BLUE ECONOMY DEVELOPMENT AND ECONOMIC GROWTH IN WEST AFRICAN COUNTRIES

Dr. Gbidum Sunday Tote

Nile University of Nigeria, Abuja

Nigeria

Abstract

The blue economy is increasingly promoted as a pathway to economic diversification in coastal West Africa, yet the extent to which fisheries and maritime activities contribute to aggregate growth in the region remains empirically unresolved. This article examines the relationship between selected blue economy indicators and economic growth in 13 coastal West African countries over the period 2010–2024. Using secondary annual data from the World Bank's World Development Indicators, the study applies two-way fixed-effects panel regression to assess the effects of capture fisheries production, aquaculture production and container port traffic on real GDP growth, controlling for gross capital formation, trade openness and population growth, with liner shipping connectivity examined in a supplementary model. The results show that none of the three blue economy indicators has a statistically significant relationship with economic growth at the 5% level, a conclusion supported by wild cluster bootstrap inference and robust to lagged specifications, while trade openness and population growth emerge as consistently positive and significant correlates of growth. The findings imply that the expansion of blue economy activity in the region has not yet translated into discernible aggregate growth dividends, plausibly because production and throughput volumes generate limited domestic value addition. The article recommends policies that strengthen fisheries processing, aquaculture value chains and port–hinterland linkages, and identifies avenues for future research using value-added measures and stronger identification strategies.

Keywords: blue economy; economic growth; capture fisheries; aquaculture; container port traffic; West Africa; fixed-effects panel regression

1 Introduction

Economic growth remains a major policy objective in West African countries because of its implications for employment, income generation, public revenue and living standards. Sustaining growth requires investment in productive activities and the effective management of natural resources. Oceans, coastal areas and aquatic resources provide opportunities for economic diversification through fisheries, aquaculture, maritime transport, port services and related commercial activities. The blue economy provides a framework for examining these opportunities while recognising the environmental conditions necessary for their continued contribution to development.

The blue economy refers to the sustainable utilisation of ocean and aquatic resources to support economic activities, livelihoods and ecosystem health. It incorporates established sectors, such as fisheries and maritime transport, alongside emerging activities, including marine renewable energy and biotechnology. Lee et al. (2020) connect the concept to sustainable development, emphasising the need to balance economic utilisation with the long-term capacity of marine ecosystems. Martínez-Vázquez et al. (2021) similarly explain that blue economy development involves interactions among economic production, environmental protection and governance. Consequently, an increase in aquatic production or maritime activity represents only one dimension of blue economy development.

Blue economy activities can influence economic growth through several mechanisms. Fisheries and aquaculture provide food, generate income and support processing, storage, transportation and distribution. Maritime activities facilitate international commerce and connect domestic producers to external markets. Investment in these sectors can expand productive capacity, encourage business development and strengthen economic linkages. However, resource depletion, weak infrastructure and limited domestic value addition can reduce the benefits arising from these activities. The relationship between blue economy development and growth therefore requires empirical investigation rather than an assumption that greater resource utilisation necessarily produces better economic outcomes.

Existing studies provide evidence of this relationship across different settings. Alharthi and Hanif (2020) identify significant contributions from blue economy factors to economic growth in SAARC countries. Imran et al. (2026) examine the NEXT 11 countries and report that fisheries and aquaculture contribute to economic growth. Their analysis also highlights the importance of resource management and regional cooperation. Although these findings support the economic relevance of aquatic activities, their applicability to coastal West Africa requires a regional assessment.

Coastal West African countries offer a relevant setting because their access to the Atlantic Ocean creates opportunities for fisheries, port operations and maritime commerce. Nevertheless, differences in infrastructure, productive capacity and economic structure may influence the benefits derived from these resources. A regional study can assess whether changes in fisheries

production and maritime activity are associated with changes in economic growth after accounting for country characteristics and common annual shocks.

This article examines the relationship between selected blue economy indicators and economic growth in coastal West African countries during 2010–2024. Specifically, it assesses the relationships of capture fisheries production, aquaculture production and container port traffic with real GDP growth, controlling for gross capital formation, trade openness and population growth. Shipping connectivity provides an additional indicator for a supplementary analysis over the years for which observations are available.

The article contributes a focused regional analysis and makes the measurement boundaries explicit. Fisheries indicators include inland and marine activities, container throughput measures port activity, and shipping connectivity measures access to liner shipping networks. These indicators capture selected economic dimensions of the blue economy; they do not constitute a comprehensive measure of its environmental sustainability.

The following null hypotheses guide the analysis:

H_{01}: Capture fisheries production has no statistically significant relationship with economic growth in coastal West African countries.

H_{02}: Aquaculture production has no statistically significant relationship with economic growth in coastal West African countries.

H_{03}: Container port traffic has no statistically significant relationship with economic growth in coastal West African countries.

2 Literature Review

2.1 Conceptual Review

This section provides conceptual review of the independent and dependent of the study which examine the effect of blue economy indictors.

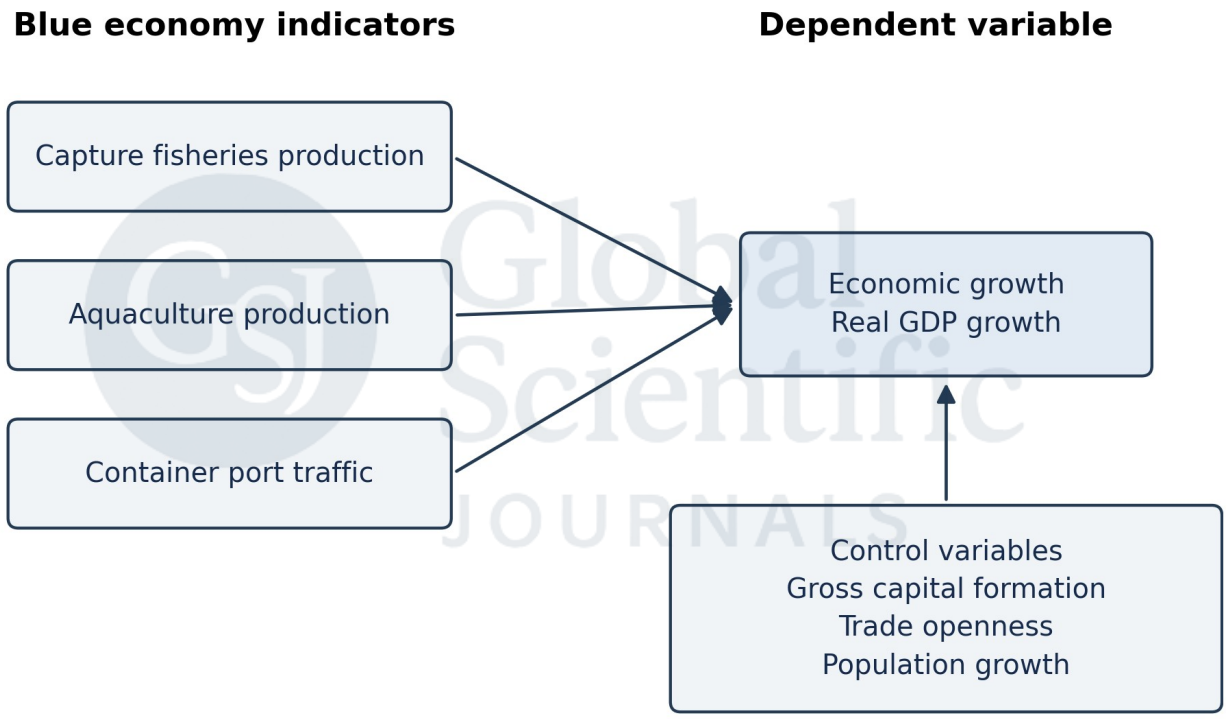


Figure 1: *Conceptual framework of blue economy development and economic growth*

Source: Researcher's conceptualisation 2026.

Blue economy development

Blue economy development concerns the productive and sustainable utilisation of aquatic and marine resources. Its economic dimension includes the generation of output, employment, income and commercial opportunities. Its environmental dimension concerns the maintenance of ecosystems and resource stocks that support production. Its social dimension addresses livelihoods and the distribution of benefits. Martínez-Vázquez et al. (2021) identify sustainability, governance

and coordination among economic sectors as important elements of the concept. Consequently, the blue economy cannot be adequately understood through output expansion alone.

For this article, blue economy development is operationalised through selected fisheries and maritime indicators. This narrower approach reflects the availability of comparable annual data and permits an assessment of specific economic channels. The interpretation of findings remains confined to those channels.

Economic growth

Economic growth refers to an increase in the real output of an economy over time. The article measures it using the annual percentage growth rate of real gross domestic product. Real GDP growth captures changes in aggregate production after accounting for price changes. It does not directly measure income distribution, poverty reduction or environmental quality. Accordingly, a positive relationship between blue economy activities and GDP growth does not, by itself, establish inclusive or sustainable development.

Capture fisheries and aquaculture

Capture fisheries involve harvesting aquatic organisms from natural environments, whereas aquaculture involves their cultivation under managed conditions. Both activities can contribute to growth through food production, employment, trade and processing industries. Their economic effects may differ because production methods, investment requirements and exposure to ecological conditions vary.

The article treats capture fisheries and aquaculture as separate explanatory variables. Total fisheries production is retained for descriptive purposes but is excluded from the same regression because it overlaps with these components. Moreover, the available country totals include inland production and therefore represent broad aquatic-sector indicators rather than exclusively marine activities.

Maritime activity

Maritime activity supports economic transactions through shipping services, cargo handling and port operations. Container port throughput measures the volume of containers handled in twenty-foot equivalent units. It serves as an indicator of port activity rather than the monetary value of maritime trade. Liner shipping connectivity measures integration into international container

shipping networks. These measures capture distinct aspects of maritime development and should not be interpreted as water transport value added (World Bank, n.d.).

2.2 Theoretical Framework

2.2.1 Endogenous Growth Theory

Endogenous Growth Theory explains sustained economic growth through processes originating within the economy, particularly knowledge accumulation, human capital development and innovation. Romer (1986) emphasises the role of knowledge and its spillover benefits, while Lucas (1988) identifies human capital accumulation as an important source of productivity growth.

Romer (1986) argues that knowledge generated through investment and learning can benefit other producers, creating gains beyond the organisation undertaking the original activity. Lucas (1988) similarly explains that education, training and the accumulation of productive skills improve economic performance. Together, these perspectives suggest that sustained growth depends on the capacity to develop and apply knowledge, alongside the accumulation of physical capital. Applied to blue economy activities, the theory highlights the potential contribution of fisheries research, improved aquaculture practices, technical training, digital port systems and efficient logistics. Skills development can improve production and fish handling, while technological improvements can strengthen processing, storage and distribution. These are applications of the knowledge and human capital mechanisms identified by Romer (1986) and Lucas (1988).

The theory also explains why countries with similar aquatic resources may obtain different economic benefits. Differences in skills, innovation and the ability to absorb technology can influence productivity and domestic value addition (Lucas, 1988; Romer, 1986). Within the blue economy, these capabilities operate alongside governance and ecosystem management, which shape the conditions under which economic activities remain sustainable (Martínez-Vázquez et al., 2021).

2.2.2 Solow's Growth Theory

Solow's Growth Theory explains economic growth through capital accumulation, labour and technological progress. The theory proposes that investment increases productive capacity, while technological progress improves the efficiency with which capital and labour generate output. However, diminishing returns to capital imply that capital accumulation alone cannot sustain

continuous growth in output per worker; long-term growth depends on technological progress (Solow, 1956).

For coastal West African countries, the theory provides a basis for expecting fisheries, aquaculture and maritime activities to support economic growth when accompanied by productive investment. Gross capital formation is included as a control variable to account for broader investment conditions. Nevertheless, fisheries production and container port throughput represent sectoral activity rather than direct measures of capital and labour. Their inclusion therefore constitutes an empirical application of the framework rather than a direct estimation of the original Solow production function (Imran et al., 2026; Solow, 1956).

The article adopts the Solow growth theory as its principal theoretical foundation. The framework relates output to capital, labour and productivity. Applied to the blue economy, investment in fishing equipment, aquaculture facilities, storage infrastructure and port services expands productive capital. Labour supports harvesting, cultivation, processing and transportation, while technological improvements can raise productivity across these activities. Within this framework, fisheries production and maritime activity represent sectoral channels through which productive resources contribute to aggregate economic performance Imran et al. (2026) also employ the Solow model in examining the blue economy–growth relationship in the NEXT 11 countries. Their application supports its relevance to the present analysis.

2.3 Empirical Review

Alharthi and Hanif (2020) examine the impact of blue economy factors on economic growth in eight SAARC countries using secondary data covering 1995–2018. Their findings indicate that blue economy factors play a statistically significant role in economic growth. The study establishes the relevance of aquatic economic activities within a regional setting. However, differences between South Asia and West Africa limit the direct transfer of its findings to the present study area.

Imran et al. (2026) investigate the blue economy–growth relationship in the NEXT 11 countries over 1995–2018. Guided by the Solow framework, they employ panel-corrected standard errors and system generalised method of moments estimation. Their variables include fisheries output, aquaculture production, agriculture-related value added, labour, capital and macroeconomic

conditions. They report that fisheries and aquaculture contribute to economic growth and recommend improved fisheries management and regional cooperation. Although Nigeria is included, the study does not provide a dedicated assessment of coastal West Africa.

Lqamar et al. (2025) examine blue economy factors and economic growth in Morocco using secondary data spanning 1980–2022 and an autoregressive distributed lag approach. The study distinguishes between deep-sea and coastal fishing and identifies the potential of coastal fishing to generate inclusive economic value. Its contribution lies in recognising that fisheries subsectors can produce different economic outcomes. Its single-country setting, however, does not establish whether similar relationships exist across West African economies.

Martínez-Vázquez et al. (2021) analyse research trends and conceptual developments in the blue economy literature. Their review identifies connections among sustainability, governance, economic development and ecosystem protection. Although the study does not estimate a country-level growth model, it provides an important basis for interpreting economic indicators within a broader sustainability framework.

The reviewed studies support further investigation of fisheries and maritime activities as potential contributors to growth. However, they do not resolve the specific relationship across coastal West African countries during 2010–2024. The present article addresses this contextual and measurement gap through a regional panel analysis that separates capture fisheries, aquaculture and port activity while acknowledging the limitations of the available indicators.

3 Methodology

3.1 Research Design and Scope

The article adopts an ex post facto research design and a longitudinal panel-data approach. The design is appropriate because the variables represent historical economic outcomes that the researcher does not manipulate. The panel structure permits an examination of changes within countries over time while accounting for persistent differences across countries.

The geographical scope comprises 13 coastal West African countries: Benin, Cabo Verde, Côte d’Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Nigeria, Senegal, Sierra Leone and Togo. The geographical classification includes Mauritania and is not based on ECOWAS membership. The study covers 2010–2024, producing a maximum framework of 195 country–year observations. Actual estimation samples depend on the joint availability of the

variables included in each model. The resulting regression panel is therefore potentially unbalanced.

3.2 Sources and Method of Data Collection

The article uses secondary annual data retrieved from the World Bank's World Development Indicators. Fisheries production indicators originate from the Food and Agriculture Organization, while container port traffic and shipping connectivity originate from UNCTAD, as disseminated through WDI. This retrieval route provides a consistent structure for matching indicators by country and year (World Bank, n.d.).

A standardised extraction procedure records country names, ISO country codes, years, indicator codes, units and source links. Country–year identifiers provide the basis for combining the series. Original numerical values are retained, and missing observations remain blank. No simulated values, interpolation or automatic replacement of missing observations with zero forms part of the dataset.

Comparable coastal tourism receipts, marine resource investment and water transport value added remain outside the estimated model because these series have not been collected consistently across the country sample. Their exclusion limits the article's coverage of the wider blue economy.

3.3 Definition and Measurement of Variables

Variable	Symbol	Measurement	Source	Expected sign
Economic growth	GDPG	Real GDP growth, annual %	WDI	Dependent
Capture fisheries	CAP	Capture production, metric tonnes	FAO via WDI	Positive
Aquaculture	AQU	Aquaculture production, metric tonnes	FAO via WDI	Positive
Container port traffic	PORT	Container throughput, TEU	UNCTAD via WDI	Positive
Gross capital formation	GCF	Gross capital formation, % GDP	WDI	Positive
Trade openness	TOP	Exports plus imports, % GDP	WDI	Positive or negative
Population growth	POPG	Population growth, annual %	WDI	Positive or negative

Variable	Symbol	Measurement	Source	Expected sign
Shipping connectivity	LSCI	Index, 2004 maximum = 100	UNCTAD via WDI	Positive

3.4 Model Specification

The baseline model specifies economic growth as a function of capture fisheries production, aquaculture production, container port traffic and the control variables:

$$GDPG_{it} = \alpha + \beta_1 \ln(CAP_{it}) + \beta_2 \ln(1 + AQU_{it}) + \beta_3 \ln(PORT_{it}) + \beta_4 GCF_{it} + \beta_5 TOP_{it} + \beta_6 POPG_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Here, i denotes country and t denotes year; α represents the intercept; β_1–β_6 represent the estimated coefficients; μ_i captures country fixed effects; λ_t captures year fixed effects; and ε_{it} represents the idiosyncratic error term.

Natural logarithms reduce scale differences in strictly positive production and port-throughput series. The transformation ln(1 + AQU) accommodates genuine zero aquaculture observations while preserving missing values as missing. Its coefficient requires interpretation in relation to this transformation and does not have the same interpretation as an ordinary log-level coefficient near zero.

A supplementary specification adds shipping connectivity:

$$GDPG_{it} = \alpha + \beta_1 \ln(CAP_{it}) + \beta_2 \ln(1 + AQU_{it}) + \beta_3 \ln(PORT_{it}) + \beta_4 GCF_{it} + \beta_5 TOP_{it} + \beta_6 POPG_{it} + \beta_7 LSCI_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

This model uses available observations within 2010–2021. The baseline model is also re-estimated over the same sample to distinguish changes associated with the additional variable from changes caused by sample composition.

3.5 Techniques of Data Analysis

Descriptive statistics summarise the distribution and coverage of each variable using the number of observations, mean, standard deviation, minimum and maximum. Trend analysis examines changes in fisheries production, port activity and economic growth. Correlation analysis and variance inflation factors assess potential overlap among explanatory variables.

The principal estimation technique is two-way fixed-effects panel regression. Country fixed effects account for time-invariant national characteristics, while year fixed effects account for shocks common to the sampled countries. Identification therefore comes from changes within countries after removing common annual influences.

Diagnostic analysis examines heteroskedasticity, serial correlation and cross-sectional dependence. Inference accounts for dependence within countries. Because the sample contains only 13 country clusters, conventional cluster-robust significance tests require caution; wild cluster bootstrap inference provides an additional check where supported by the estimation software.

Robustness analysis considers alternative fisheries specifications, a common-sample comparison and lagged explanatory variables. Total fisheries production can replace its capture and aquaculture components in an alternative model, but it does not enter alongside them because of their conceptual overlap.

4 Results and Discussion

4.1 Descriptive Statistics and Trends

Table 1 reports the descriptive statistics for the variables used in the analysis. The maximum framework comprises 195 country–year observations (13 countries over 2010–2024). Real GDP growth averaged 4.43% per annum, with a standard deviation of 3.78 percentage points and a minimum of –20.81% (Guinea, 2014), confirming substantial cross-country and temporal variation in economic performance. Capture fisheries production averaged approximately 228,091 metric tonnes per country–year, but the distribution is heavily skewed: the median (74,807 tonnes) is far below the mean, reflecting the dominance of a few large producers such as Mauritania, Senegal and Nigeria. Aquaculture production is even more concentrated, averaging 26,483 tonnes but reaching a maximum of 316,727 tonnes; Nigeria alone accounts for the bulk of regional aquaculture output, followed by Ghana. Thirty of the 195 country–year observations record zero aquaculture production, justifying the ln(1 + AQU) transformation adopted in the model specification. Container port traffic (161 observations) averaged about 554,133 TEU, ranging from roughly 26,382 to 2,006,435 TEU, while the liner shipping connectivity index averaged 13.50 on its 2004=100 scale. Gross capital formation averaged 25.09% of GDP, trade openness 65.30% of GDP, and population growth 2.32% per annum.

Variable	Obs.	Mean	Std. Dev.	Min	Median	Max
GDPG (%)	195	4.43	3.78	-20.81	4.99	15.84
CAP (metric tonnes)	195	228,091	250,522	5,547	74,807	967,707
AQU (metric tonnes)	195	26,483	73,880	0.00	351	316,727
PORT (TEU)	161	554,133	575,078	26,382	311,470	2,006,435
LSCI (index)	156	13.50	8.32	3.95	11.03	39.99
GCF (% of GDP)	164	25.09	8.85	9.90	22.86	52.67

TOP (% of GDP)	164	65.30	20.23	27.95	61.12	115.77
POPG (%)	195	2.32	0.70	0.01	2.44	3.92

Table 1. Descriptive statistics

Trend analysis indicates that the regional aggregates of the blue economy indicators expanded over the study period. Total capture production across the sample rose from about 2.17 million tonnes in 2010 to 3.39 million tonnes in 2024, an average annual growth rate of approximately 3.25%. Aquaculture production grew faster, from about 213,465 tonnes to 407,256 tonnes (approximately 4.72% per annum), although from a low base and concentrated in Nigeria. Container throughput recorded the fastest expansion, growing at roughly 6.72% per annum between 2010 and 2019, from about 3.96 million to 7.10 million TEU, before several series were discontinued in the source database. Meanwhile, average real GDP growth moderated slightly, from 4.73% in 2010–2014 to 4.28% in 2019–2024. The descriptive evidence therefore shows expanding blue economy activity alongside moderate growth, but it does not establish an association between them; that question is addressed by the regression analysis.

4.2 Correlation and Multicollinearity

Pairwise correlations among the explanatory variables are moderate. The highest correlation is between ln(1 + AQU) and ln(PORT) (r = 0.833), which is unsurprising given that aquaculture investment and containerised trade are both concentrated in the region's larger economies such as Nigeria, Ghana and Côte d'Ivoire. Correlations among the remaining variables are below 0.50 in absolute value. Variance inflation factors computed on the baseline regression sample range from 1.70 (TOP) to 4.81 (ln(1 + AQU)), all well below the conventional threshold of 10, indicating that multicollinearity does not threaten the estimation. Nevertheless, the moderately elevated VIF of the aquaculture term suggests that its coefficient should be interpreted with some caution.

4.3 Baseline Two-Way Fixed-Effects Estimates

Table 2 presents the two-way fixed-effects estimates. Column (1) reports the baseline model over the full estimation sample of 136 observations covering 11 countries from 2010 to 2024. The sample is smaller than the maximum framework because Liberia and Nigeria have no observations for gross capital formation and trade openness in the retrieved World Development Indicators series, and because container port traffic is unavailable for several country–years. The regression panel is therefore unbalanced, as anticipated in the methodology.

Variable	(1) Baseline 2010–2024	(2) Baseline 2010–2021	(3) + LSCI
ln(CAP)	-1.341 (0.822)	0.177 (0.734)	0.130 (0.785)
ln(1 + AQU)	-0.298 (0.335)	-0.866 (0.379)	-0.880 (0.364)
ln(PORT)	1.460	2.041	1.324

	(1.212)	(1.132)	(1.354)
GCF	0.049 (0.080)	0.104 (0.078)	0.103 (0.078)
TOP	0.133 (0.047)	0.126 (0.042)	0.130 (0.043)
POPG	4.411 (1.612)	3.323 (1.176)	3.653 (1.331)
LSCI	—	—	0.075 (0.069)
Observations	136	121	121
Countries	11	11	11
R-squared	0.413	0.451	0.453

In the baseline specification, none of the three blue economy indicators attains statistical significance at the 5% level. The coefficient on ln(CAP) is negative (–1.341) with a p-value of 0.103; the coefficient on ln(1 + AQU) is –0.298 (p = 0.374); and the coefficient on ln(PORT) is positive (1.460) but imprecisely estimated (p = 0.228). Wild cluster bootstrap inference, applied because the sample contains only 11 country clusters, confirms these conclusions (bootstrap p-values of 0.144, 0.739 and 0.364 respectively). The null hypotheses H_{01}, H_{02} and H_{03} therefore cannot be rejected: conditional on the controls, country characteristics and common annual shocks, within-country changes in capture fisheries production, aquaculture production and container port traffic show no statistically significant relationship with real GDP growth in coastal West African countries during 2010–2024.

Among the control variables, trade openness is positive and statistically significant (coefficient 0.133, p = 0.005), indicating that a one-percentage-point increase in the trade-to-GDP ratio is associated with about 0.13 percentage points higher growth, conditional on fixed effects. Population growth is also positive and significant (coefficient 4.411, p = 0.006), consistent with a demographic dividend or market-size effect, though population growth is not a direct measure of labour-force growth. Gross capital formation carries the expected positive sign but is not statistically significant (p = 0.540), possibly because investment effects materialise with lags that the annual specification cannot capture.

4.4 Supplementary Model with Shipping Connectivity

Columns (2) and (3) of Table 2 restrict the baseline to the 2010–2021 common sample (121 observations) for which the liner shipping connectivity index is available. Column (2) shows that the baseline coefficients are broadly stable in sign and magnitude when the sample is held constant. Column (3) adds LSCI, which enters with a positive but statistically insignificant coefficient (0.075, p = 0.280). The shipping connectivity result is tentative: with only 11 clusters and 12 years, the test has limited power, and LSCI measures network integration rather than the volume or value of maritime activity. On this common sample, the coefficient on ln(1 + AQU) becomes negative

and statistically significant (–0.880, p = 0.016). This result is discussed in Section 4.5 but should be treated as fragile, since it does not survive in the full sample and the aquaculture series is dominated by a single country.

4.5 Discussion

The principal finding is that, once country fixed effects, year fixed effects and standard growth correlates are taken into account, the selected blue economy indicators are not statistically associated with economic growth in coastal West Africa over 2010–2024. This result contrasts with the significant positive relationships reported by Alharthi and Hanif (2020) for SAARC countries and by Imran et al. (2026) for the NEXT 11 economies. Three considerations help reconcile the differences. First, the earlier studies cover earlier periods (1995–2018) and different regions whose fisheries sectors are more commercially integrated and better capitalised. Second, their specifications include sectoral value added and labour inputs rather than physical production volumes, which may capture the economic contribution of fisheries more directly. Third, the present study's identification comes from within-country variation net of common shocks, a demanding standard that absorbs much of the between-country differences that drive positive cross-sectional correlations.

The insignificant capture fisheries coefficient is nonetheless informative. Capture production grew regionally at about 3.25% per annum, but much of this output is exported unprocessed or consumed domestically with limited linkage to processing, storage and distribution industries. The result is consistent with the argument in the conceptual review that output expansion alone does not translate into growth where domestic value addition is weak and where resource depletion erodes the natural capital base. It also aligns with Lqamar et al. (2025), whose disaggregated analysis for Morocco shows that fisheries subsectors differ in their growth contributions, implying that aggregate production volumes can mask heterogeneous economic effects.

The fragile negative association between aquaculture and growth observed on the 2010–2021 common sample should be interpreted with caution and not as evidence that aquaculture harms growth. The series is heavily concentrated in Nigeria, whose economy experienced oil-price shocks and currency depreciations during the period; the coefficient may partly absorb country-specific macroeconomic disturbances despite the fixed effects. Moreover, the ln(1 + AQU) transformation means the coefficient does not have a conventional log-level interpretation near zero, and the region's aquaculture sector remains small, import-dependent for feed and fingerlings, and weakly integrated with domestic agro-industrial supply chains.

The positive but insignificant port traffic coefficient suggests that container throughput, while expanding rapidly, functions largely as a transit activity whose growth benefits leak to transnational shipping lines and hinterland economies outside the sampled countries. The significant trade openness result supports this interpretation: it is the trade intensity associated with port activity, rather than the physical volume of containers, that correlates with growth. The positive LSCI coefficient, although insignificant, points in the same direction: integration into liner

shipping networks matters more than raw throughput, echoing the distinction drawn in the literature review between activity measures and value-added measures of maritime development.

4.6 Robustness Checks

Variable	(4) Total fisheries	(5) Lagged blue-economy vars
ln(TOTFISH)	-1.441 (0.692)	—
ln(PORT)	1.157 (1.021)	—
ln(CAP)t–1	—	-0.471 (1.185)
ln(1 + AQU)t–1	—	0.516 (0.399)
ln(PORT)t–1	—	-2.049 (1.726)
Controls	Yes	Yes
Observations	136	131
R-squared	0.422	0.427

Table 3. Robustness estimates (two-way fixed effects; cluster-robust standard errors in parentheses).

Two robustness exercises were conducted. First, total fisheries production (capture plus aquaculture) replaced its two components in the baseline model. The coefficient on total production is positive and statistically significant ($p = 0.037$); however, because the components showed no significant effects individually and total production is dominated by capture output, this result likely reflects aggregation rather than a robust economic relationship, and it illustrates why the components were modelled separately in the baseline. Second, the blue economy variables were lagged one year to allow for delayed effects; all three lagged coefficients are statistically insignificant, suggesting that the null baseline results are not an artefact of contemporaneous timing. Diagnostic analysis detected heteroskedasticity (Breusch–Pagan $p = 0.017$), which the cluster-robust inference addresses, and no strong evidence of first-order serial correlation within countries.

Conclusion

This article examined the relationship between selected blue economy indicators and economic growth in 13 coastal West African countries during 2010–2024, using two-way fixed-effects panel regression on World Bank World Development Indicators data. Descriptive analysis shows that capture fisheries production, aquaculture output and container port traffic all expanded over the period, with aquaculture and port traffic growing fastest, while average real GDP growth moderated slightly.

The central empirical finding is that, conditional on gross capital formation, trade openness, population growth, country fixed effects and year fixed effects, none of the three blue economy indicators capture fisheries production, aquaculture production and container port traffic has a statistically significant relationship with real GDP growth at the 5% level. The null hypotheses H_{01}, H_{02} and H_{03} are therefore not rejected. These conclusions are supported by wild cluster bootstrap inference and are robust to lagged specifications; a supplementary model found no significant role for liner shipping connectivity. Trade openness and population growth emerge as the variables consistently and positively associated with growth.

The findings imply that the expansion of blue economy activity in coastal West Africa during 2010–2024 has not, by itself, been a statistically discernible driver of aggregate economic growth. This does not mean aquatic resources lack economic value; rather, the volume-based indicators capture production and throughput rather than value added, employment or income generation, and the benefits of these activities may leak abroad through unprocessed exports, foreign-flagged shipping and enclave port operations. The result qualifies the optimistic cross-country evidence from SAARC and NEXT 11 studies and underscores the importance of regional context and of measurement boundaries, consistent with the conceptual arguments of Martínez-Vázquez et al. (2021) and Lee et al. (2020).

6.1 Recommendations for Policy makers

First, governments in the sub-region should prioritise domestic value addition in capture fisheries processing, cold storage, packaging and distribution so that production growth translates into income and employment rather than unprocessed exports. The insignificant capture fisheries coefficient suggests that current production patterns generate limited aggregate growth dividends.

Second, aquaculture development should be supported through feed and fingerling production, extension services and access to finance, while its growth should be monitored for quality and value addition rather than tonnage alone, given the fragile negative association observed on the common sample and the sector's concentration in one country.

Third, port policy should shift emphasis from throughput expansion toward connectivity and linkages: hinterland transport infrastructure, customs efficiency, and integration of port activity with domestic firms, so that container traffic functions as a channel for trade-led growth rather than a transit enclave. The significant positive association of trade openness with growth indicates that the trade channel, not the volume channel, is where maritime activity appears to pay off.

Fourth, regional cooperation in fisheries management, maritime security and shipping services as advocated by Imran et al. (2026) remains warranted to address shared stocks and illegal, unreported and unregulated fishing that erode the natural capital underpinning the blue economy.

6.2 Recommendations for Future Research

Future studies should employ value-added, employment and export-value measures of blue economy activity where data permit; explore sectoral and firm-level data to identify where growth linkages fail; extend the analysis to non-coastal West African countries for comparison; and adopt identification strategies such as instrumental variables, natural experiments, or system GMM that address endogeneity more convincingly. Improving the collection of maritime statistics, including coastal tourism, marine investment and water transport value added, would enable a more comprehensive assessment of the blue economy's contribution to the region's development.

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