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Population Dynamics, Somatic Growth, and Mortality Patterns of *Leukoma asperrima* (Bivalvia: Veneridae) in the Panamanian Pacific

Dinámica Poblacional, Crecimiento Somático y Patrones de Mortalidad de *Leukoma asperrima* (Bivalvia: Veneridae) en el Pacífico Panameño

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ABSTRACT

Sustainable management of commercial bivalves in the Eastern Tropical Pacific requires an in-depth understanding of their bionomics in response to seasonal oceanographic variability. This study evaluated the growth and mortality dynamics of *Leukoma asperrima* in the Gulf of Panama over an annual cycle (November 1995 – October 1996). The population exhibited a mean shell length of 25.99 mm and a total weight of 7.05 g, with significant fluctuations associated with the coastal upwelling regime. Results revealed non-uniform growth across cohorts; the highest longitudinal increment rate was recorded in intermediate-sized individuals (0.109 mm/month), whereas maximum weight gain (0.13 g/month) was observed in larger specimens, suggesting high efficiency in phytoplankton assimilation during the rainy season. Average monthly mortality was 11.3%, with critical peaks in October (21.5%) and January (19.42%) linked to post-reproductive stress and senescence. The detection of endoparasites in gonadal tissue is postulated as a determining factor in tissue disorganization and adult survival. These findings highlight the importance of environmental and pathological factors in regulating *L. asperrima* biomass, providing critical parameters for the implementation of fisheries exploitation models.

Keywords: coastal upwelling, bivalve bionomics, allometric growth, *Leukoma asperrima*, fisheries management, seasonal mortality, Eastern Tropical Pacific.

Resumen
La gestión sostenible de los bivalvos comerciales en el Pacífico Este Tropical requiere un conocimiento profundo de su bionomía en respuesta a la variabilidad oceanográfica estacional. Este estudio evaluó la dinámica de crecimiento y mortalidad de *Leukoma asperrima* en el Golfo de Panamá durante un ciclo anual (noviembre 1995 – octubre 1996). La población exhibió una talla media de 25.99 mm y un peso de 7.05 g, con fluctuaciones significativas asociadas al régimen de afloramiento costero. Los resultados revelaron que el crecimiento no es uniforme entre cohortes; la mayor tasa de incremento longitudinal se registró en individuos de talla intermedia (0.109 mm/mes), mientras que el crecimiento ponderal máximo (0.13 g/mes) se observó en ejemplares de mayor tamaño, sugiriendo una alta eficiencia en la asimilación de fitoplancton durante la temporada lluviosa. La mortalidad mensual promedio fue del 11.3%, con picos críticos en octubre (21.5%) y enero (19.42%), vinculados al estrés post-reproductivo y la senescencia. La presencia detectada de endoparásitos en el tejido gonadal se postula como un factor determinante en la desorganización tisular y la supervivencia de los adultos. Estos hallazgos subrayan la importancia de los factores ambientales y patológicos en la regulación de la biomasa de *L. asperrima*, proporcionando parámetros críticos para la implementación de modelos de explotación pesquera.

Palabras claves: afloramiento costero, bionomía de bivalvos, crecimiento alométrico, *Leukoma asperrima*, manejo pesquero, mortalidad estacional, Pacífico Este Tropical

INTRODUCTION

The white clam, *Leukoma asperrima* (Sowerby, 1835), constitutes one of the most ecologically relevant and economically promising benthic resources for coastal communities in the Central American Pacific. In the Gulf of Panama, the dynamics of these populations are intrinsically linked to seasonal environmental variability, particularly the coastal upwelling phenomenon occurring between January and April. This oceanographic event, characterized by the ascent of nutrient-rich deep waters, generates drastic fluctuations in temperature and salinity, which in turn regulate primary productivity and the availability of phytoplankton, the primary energy source for filter-feeding bivalves. Growth in bivalve mollusks is not a linear process but an adaptive response to exogenous factors such as water temperature and available food ration.

According to Bayne (1976), growth efficiency is a function of animal size and the nutritional value of the ingested food. In tropical systems, it has been postulated that growth rates may decrease upon reaching sexual maturity due to energy reallocation toward gametogenesis. However, research on the genus *Leukoma* suggests variable patterns where the energy required for reproduction may limit or delay somatic growth depending on the species' metabolic strategy.

Authors such as Ansell (1961) have emphasized that the relationship between growth and the reproductive cycle is highly specific and depends on the energy balance accumulated in storage tissues prior to the gonadal proliferation phase. Conversely, mortality in marine bivalves is a multifactorial phenomenon including predation, thermal stress, sedimentation, and parasitic pathologies. Kautsky (1982) notes that food shortages and reproductive metabolic stress can exacerbate mortality rates in natural populations.

In *L. asperrima*, the presence of endoparasites that disorganize gonadal tissue has been documented, representing a critical pathological factor for population survival. Broom (1982) contends that in intertidal bivalves, mortality due t

post-reproductive stress can account for up to 20% of annual population loss, which is consistent with observations along the Panamanian Pacific coast. The present study aims to evaluate variations in size, weight, and mortality of *L. asperrima* under the fluctuating conditions of the Panamanian Pacific, providing fundamental data for the biological management of the resource.

MATERIALS AND METHODS

Collection and Culture Area

Specimens were collected at Playa Bique (8° 53' 27" N, 79º 39' 44" W), a sandy-muddy shoreline in the Arraiján District. Subsequently, they were transferred to the Smithsonian Tropical Research Institute (S.T.R.I.) facilities at Isla Naos (8° 54' 55" N, 79° 31' 37" W). Organisms were placed in lantern nets with pearl net subdivisions at a density of 30 individuals per basket.

Biometric Analysis and Growth Rates

Total length (L) was determined for everyone using a digital caliper (±0.01 mm precision), and total wet weight (*W*) was measured with an analytical balance (±0.01 g). The population was categorized into five size classes for differential analysis (See Table 1). Monthly growth rates (TC) were calculated using the relationship:

$$TC = \frac{L_f - L_i}{\Delta t}$$

Table 1.
Size classification of L. asperrima based on shell height.

Size	Shell Height
1	17.0-21.0 mm
2	21.1-24.0 mm
3	24.1-27.0 mm
4	27.1-31.0 mm
5	31.1 mm-36.0 mm

Mortality Estimation and Statistical Analysis

Mortality was quantified monthly as the percentage of dead individuals (empty valves with remaining tissue or evidence of recent predation) relative to the total sample. Data normality was verified using the Shapiro-Wilk test. Due to the non-parametric nature of the mortality distribution, the Kruskal-Wallis test was applied to evaluate significant differences between months and size classes ($P < 0.05$).

RESULTS

Population Structure and Biometric Variation

The *Leukoma asperrima* population exhibited relative biometric stability, with an average annual size of 25.99 mm and a total weight of 7.05 g. A marginal increase in parameters was observed during the transition to the rainy season (May-October), where size rose to 26.14 mm and weight to 7.18 g, compared to the 25.77 mm and 6.88 g recorded at the start of the cycle.

Growth Rate Analysis

Longitudinal and ponderal growth exhibited allometric variations according to size class (Table 2). The highest longitudinal growth rate was quantified in Size Class 3 at 0.109 mm/month, while maximum weight gain was recorded in Size Class 5 with an increment of 0.13 g/month. The average population growth was 0.081 mm/month and 0.05 g/month.

Table 2.
Monthly growth dynamics by size range in L. aspérrima

Size Class	Length Growth (mm/month)	Weight Growth (g/month)
Talla 1-2	0.049	0.05
Talla 3	0.109	0.05
Talla 4	0.084	0.04
Talla 5	0.083	0.13

Mortality Patterns

The average annual mortality stood at 11.3%. Statistical analysis (Kruskal-Wallis) confirmed significant differences between months ($P < 0.05$). The lowest mortality levels were reported in March (3.3%), while critical peaks occurred in October (21.5%) and January (19.42%). By category, Size Class 4 exhibited the greatest vulnerability, with a cumulative mortality of 12.4%.

DISCUSSION

The growth patterns observed in *L. asperrima* during the annual cycle in the Panamanian Pacific reflect phenotypic plasticity adapted to high environmental variability regimes. The reported mean size (25.99 mm) and weight (7.05 g) are consistent with descriptions by Palacios (1985) for populations in the Gulf of Nicoya, suggesting a stable bionomic structure for the species in the Eastern Tropical Pacific.

A critical finding was the acceleration of the longitudinal growth rate during the juvenile-adult stage (Size Class 3: 0.109 mm/month) and the maximum weight increment in the largest specimens (Size Class 5: 0.13 g/month). This phenomenon contradicts the classic model of declining post-maturity growth in tropical bivalves, suggesting that *L. asperrima* possesses high metabolic efficiency to capitalize on phytoplankton peaks during the rainy season and upwelling periods. Ansell (1961) postulates that somatic growth in venerids is contingent upon the balance between food ration and the energy cost of reproduction; in this study, the weight gain in Size Class 5 indicates substantial reserve accumulation prior to spawning events.

Mortality dynamics (11.3% average) showed marked seasonality. The peak recorded in October (21.5%) coincides with maximum reproductive effort and the end of the rainy season, suggesting post-spawning physiological weakening. Conversely, the high mortality in January (19.42%) may be linked to the initial thermal stress of upwelling or the senescence of individuals reaching their biological limit following the massive end-of-year spawning. The identification of endoparasites in gonadal tissue reinforces the hypothesis that local pathologies act as limiting factors for survival, disorganizing tissue architecture and compromising population resilience to environmental fluctuations.

CONCLUSIONS

The *L. asperrima* population in the Gulf of Panama exhibits a stable biometric structure, with an average annual size of 25.99 mm and a weight of 7.05 g, reflecting successful adaptation to the region's seasonal regimes.

Somatic growth in this species does not follow a linear post-maturity decline; instead, larger specimens (Size Class 5) show the highest weight increment rate (0.13 g/month), indicating high metabolic efficiency in energy assimilation during periods of high phytoplankton productivity.

Mortality exhibits marked seasonality with a monthly average of 11.3%, reaching critical peaks exceeding 20% in October—a phenomenon closely linked to physiological stress from massive

reproductive effort and the potential incidence of gonadal endoparasites.

It is concluded that the population dynamics of *L. asperrima* are regulated by a complex interaction between exogenous factors (food availability and temperature) and endogenous factors (reproductive cost), which must be considered when formulating closed seasons and minimum catch sizes to ensure resource resilience.

REFERENCES

Ansell, A. (1961). Reproduction, growth and mortality of *Venus striatula* (Da Costa) in Kames Bay, Millport. *Journal of the Marine Biological Association of the United Kingdom*, 41, 191-215.

Avilés, M. C. (1976). *Estudios Histológicos de Protothaca asperrima (Sowerby, 1835) (Mollusca, Pelecypoda) en Panamá*. Tesis de Licenciatura, Universidad de Panamá, Panamá.

Bayne, B. L. (1976). *Marine Mussels: Their Ecology and Physiology*. Cambridge University Press, Cambridge.

Broom, M. J. (1982). Analysis of the growth of *Anadara granosa* (L.) (Bivalvia: Arcidae) in natural, artificial and experimental populations. *Marine Ecology Progress Series*, 9, 77-89.

Kautsky, N. (1982). Quantitative studies of the gonad cycle, fecundity and reproductive output in a Baltic *Mytilus edulis* population. *Marine Biology*, 68, 143-160.

Palacios, J. A. (1985). *Biometría, Crecimiento y Maduración Sexual en la Almeja Blanca Protothaca asperrima en Colorado de Abangares, Costa Rica*. Tesis de Maestría, Universidad Nacional, Heredia, Costa Rica.