aquaculture while contributing to the biological control of pest snails in brackish water ponds.

INTRODUCTION

Gastropods play a vital role in aquatic ecosystems by contributing to nutrient cycling and serving as food for a variety of organisms. However, some species can become pests in aquaculture systems, where their uncontrolled proliferation poses challenges to pond management and productivity (O'Brien & Pellett, 2022). *Pirenella* sp., an operculated brackish water snail belonging to the family Potamididae (Solanki et al., 2017), is one such species. It is widely regarded as a nuisance in brackish water ponds, particularly in environments where natural predators and competitors are scarce (Zvonareva & Kantor, 2016).

To manage these pest populations, several chemical control methods have been introduced, including the use of triphenyltin (TPT) compounds, Aquatin, and Brestan. Although effective in reducing snail populations, TPT is highly toxic to non-target organisms such as fish, algae, bacteria, and even humans. Due to its detrimental environmental and health impacts, the Philippine Department of Agriculture banned the use of TPT in 1993 following reports of poisoning among rice farmers (Bagarinao & Lantin-Olaguer, 2000). Consequently, the search for sustainable, environmentally friendly, and cost-effective alternatives to chemical control remains a pressing concern in aquaculture management.

Despite their status as pests, mollusks like *Pirenella* sp. possess a favorable nutritional profile (Warsidah et al., 2024) that justifies their selection as a dietary supplement for farmed fish. Generally, gastropods are recognized as a dense source of high-quality animal protein, containing essential amino acids necessary for growth and tissue repair (Batista & Pires, 2022; Warsidah et al., 2024). Furthermore, they are rich in essential minerals, particularly calcium and phosphorus—which are vital for skeletal mineralization—as well as trace elements such as iron, magnesium, and zinc (Batista & Pires, 2022; Warsidah et al., 2024). By leveraging these nutritional benefits, these snails can be transitioned from a biological nuisance into a functional, low-cost feed ingredient.

The snubnose pompano (*Trachinotus blochii*), locally known as "apahan" or "dawis lawin," is a high-value marine fish recognized for its rapid growth, high-quality flesh, and strong market demand. This species has been reported in Indian coastal catches since 1956 and has become an important aquaculture species in several Asia-Pacific countries, including Taiwan and Indonesia (FAO, 2025). Juvenile pompano typically inhabits coastal sandy shores and shallow estuarine bays, while adults are found in offshore coral and rocky reef areas. They are diurnal feeders that consume mollusks, crustaceans, and other hard-shelled invertebrates, such as coquina clams and mole crabs (Froese & Pauly, 2025).

Given their natural feeding preference for mollusks, snubnose pompano may serve as potential biological control agents against pest gastropods like *Pirenella* sp. Utilizing these snails as a supplementary feed could offer dual benefits—reducing pest populations in ponds while providing a cost-effective source of natural feed. In intensive aquaculture systems, feed expenses account for nearly half of the total operational cost (SEAFDEC/AQD, 2024). Therefore, the use of locally available, underutilized, and nutritionally viable organisms such as *Pirenella* sp. may enhance the economic efficiency and sustainability of pompano culture operations.

This study explores the potential of *Pirenella* sp. as a supplemental feed for snubnose pompano and evaluates its capacity to contribute to the biological control of pest snails in brackish water ponds. If proven effective, this approach could significantly reduce the reliance on synthetic molluscicides and lower feed costs, thereby minimizing toxic chemical inputs in aquaculture environments. Moreover, the initiative aligns with several United Nations Sustainable Development Goals (SDGs): SDG 2 (Zero Hunger) by promoting sustainable and resilient food production systems; SDG 12 (Responsible Consumption and Production) by encouraging the use of locally available and underutilized resources; and SDG 14 (Life Below Water) by supporting sustainable aquaculture practices that protect aquatic biodiversity and reduce pressure on wild fish stocks. Overall, this research seeks to contribute to the advancement of environmentally sound, economically viable, and ecologically sustainable aquaculture practices in the

Philippines through the integration of natural pest control and resource-efficient feeding strategies.

MATERIAL AND METHODS

Study Area

The experiment was conducted at Sitio Calubuyan, Barangay Bantud Fabrica, Dumangas, Iloilo, Philippines, within the Dumangas Brackishwater Station (DBS) of SEAFDEC/AQD (Figure 1). The study utilized a 0.5–0.8 ha brackish water pond equipped with a double gate system (wood or concrete) and a separate supply and drainage canal. The pond bottom was leveled, with a gentle slope toward the gate to facilitate complete drainage.

Experimental Design and Setup

The study employed a completely randomized design (CRD) consisting of three treatments, each performed in triplicate (n=3). A total of nine black nylon hapa nets, each measuring 5 × 5 × 1.5 m, were suspended within a common earthen pond.

T. blochii (pompano) fingerlings, with an initial mean body weight (MBW) range of 120.90±.20 g to 133.43±3.2 g, were acclimated for two weeks prior to the commencement of the study. The fish were stocked at a density of 100 individuals per hapa (equivalent to 2.67 fish/m^3), totaling 300 fish per treatment and a collective experimental population of 900 individuals.

The use of triplicate hapa nets per treatment was selected to balance statistical power with the logistical requirement of maintaining identical water quality and minimizing environmental stressors across all units. This level of replication is consistent with established protocols for large-scale field trials in fish nutritional and performance studies (Kalidas et al., 2012; Babu et al., 2025), ensuring that inter-unit variability is accounted for while maintaining the feasibility of the trial within a common pond ecosystem.

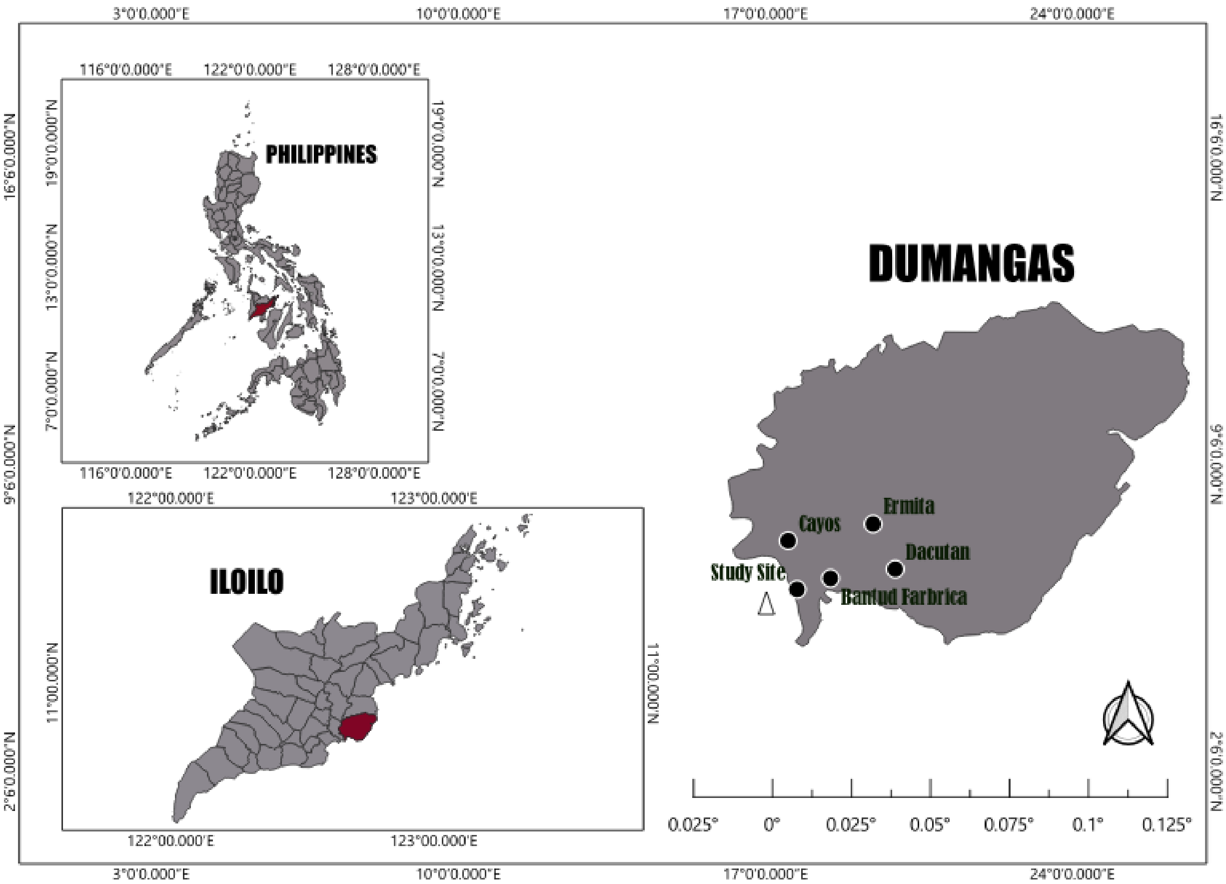

Figure 1. Experimental site located at the Dumangas Brackish Station of the SEAFDEC/AQD, Dumangas, Iloilo, Philippines

Pond Preparation

The pond was completely drained and sun-dried for 1-2 weeks until surface cracks appeared. The topsoil layer containing accumulated organic waste was removed, and the pond bottom was plowed to a depth of approximately 30 cm. Feeding areas, corners, and side ditches were tilled and dried to prevent anaerobic "black soil" formation. Agricultural lime was applied to neutralize soil pH. Prior to water filling, the inlet pipe was fitted with two layers of 100-μm fine mesh to prevent the entry of unwanted organisms.

Water Culture and Management

Water was sourced by gravity flow or pumping from a reservoir. The pond was fertilized one week prior to stocking with organic (10-30 kg/ha) and inorganic (1-3 kg/ha) fertilizers to promote plankton bloom, essential for early pompano growth. Water depth was maintained at 1 m throughout the culture period. A weekly 10% water exchange was implemented during the first three months, increasing to 20% thereafter. Agri-lime was applied regularly to maintain pH between 7.5 and 8.5. Water quality parameters recorded during the experiment were given in Table 1.

Table 1. Water quality parameters maintained during the experiment

Parameter	Range
Salinity (‰)	25-33
Temperature (°C)	26-32
Dissolved oxygen (ppm)	4-8
pH	6.5-8.5
Transparency (cm)	35-45
Water color	Light green to brownish-green

Source of Fingerlings and Feed Materials

Snubnose pompano juveniles (average body weight ranging from 120.9 ± 0.20 g to 133.43 ± 3.20 g and total length from 19.14 ± 0.06 cm to 19.46 ± 0.19 cm) were obtained from the SEAFDEC/AQD Dumangas Brackishwater Station. *Pirenella* sp. snails were collected from nearby snail-infested ponds and identified taxonomically before use. Only young, active snails were selected for feeding.

Stocking and Feeding Management

Snubnose pompano juveniles were stocked at a density of 100 individuals per hapa net for each treatment, with a total of 900 fish used in the experiment. The fish were fed three times daily throughout the culture period. Treatment I fish were fed exclusively with commercial pompano feed, while Treatment II received a mixed diet consisting of 50% commercial feed and 50% snail meat derived from *Pirenella* sp. Treatment III fish were provided with whole *Pirenella* sp. snails only, which were placed in feeding trays inside the hapa nets. To ensure experimental control, each hapa was covered with a fine-mesh net to prevent snail escape and to protect the fish from potential predators.

Proximate Composition of the Commercial Feeds and Snails

The proximate compositions (moisture content, crude protein, crude lipid, ash, and crude fiber) of the whole *Pirenella* sp. (shell and soft tissue) and commercial feeds were determined following AOAC (2016) standard procedures. Moisture content was determined using the gravimetric method (oven drying at 105°C). Crude protein was analyzed using the Kjeldahl method, with nitrogen converted to protein using a factor of 6.25. Crude lipid was investigated using Soxhlet extraction with a non-polar solvent. Ash content was determined via the dry ashing method (muffle furnace incineration at 550-600°C). Lastly, crude fiber was determined through sequential acid-alkali digestion of the defatted sample.

The proximate composition of the commercial feeds used in the experiment is presented in Table 2. The crude protein content of the feeds ranged from 44% to 48%, with PO1 and PO2 containing the highest levels (48%), followed by PN2F (46%) and PN3F-PN4F (44%). All feeds had a uniform moisture content of 12% and crude fiber content of 4%. The crude fat content varied between 7% and 14%, with PN2F showing the highest value (14%), while the ash content ranged from 15% to 16%.

Meanwhile, the proximate composition of *Pirenella* sp. snails (Table 3) revealed that the snail meat contained 4.81% crude protein, 43.11% moisture, 0.26% crude fat, 4.35% crude fiber, and 89.83% ash. These results indicate that *Pirenella* sp. has relatively low protein and lipid contents compared to commercial feeds but is rich in mineral components, as reflected by its high ash content.

Table 2. Proximate composition of commercial feeds

Nutrient	PN3F (1-30 days)	PN4F (31-60 days)
Crude protein (%)	44	44
Moisture (%)	12	12
Crude fat (%)	12	12
Crude fiber (%)	4	4
Ash (%)	15	15

Table 3. Proximate composition of *Pirenella* sp. snails

Nutrient	Value (%)
Protein	4.81
Moisture	43.11
Crude fat	0.26
Crude fiber	4.35
Ash	89.83

Sampling and Monitoring

Growth performance and survival were assessed every 15 days (Days 0, 15, 30, 45, and 60). At the start of the trial, each replicate was stocked with 100 fish. During each 15-day sampling event, all fish remaining in the cage were measured for total length and body weight to calculate absolute body weight (ABW), specific growth rate (SGR), and weight gain (WG). Following these measurements, 10 fish per replicate were randomly selected and removed for gut content analysis (independent study; results not included here). Consequently, the number of fish measured per replicate decreased by 10 at each subsequent sampling interval (e.g., 100 fish at Day 0, 90 fish at Day 15, etc.)

In Treatments II and III, snail consumption was monitored by counting and weighing remaining snails and recording cracked shells as indicators of feeding activity.

Water quality parameters (pH, salinity, temperature, dissolved oxygen, and turbidity) were measured twice daily (morning and afternoon).

Data Collection and Calculations

To evaluate the growth performance and feed utilization of the fish, the following parameters were calculated according to standard formulas given below in Equations 1-5:

$$ABW = \frac{Total\ weight\ of\ fish\ samples}{Number\ of\ fish\ sampled} \quad (1)$$

$$WG = Final\ weight - Initial\ weight \quad (2)$$

$$SGR = \frac{\ln(Final\ weight) - \ln(Initial\ weight)}{Number\ of\ days} \times 100 \quad (3)$$

$$Survival\ Rate(\%) = \frac{Final\ number\ of\ live\ fish}{Total\ number\ of\ fish\ stocked} \times 100 \quad (4)$$

$$FCR = \frac{Total\ feed\ consumed\ (dry\ weight)}{Wet\ weight\ gain\ of\ fish} \quad (5)$$

To ensure a standardized comparison between the dry commercial diet and the live snail diet, feed conversion ratio (FCR) was calculated on a dry matter basis. Live snails (including shells) were oven-dried at 60°C to determine a dry matter content of 43.11 %. Total feed intake for Treatments II and III was then adjusted to reflect dry matter intake before calculating FCR.

Data Analysis

Growth and survival data were subjected to one-way analysis of variance (ANOVA) at a 5% significance level to determine differences among treatments. Where significant differences were observed, least significant difference (LSD) and Tukey's HSD post-hoc tests were applied for mean comparison.

RESULTS AND DISCUSSION

Growth Performance

The present study evaluated the effects of dietary composition on the growth performance and survival of snubnose pompano (*T. blochii*) over a 60-day culture period. Three dietary treatments were tested: Treatment I: 100% commercial feed, Treatment II: 50% commercial feed + 50% snails, and Treatment III: 100% snail-based feed.

Table 4 presents the mean initial average body weight (ABW) and total length of snubnose pompano at stocking. Initial sizes were comparable across treatments, with ABW ranging from 120.9 ± 0.20 g to 133.43 ± 3.20 g and total length from 19.14 ± 0.06 cm to 19.46 ± 0.19 cm. There were no significant differences ($p > 0.05$) in total length, indicating uniform initial conditions among treatments.

Table 4. Mean initial average body weight (ABW) and length of snubnose pompano *Trachinotus blochii*

Growth Parameters	Treatment I	Treatment II	Treatment III
ABW	125.86±2.2	133.43±3.2	120.90±.20
Total length	19.22±.20	19.14±.06	19.46±.19

Table 5. Growth performance of snubnose pompano (*Trachinotus blochii*) every 15 days, fed with 100% feeds, 50% feeds and 50% snails, and 100% snails for 60 days of culture

Parameters	Day	Treatment I	Treatment II	Treatment III
Average body weight	15	160.53±1.6^{a}	163.39±6.81^{a}	127.30±.30^{b}
Weight gain (g)		34.66±2.1^{a}	30.09±9.4^{a}	6.43±.49 ^{b}
Specific growth rate		2.31±.14^{a}	2.00±.62^{a}	0.42±0.33^{b}
Total length		20.11±1.40^{a}	20.78±.22^{a}	19.78±.17^{a}
Survival rate (%)		100.00±0.00^{a}	100.00±0.00^{a}	100.00±0.00^{a}
Average body weight	30	175.66±1.4^{a}	177.51±6.7^{a}	133.11±1.52^{b}
Weight gain (g)		15.1±3.02^{a}	14.06±1.27^{a}	5.83±1.70^{b}
Specific growth rate		1.00±.20^{a}	0.93±.08^{a}	0.38±.11^{b}
Total length		21.33±.19^{a}	22.09±.14^{a}	20.32±.06^{b}
Survival rate (%)		100.00±0.00^{a}	100.00±0.00^{a}	100.00±0.00^{a}
Average body weight	45	193.76±1.2^{a}	194.5±3.5^{a}	134.92±1.4^{b}
Weight gain (g)		18.06±.48^{a}	17.09±5.5^{a}	1.81±.08^{b}
Specific growth rate		1.20±.03^{a}	1.13±.37^{a}	0.73±.62^{b}
Total length		22.54±.09^{a}	22.97±.11^{a}	20.94±.12^{b}
Survival rate (%)		100.00±0.00^{a}	100.00±0.00^{a}	100.00±0.00^{a}
Average body weight	60	211.43±3.30^{a}	215.88±4.34^{a}	138.3±1.06^{b}
Weight gain (g)		21.00±2.70^{a}	23.21±3.65^{a}	3.46±.39^{b}
Specific growth rate		1.40±.18^{a}	1.46±.27^{a}	0.22±.02^{b}
Total length		23.99±.05^{a}	24.25±.10^{a}	21.76±.24^{b}
Survival rate (%)		100.00±0.00^{a}	100.00±0.00^{a}	100.00±0.00^{a}

Note: *Values are expressed as mean ± standard error (n = 3). Means in the same row with different superscript letters are significantly different ($p < 0.05$) based on one-way ANOVA.

Growth performance results are summarized in Table 5. During the first 15 days, snubnose pompano fed with 100% commercial feed (Treatment I) exhibited the highest mean weight gain (34.66 ± 2.1 g), followed by the 50:50 feed-snail group (30.09 ± 9.4 g), while the snail-fed group (Treatment III) showed minimal gain (6.43 ± 0.49 g). This trend continued through Day 30 and Day 45, where Treatments I and II maintained significantly higher growth rates than Treatment III ($p < 0.05$). By the end of the 60-day culture, Treatment II (50% commercial feed + 50% snails) achieved the highest mean weight gain (23.21 ± 3.65 g), slightly higher but statistically comparable to Treatment I (21.00 ± 2.70 g). Both treatments showed markedly better performance than the snail-only diet (3.46 ± 0.39 g). The specific growth rate (SGR) after 60 days were 1.40 ± 0.18 % day^{-1} for Treatment I, 1.46 ± 0.27% day^{-1} for Treatment II, and 0.22 ± 0.02% day^{-1} for Treatment III.

These results clearly indicate that snubnose pompano fed with 100% commercial feed or a 50:50 mixture of feed and snails exhibited superior growth performance compared with those fed only with snails. The comparable growth between Treatments I and II suggests that partial replacement of commercial feed with snail meat did not compromise nutrient intake or growth potential.

Formulated feeds are specifically designed to provide balanced levels of protein, lipid, and essential micronutrients required by snubnose pompano (Viet et al., 2022). The comparable performance of Treatment II supports the possibility that snail meat can supply a portion of the animal protein requirements, potentially improving feed palatability and stimulating feeding behavior. Similar findings have been reported in *T. ovatus*, where partial replacement of fishmeal with alternative protein sources did not significantly affect growth (Ma et al., 2020).

The markedly low growth observed in Treatment III aligns with findings in other carnivorous species such as cobia (*Rachycentron canadum*), where natural mollusk diets alone resulted in poor performance due to amino acid imbalance and low energy density (Oliva-Teles et al., 2006). The low SGR in this treatment (0.29% day^{-1}) likely reflects inadequate digestible protein and lipid content in snails (Milinsk et al., 2006), underscoring the importance of balanced formulated diets in intensive culture systems.

Survival Rate

Survival rates remained at 100% across all treatments throughout the 60-day period, with no significant differences among groups ($p > 0.05$). This indicates that all diets supported basic physiological maintenance and that the culture environment was conducive to fish health.

High survival suggests that experimental conditions such as water quality, stocking density, and feeding protocols were optimal. These results are consistent with earlier studies on *T. blochii*, which reported survival rates exceeding 95% under good pond management (Juniyanto et al., 2008; Jayakumar et al., 2014).

The ability of snubnose pompano to thrive under varying salinities (Young et al., 2021) and its resilience against common marine pathogens (Lan et al., 2022) may have also contributed to these outcomes. Maintaining optimal temperature, dissolved oxygen, and pH likely minimized stress, preventing immune suppression and mortality (Tacon & Metian, 2015).

While dietary composition had a marked effect on growth, it did not influence survival. This observation agrees with Glencross et al. (2016), who reported that juvenile snubnose pompano can maintain high survival even on suboptimal diets, though growth may be impaired. Thus, survival reflects the adequacy of environmental conditions, whereas growth performance more directly indicates nutritional sufficiency.

Feed Conversion Ratio (FCR)

Feed conversion ratio (FCR) values after 60 days are summarized in Table 6. Treatment II (50% commercial feed + 50% snails) achieved the lowest FCR values (0.34 ± 0.01), indicating the most efficient feed utilization. Treatment I (100% commercial feed) recorded slightly higher FCRs (0.47 ± 0.01), while Treatment III (100% snails) showed the highest FCR (1.13 ± 0.12), reflecting poor feed efficiency.

Table 6. Average feed conversion ratio (FCR) of *Trachinotus blochii* fed with different dietary treatments for 60 days

Treatment	FCR
Treatment I	0.47 ± 0.02[b]
Treatment II	0.34 ± 0.01[c]
Treatment III	1.13 ± 0.12[a]

Note: Treatment I (100% commercial feed), Treatment II (50% commercial feed + 50% snails), Treatment III (100% snails). Values are mean ± standard error (n=3). Means in the same column with different superscript letters are significantly different ($p < 0.05$) based on one-way ANOVA followed by Tukey's HSD test.

The superior FCR in Treatment II likely resulted from the complementary nutritional properties of the two feed components. Commercial diets meet the full nutritional requirements of snubnose pompano (Glencross et al., 2016; Lan et al., 2022), while snail meat provides fresh animal protein that enhances palatability and feed intake. The synergy between formulated feed and natural feed may have improved nutrient digestibility and assimilation, similar to results observed in other marine fish supplemented with natural ingredients (Yones & Metwalli, 2015).

The moderately higher FCR in Treatment I may be due to the absence of natural feeding stimuli found in mixed diets, which can enhance enzyme activity and digestive efficiency (De Silva & Anderson, 1995). Conversely, the high FCR of the snail-only group (Treatment III) can be attributed to the limited nutrient content of snails, particularly deficiencies in essential amino acids and fatty acids (Young et al., 2021). Variable nutrient composition may also have contributed to inconsistent intake and growth (Shi et al., 2023).

From an economic perspective, Treatment III had the lowest feed cost due to the availability of snails as a natural resource in brackish water ponds. However, its poor growth performance limits its suitability for commercial use. Treatment II offers a more balanced approach, reducing commercial feed costs by 50% while maintaining efficient feed utilization and good growth. Similar results were reported by Pham et al. (2021), where supplementing formulated feeds with low-cost natural ingredients reduced production expenses without compromising performance.

CONCLUSION

This study demonstrated that the partial replacement of commercial feed with *Pirenella* sp. in the diet of snubnose pompano (*T. blochii*) can sustain optimal growth and feed utilization while maintaining 100% survival. Fish fed with a 50:50 ratio of commercial feed and snails exhibited comparable growth performance and superior feed conversion efficiency to those fed solely with commercial diets, indicating that *Pirenella* sp. can serve as an effective, sustainable, and low-cost supplemental feed. In contrast, exclusive feeding with snails resulted in poor growth, underscoring the need for balanced nutrient formulation. The integration of *Pirenella* sp. into snubnose pompano culture systems not only reduces feed costs but also provides a natural means of controlling pest snail populations in brackish water ponds, contributing to more eco-friendly and cost-efficient aquaculture practices. Further studies should focus on optimizing the inclusion levels of *Pirenella* sp. in formulated diets, evaluating its nutritional digestibility, and assessing long-term effects on fish health and product quality under different culture conditions.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the following individuals for their invaluable assistance and technical support during the conduct of this study: Jesus G. Apelacio, Jefran T. Arellado, May Vincent A. Arellano, Julie B. Biogos, Roselie S. Cabatia, John Andrew C. Cercado, Joshua V. Dela Peña, Ralen A. Depamaylo, Mary Jane D. Embalsado, Roderix E. Escosa, Brench T. Genzola, Johnbert L. Godio, Efren J. Gonzales Jr., Felix J. Javero, Dominador J. Leabres, Dominic J. Leabres, Melben M. Magpili, Lister G. Salvaria, Russel D. Somblingo, and Ronnie H. Teñefrancia.

Compliance with Ethical Standards

Authors' Contributions

EFS: Conceptualization, Supervision, Writing – original draft, Funding acquisition, Formal Analysis.

DDB: Investigation, Methodology.

REPM: Investigation, Methodology.

ABC: Investigation, Methodology.

EFS: Conceptualization, Supervision, Writing – review and editing.

All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

Approval was obtained from the ethics committee of Iloilo State University of Fisheries Science and Technology. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Funding

This study was financially supported by Southeast Asian Fisheries and Development Center-Aquaculture Department (SEAFDEC/AQD) with grant number: 5310-T-TV-F0224D.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Disclosure

The authors confirm that no generative AI was used in writing this manuscript or creating images, tables, or graphics.

REFERENCES

AOAC. (2016). *The official methods of analysis of AOAC International* (20th ed.). AOAC International.

Bagarinao, T., & Lantin-Olaguer, I. (2000). From triphenyltins to integrated management of the 'pest' snail *Cerithidea cingulata* in mangrove-derived milkfish ponds in the Philippines. *Hydrobiologia, 437*(1–3), 1-16. https://doi.org/10.1023/A:1026580726648

Batista, I., & Pires, C. (2023). *A review of the nutritional value of bivalve molluscs and gastropods*. Relatórios Científicos e Técnicos do IPMA (No. 41). Instituto Português do Mar e da Atmosfera.

De Silva, S. S., & Anderson, T. A. (1995). *Fish nutrition in aquaculture*. Chapman & Hall.

FAO. (2025). Dialogue on emerging markets: The golden pompano. Retrieved on August 14, 2025, from https://www.fao.org/in-action/globefish/news-events/news/news-detail/dialogue-on-emerging-markets--the-golden-pompano/en

Froese, R., & D. Pauly. (Eds.) (2025). *Trachinotus blochii*. In FishBase species summary. Retrieved on August 14, 2025, from https://www.fishbase.se/summary/trachinotus-blochii

Glencross, B., Blyth, D., Irvin, S., Bourne, N., Campet, M., Boisot, P., & Wade, N. M. (2016). An evaluation of the complete replacement of both fishmeal and fish oil in diets for juvenile Asian seabass, *Lates calcarifer*. *Aquaculture, 451*, 298–309. https://doi.org/10.1016/j.aquaculture.2015.09.012

Jayakumar, R., Abdul Nazar, A. K., Tamilmani, G., Sakthivel, M., Kalidas, C., Rameshkumar, P., Hanumanta Rao, G., & Gopakumar, G. (2014). Evaluation of growth and production performance of hatchery produced silver pompano *Trachinotus blochii* (Lacépède, 1801) fingerlings under brackishwater pond farming in India. *Indian Journal of Fisheries*, *61*(3), 58-62.

Juniyanto, N. M., Akbar, S., & Zakimin, Z. (2008). Breeding and seed production of silver pompano (*Trachinotus blochii*, Lacepede) at the Mariculture Development Center of Batam. *Aquaculture Asia Magazine, 13*(2), 46-48.

Kalidas, C., Sakthivel, M., Tamilmani, G., Ramesh Kumar, P., Abdul Nazar, A. K., Jayakumar, R., Balamurugan, Ramkumar, Jothi, P., & Gopakumar, G. (2012). Survival and growth of juvenile silver pompano *Trachinotus blochii* (Lacepède, 1801) at different salinities in tropical conditions. *Indian Journal of Fisheries*, *59*(3), 95-98.

Lan, H. -Y., Afero, F., Huang, C. -T., Chen, B. -Y., Huang, P. -L., & Hou, Y. -L. (2022). Investment feasibility analysis of large submersible cage culture in Taiwan: A case study of snubnose pompano (*Trachinotus anak*) and cobia (*Rachycentron canadum*). *Fishes*, *7*(4), 151. https://doi.org/10.3390/fishes7040151

Ma, Y., Xu, C., Li, M., Chen, H., Ye, R., Zhang, G., Xie, D., Ning, L., Wang, S., Sun, L., Wang, Y., & Li, Y. (2020). Diet with a high proportion replacement of fishmeal by terrestrial compound protein displayed better farming income and environmental benefits in the carnivorous marine teleost (*Trachinotus ovatus*). *Aquaculture Reports*, *18*, 100449. https://doi.org/10.1016/j.aqrep.2020.100449

Milinsk, M. C., das Graças Padre, R., Hayashi, C., de Oliveira, C. C., Visentainer, J. V., de Souza, N. E., & Matsushita, M. (2006). Effects of feed protein and lipid contents on fatty acid profile of snail (*Helix aspersa maxima*) meat. *Journal of Food Composition and Analysis*, *19*(2-3), 212-216. https://doi.org/10.1016/j.jfca.2004.09.011

O'Brien, M. F., & Pellett, S. (2022). Diseases of Gastropoda. *Frontiers in Immunology*, *12*, 802920. https://doi.org/10.3389/fimmu.2021.802920

Oliva-Teles, A., Guedes, M. J., Vachot, C., & Kaushik, S. J. (2006). The effect of nucleic acids on growth, ureagenesis and nitrogen excretion of gilthead sea bream *Sparus aurata* juveniles. *Aquaculture*, *253*(1-4), 608-617. https://doi.org/10.1016/j.aquaculture.2005.09.010

Pham, H. D., Siddik, M. A., Van Phan, U., Le, H. M., & Rahman, Md. A. (2021). Enzymatic tuna hydrolysate supplementation modulates growth, nutrient utilisation and physiological response of pompano (*Trachinotus blochii*) fed high poultry-by product meal diets. *Aquaculture Reports*, *21*, 100875. https://doi.org/10.1016/j.aqrep.2021.100875

SEAFDEC/AQD. (2024). *Development of cost- efficient feeds*. Southeast Asian Fisheries Development Center / Aquaculture Department. Retrieved on August 14, 2025, from https://www.seafdec.org.ph/development-of-cost-efficient-feeds/

Shi, L., Song, F., Xing, S., Zhang, W., Liang, Y., Zhang, K., Sun, J., & Luo, J. (2023). The muscle nutritional components analysis of golden pompano (*Trachinotus blochii*) in different mariculture area, growth stages, and genders. *Frontiers in Nutrition*, *10*, 1148687. https://doi.org/10.3389/fnut.2023.1148687

Solanki, D., Kanejiya, J., & Gohil, B. (2017). Ecological status of *Pirenella cingulata* (Gmelin, 1791) (Gastropod: Potamididae) in mangrove habitat of Ghogha coast, Gulf of Khambhat, India. *Cibtech Journal of Zoology*, *6*(2), 10-16.

Suresh Babu, P. S., Talwar, P., Anuraj, A., Ebeneezar, S., Shilta, M. T., Kurva, R. R., Revankar, S., & Pal, M. (2025). Impact of short-term stunting on growth and biochemical composition of snubnose pompano *Trachinotus blochii* (Lacepede 1801). *Indian Journal of Fisheries*, *72*(2), 77-83. https://doi.10.21077/ijf.2025.72.2.135868-09

Tacon, A. G. J., & Metian, M. (2015). Feed matters: Satisfying the feed demand of aquaculture. *Reviews in Fisheries Science & Aquaculture*, *23*(1), 1-10. https://doi.org/10.1080/23308249.2014.987209

Viet, L. Q., Hien, T. T. T., Tu, T. L C., Khoa, T. N. D., Linh, D. T. N., Gam, N. T. H., Waqalevu V., Tomonari, K., Koshio, S., Phu, T. Q., & Hai, T. N. (2022). Effects of dietary protein and lipid levels on growth, feed utilization and body composition of juvenile snubnose pompano (*Trachinotus blochii)*. *Aquaculture, Aquarium, Conservation & Legislation*, *15*(6), 2840-2849.

Warsidah, Safitri, I., Sofiana, M. S. J., & Oktavia. (2024). Proximate and macromineral content of gastropods in the mangrove area of Desa Bakau Sambas Regency. *Jurnal Ilmiah PLATAX*, *12*(1), 249-260. https://doi.org/10.35800/jip.v12i1.54376

Yones, A. M. M., & Metwalli, A. A. (2015). Effects of fish meal substitution with poultry by-product meal on growth performance, nutrients utilization and blood contents of juvenile Nile Tilapia (*Oreochromis niloticus*). *Journal of Aquaculture Research and Development*, *7*(1), 389-395.

Young, B. C., Hussain Alfaggeh, R., & AlMoutiri, I. (2021). Larviculture of snubnose pompano under conditions of high salinity. *North American Journal of Aquaculture*, *83*(1), 38-40. https://doi.org/10.1002/naaq.10173

Zvonareva, S., Kantor, Y., Li, X., & Britayev, T. (2015). Long-term monitoring of Gastropoda (Mollusca) fauna in planted mangroves in central Vietnam. *Zoological Studies*, *54*, 39. https://doi.org/10.1186/s40555-015-0120-0