Does the Blue Economy Resource of Capture Fisheries Generate Economic Growth? Evidence from Indonesia

Mohamad Egi Destiartono, Firmansyah and Evi Yulia Purwanti
Department Economics, Faculty of Economics and Business, Universitas Diponegoro, 50275, Semarang, Indonesia

Keywords: Blue Economy, Fisheries, Economic Growth.

Abstract: Indonesia is the center of the blue economy resources since the region is located in the Coral Triangle. This paper is aimed at estimating the relationship between capture fisheries production and economic growth in Indonesia for the period 1984-2019, by utilizing the extended version of the Solow growth model. The data were retrieved from the World Development Indicators (WDI). Dynamic and cointegration relationships are revealed through the application of the autoregressive distributed lags (ARDL)-bounds test model. Also, the Zivot-Andrew (ZA) test is utilized to identify the presence of unit roots with a structural break. The results report that variables are stationary at their levels and there is a cointegration nexus among them. Further, the capture fisheries production is found to have a positive affluence on GDP growth in the long run. Thus, marine fisheries resources have a notable role as an engine of economic growth. Importantly, the estimated parameters are robust with the alternative method of DOLS. Following these empirical findings, we advocate for fisheries stakeholders to jointly define policies and schemes that could augment the productivity level of the capture fisheries given that it contributes significantly to GDP.

1 INTRODUCTION

The agricultural sectors of fisheries are expected to have a significant role in fostering inclusive economic growth in long-coastal countries such as Indonesia. With around 18,000 islands, the country has a coastline of 68,075 miles and an exclusive economic zone of 2.91 million km2, indicating the massive potential for marine fisheries sectors. It is widely admitted that Indonesia is the home of marine biodiversity given that the country is located in the Coral Triangle (Ceccarelli, Lestari, Rudyanto, & White, 2022).

There are around 553 coral species and 4,954 marine fish species embodied in Indonesia (Asian Development Bank, 2014)(Peristiwady, 2021). Those various types of marine animals indices the blue economy resources that can be managed by Indonesians.

The fisheries sectors still account for around 7.06% of the Gross Domestic Product (GDP) and employ around 6.06% of the workforce. Moreover, the livelihoods of 2.5 million households are directly connected to Small-Scale-Fisheries (SSF) activities. The development of fisheries sectors to increase their productivity will have a significant impact on coastal communities. In 2021, the total fisheries production is around 21.81 million metric tons, consisting of the traditional small-scale artisanal and the large-scale commercial.

The fisheries sectors have strategic roles in fostering economic development through various pathways. To begin with, fisheries resources support food security by supplying affordable sources of nutrition for both rural and urban households that are poor (Kent, 1997). This role, in turn, affects human capital.

To this day, the consumption of fish per capita in Indonesia is around 40 kilograms. (SEAFDEC, 2020). Another benefit is that both marine and freshwater fisheries are the livelihoods of Indonesian coastal communities.

The prosperity of fisheries producers and consumers can depend on the shocks in these sectors. Last, of all, fisheries commodities have remarkable roles on foreign exchange through export. It is widely known that Indonesia's competitive position in the global fish market is quite high, one of the global leading (Oktavilia, Firmansyah, Sugiyanto, & Rachman, 2019).

Destiartono, M., Firmansyah, . and Purwanti, E.
Does the Blue Economy Resource of Capture Fisheries Generate Economic Growth? Evidence from Indonesia.
DOI: 10.5220/0012646600003798

In *Proceedings of the 2nd Maritime, Economics and Business International Conference (MEBIC 2023) - Sustainable Recovery: Green Economy Based Action*, pages 17-24
ISBN: 978-989-758-704-7

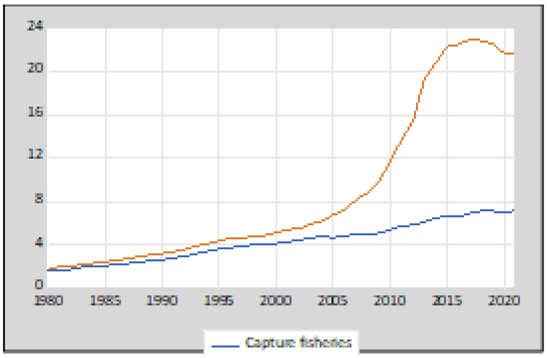

Figure 1: Capture fisheries and total fisheries production for the period 1980-2021 (billions of metric tons).

Indonesia's fisheries sectors are faced with numerous problems, despite their vital role. Illegal, unregulated, and unreported (IUU) fishing activities are empirical cases that caused Indonesia cannot to achieve its best optimal level of fish production and meet sustainable indicators (Ardhani, 2021). The presence of crimes in the fisheries industry has the potential to reduce the role of fisheries in the economy and social security in the long run. Currently, the contribution of the fisheries to aggregate national output is relatively low compared to land-based agriculture such as crops.

Various econometric methods have been used in numerous studies to estimate the link between fisheries and economic growth. For instance, Eyüboğlu & Akmermer (Eyüboğlu & Akmermer, 2023) estimated the dynamic nexus between fisheries production and economic growth in Turkey by employing annual data for the period 1990-2019. The autoregressive distributed lags (ARDL)-bounds testing is applied. The cointegration relationship is confirmed. Furthermore, fisheries production positively affluence on GDP in the long run. In a similar vein, Rehman et al. (Rehman, Deyuan, Hena, & Chandio, 2019) explored the role of fisheries on economic growth in Pakistan from 1970 to 2015 by performing the ARDL model. The empirical results represent that aquaculture and capture fisheries are found to have a significant and cogent impact on GDP growth which implies that both sectors have remarkable roles to sustain the economy of Pakistan.

In another research, Jaunky (Jaunky, 2011) explored the causal linkage between fisheries export growth and economic growth in the Small Island Developing States (SIDS) for the period 1980-2002. The system Generalized Method of Moment (GMM) and Fully Modified OLS (FMOLS) were applied. The empirical finding noted that fisheries export has a positive impact on GDP growth. Further, an empirical case in Nigeria by Oyakhilomen & Zibah (Oyakhilomen & Zibah, 2013) reported there is no causal connection between Fishery Production Index (FDI) and per capita GDP. In addition, Sugiawan et al. (Sugiawan, Islam, & Managi, 2019) reported there is a one-way causal linkage. Initially, economic growth causes the depletion of marine ecosystems. Nonetheless, after a certain level of per capita income, i.e., 3827 USD, economic growth has a beneficial affluence on the sustainability of marine ecosystems.

More recently, Ilyas et al. (Ilyas et al., 2021) examined the role of agriculture sub-sectors of fisheries, livestock, and crops on economic growth in Pakistan over the period 1987-2017 by employing the Johansen cointegration test and Vector Autoregressive (VAR) model. The results indicate that there is a long-term relationship and significant impact of all agricultural sub-sectors on economic growth, which implies that boosting agricultural sector performance is beneficial for Pakistan's economy.

Although the notion hypothesis of agriculture (incl. fishery sector)-led economic growth is widely discussed and confirmed; still, the empirical findings of the role of capture fisheries on economic growth in Indonesia using econometric models are not evident, giving room for scholars to fill the gap. Hence, the reasons and novelties are proposed as follows: this paper aims to examine the dynamic short- and long-run linkages between capture fisheries and economic growth by adopting the extended version of the Solow growth model.

To the best author's knowledge, this angle of research is not yet proven. We employ the ARDL-bounds testing method due to its ability to generate both short- and long-run parameters, as well as a cointegration model. In addition, the breakpoint unit root test is applied to check the order of integration and ensure that the ARDL is proper to be employed.

2 RESEARCH METHODOLOGY

2.1 Data and Variables

This paper applied time series from 1984 to 2019 to estimate the relationship between capture fisheries and economic growth in Indonesia. Following previous studies (Hassan, Xia, Latif, Huang, & Ali, 2020) (Africa, 2020) and the Solow growth model, this research included the additional control variables namely population growth, gross capital formation, and inflation rates with the aim of handling omitted variables bias. All the series used were retrieved from the World Development Indicators (WDI).

Capture fisheries production (metric tons) growth is the explanatory variable. The figure reflects the increase in the volume of fish catches that are landed annually. Economic growth is the explained variable and it is proxied by Gross Domestic Product (GDP) (current USD) growth. The monetary value added to final goods and services within a country is known as GDP. Next, Gross Capital Formation (GFC) growth is used as a proxy for capital accumulation in the Solow growth model. The GFC includes outlays on additions to the assets of the economy plus net changes in the level of inventories and it is based on constant local currency (constant 2010 USD).

Furthermore, we consider population growth to be a proxy for human capital growth. Last, of all, inflation rates are measured by the yearly increase rate of the GDP implicit deflator. This figure shows the rate at which prices change in the economy as a whole. All the regressors used in this paper are expected to have a positive influence on GDP growth, except for inflation rates.

2.2 Model Specification

The relationship between economic growth and its determinants can be expressed as an equation (Eq.) according to the Solow growth model. (1):

$$Y_t = F(K, L_t) \quad (1)$$

Eq. (1) above depicts that rill per capita income (Y) is a function of capital (K) and labour (L). Further, this paper modified the Solow growth model by incorporating the role of natural resources, i.e., the blue economy source of fisheries, and other related variables.

$$Y_t = F(K, L_t\, N_t\, I_t) \quad (2)$$

where N and I depict the natural resource and additional variables that affect rill per capita income. Following the Solow growth theory and previous studies (Alharthi & Hanif, 2020) (Ilyas et al., 2021), an empirical model in this paper is specified as Eq. (3).

$$GDP_t = \beta_0 + \beta_1 FISH_t + \beta_2 C_t + \beta_3 P_t + \beta_4 I_t + \varepsilon_t \quad (3)$$

where GDP and FISH represent economic growth and capture fisheries production growth. C, P, and I depict the additional control variables, i.e., population growth, gross capital formation growth, and inflation rates. β_0 is the constant term. $\beta_1 \ldots \beta_4$ are coefficients. The subscript t indices yearly series. Last, of all, ε_t is the error term.

2.3 Unit Root Test

The ARDL model demands that all variables in the second order are stationary. Hence, this research examined the order of integration thru the unit root test developed by Zivot & Andrews (1992). The Z-A test is capable of confirming the presence of unit roots with a structural break. Previous studies have employed the ZA test given its ability to determine the breakpoint (Usman, Iorember, & Olanipekun, 2019) (Liu, Amin, Rasool, & Zaman, 2020) (Agboola, Bekun, Osundina, & Kirikkaleli, 2022). The null hypothesis that series have a unit root with drift is proposed. Conversely, the alternative hypothesis is that there is a stationary series with a one-year break in the level.

2.4 ARDL-Bounds Testing

The ARDL-bounds testing was applied with the aim of estimating the impact of marine fisheries on economic growth since this method offers several advantages as follows: (a) it produces short- and long-run coefficients; (b) it includes cointegration test; (c) it declines the issues of endogeneity by plugging sufficient lags for dependent and independent variables; (d) it gives robust estimates in the case of small samples; (e) it is appropriate to be applied either variable are $I(0)$, $I(1)$, or mixed order of integration (Nathaniel & Bekun, 2020) (Ridzuan, Marwan, Khalid, Ali, & Tseng, 2020).

Further, the ARDL is proper to be applied when the empirical model combines variables in growth and level (Tinoco-Zermeño, Venegas-Martínez, & Torres-Preciado, 2014). Following Pesaran et al. (Pesaran, Shin, & Smith, 2001), the ARDL (B) model can be specified as Eq. (1).

$$\Delta GDP_t = \gamma_0 + \sum_{i=1}^{B} \gamma_1 \Delta GDP_{t-i} + \sum_{i=1}^{B} \gamma_2 \Delta FISH_{t-i} + \sum_{i=1}^{B} \gamma_3 \Delta X_{t-i} + \delta_1 GDP_{t-1} + \delta_2 FISH_t + \delta_3 X_t e_t + \mu_t \quad (4)$$

where Δ is the first difference operator. For simplicity, the additional control variables of C, P, and I are jointly presented by X. γ_i and δ_i denote the dynamic short and long-run parameters. B points out the optimal lag length for each variable. The presence of cointegration among variables was estimated by the Bounds test and the null hypothesis of no level relationship is proposed. The null and alternative hypotheses of the cointegration test can be written as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = 0 \quad (5)$$
$$H_0: \delta_1 \neq \delta_2 \neq \delta_3 \neq 0 \quad (6)$$

Two critical values are considered in the bound test, namely lower, $I(0)$, and upper, $I(1)$, critical values. The cointegration relationship is confirmed if the calculated F-statistic $>$ $I(1)$. There is no cointegration relationship if F-statistic $<$ $I(0)$ and inconclusive result if $I(0)$ $<$ F-statistic $<$ $I(1)$. Assumed there is cointegration among variables, the error correction equation can be written as Eq.

$$\Delta GDP_t = \gamma_0 + \sum_{i=1}^{B} \gamma_1 \Delta GDP_{t-i} + \sum_{i=1}^{B} \gamma_2 \Delta FISH_{t-i} + \sum_{i=1}^{B} \gamma_3 \Delta X_{t-i} + \phi ECT_{t-1} + \mu_t \quad (7)$$

where the ECM parameter of ϕ is supposed to be varied from -1 to 0. ϕ denotes the pace of adjustment toward a long-run equilibrium in response to shocks in the short run.

3 RESULT AND DISCUSSION

Table 1 displays the empirical findings for the stationary test with a structural break to initiate the discussion. We present both models with or without a linear trend. The ZA test depicts that all variables used, i.e., GDP_t, $FISH_t$, C_t, P_t, and I_t, are stationary at their levels. Hence, they are integrated of order 0, $I(0)$. Since there are none of the single variables that are stationary at the second difference; therefore, the ARDL-bounds testing approach is proper to be applied to estimate the dynamic relationship.

Table 1: The Z-A test results.

	Statistic (intercept)	Statistic (intercept & trend)
GDP	-6.0279** (0.0103)	-5.9519** (0.0309)
FISH	-7.1150** (0.0153)	-7.1557** (0.0139)
C	-5.4993* (0.0589)	-5.5329** (0.0340)
P	-6.4612*** (0.0001)	-4.9732*** (0.0003)
I	-6.1687*** (0.0074)	-6.7129** (0.0300)

Note: *, ** and *** represent significance at 10%, 5% and 1% levels; p-values are in parentheses.

Table 2: The optimal lag selection.

Methods	(0)	(1)	(2)
AIC	14.2046	9.016687*	9.5117
SC	14.4291	10.36348*	11.9808
HQ	14.2812	9.475981*	10.3537

Note: *depicts the optimal lag length.

3.1 Optimal Lag Selection

The dynamic ARDL coefficients are sensitive in regard to the number of lags chosen. This paper considers the optimal lag selection by information criteria to ensure that the ARDL equation is well established. As shown in Table 2, all approaches, i.e., AIC, SC, and HQ, depict that the optimal lag order is one. Therefore, the ARDL in this research selects the maximum lag order of one. Based on the automatic lag structure selection of SC, the ARDL (1,1,0,1,0) is the most proper model.

3.2 Co-Integration Test

The presence of a long-run relationship among variables is investigated by the Bound test and the outcomes are exhibited in Table 2. There is a cointegration connection given that the F-statistic is higher than the upper bounds critical value at a 1% level. The findings indicate that GDP growth, capture fisheries production growth, gross capital formation growth, inflation rates, and population growth all move towards long-run equilibrium. In other words, the long-run relationship among variables used in this paper is not spurious. Thus, it is meaningful to interpret the estimated coefficients.

Table 3: Co-integration test results.

Sign.	$I_b(0)$ Lower	$I_b(1)$ Upper
0.10	2.460	3.460
0.05	2.947	4.088
0.01	4.093	5.532
F-stat = 74.128 k = 4 Actual sample size = 35		

3.3 The ARDL Estimates

The dynamic short- and long-run of ARDL estimates are presented in Table 4. The increase in the production of caught fish has a positive effect (0.251) on GDP growth at a significant level of 5% in the long run. Thus, an increase in capture fisheries production has a beneficial affluence on economic growth. This finding aligns with previous research in Pakistan and Turkey (Rehman et al., 2019), (Eyüboğlu & Akmermer, 2023). The hypothesis of agriculture-led economic growth in a coastal developing country is confirmed by this finding because fisheries resources are considered part of the agricultural sector. In other words, the blue economy resources of fisheries commodities are essential in order to support the economic development in Indonesia.

A positive connection between capture fisheries and GDP implies that the fisheries sectors have remarkable roles in the economy. It is widely known that fisheries commodities contribute to the national income through several pathways; food supply, livelihoods, and exports. Therefore, it is beneficial for Indonesia to enhance the productivity levels of its marine fisheries. For notes, policies that have the feasibility to enhance marine fish production can be enforced as follow: (a) improving fisheries governance; (b) fishing port advancement; (c) improving fish processing industry; (d) human resource development; (e) integrated fishing ports and industrial estates; (f) attracting local and foreign investment; (g) precautionary management to decline risks of ecosystem collapse; (h) conservation of remaining blue economic resources; and (i) coastal ecosystem management (McClanahan, Allison, & Cinner, 2015), (Wijayanto, Wibowo, & Setiyanto, 2021), (Kurohman, Wijayanto, & Jayanto, 2020).

For the additional variables, the estimated long-run coefficient of gross capital formation growth is found to be positive, i.e., 0.04162, and significant at a 5% level. This finding supports the Solow growth model. Also, this result aligns with previous studies in Malaysia and South Asia (Solarin & Shahbaz, 2015) (Sahoo & Dash, 2012). Moreover, we found that the long coefficient of population growth is positive (2.036) and it is significant at a 5% level. This result supports the hypothesis of the Solow growth model.

Population growth, which represents labor, contributes to the economy by providing production factors. This finding also aligns with previous research in Nigeria by Tartiyus et al. (Tartiyus, Dauda, & Peter, 2015). For note, Wilmoth et al. (Wilmoth, Menozzi, & Bassarsky, 2022) the affluence of population growth in both production and consumption sectors will be more effective if followed by an increase in per capita income. Last, of all, inflation rates have a negative and significant relationship related to GDP growth.

Therefore, it can be said that the rise in inflation rates from 1984 to 2019 hinders the growth of national output. This result is consistent with previous articles in the case of Ethiopia (Wollie, 2018), Nigeria (Adaramola & Dada, 2020), and Tanzania (Moore, 2013).

Table 4: The short- and long-run ARDL coefficients.

	Variables	Coefficients
Long-run model	*FISH*	0.25125** (0.12099)
	C	0.04162** (0.01937)
	P	2.03646** (0.85743)
	I	-0.30435*** (0.03014)
Short-run model	$\Delta FISH$	-0.01046 (0.08797)
	ΔC	0.04055** (0.01728)
	ΔP	27.11456** (10.10388)
	ΔI	-0.29651*** (0.03269)
	Constant	4.18069*** (1.05842)
	ECM	-0.97424*** (0.07215)
	R-square	0.942972
	Adj. R-square	0.939408

Note: p-value is the parentheses; Δ depicts the first difference operator; ** and *** denote significant at 5% and 1% levels.

The estimated parameters of captured fisheries and ECM are our main focus for short-term analysis. The outcomes denote that the relationship between marine fisheries production and GDP growth is not evident. Hence, the role of fisheries as an engine of economic growth is only validated in the long run. Nonetheless, the ECM is found to have a negative sign (-0.97424) as expected and it is significant at a 1% level. This finding implies that shock in the short run will be adjusted around 97% within a year toward long-run equilibrium. The significance and negative sign of the ECM also corroborates the presence of cointegration relationship.

Table 5: Diagnostics test results.

Tests		*P*-value
Jarque-berra	0.488783[a]	0.6191
Breusch-godfrey	1.412013[b]	0.2412
Glejser	1.333848[b]	0.5133

Note: the power of a shows the calculated JB-value; the power of b depicts the calculated F-statistic.

3.4 Diagnostic and Stability Test

The estimated model's reliability was ensured by a package of diagnostic and stability tests performed by this paper. As shown in Table 4, Fig. 2, and Fig. 3, the Jarque-Berra, Breusch-Pagan serial LM, and Glejser tests point out results as follows: residuals are normally distributed; there is no problem of serial correlation; and there is no issue of heteroscedasticity. Moreover, the CUSUM and CUSUMQ tests depict that the estimated parameters are consistent given that the red plots are within the critical value at a 5% level.

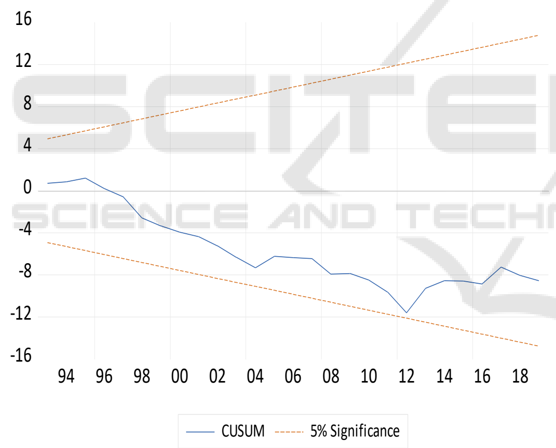

Figure 2: Plots of CUSUM recursive residuals.

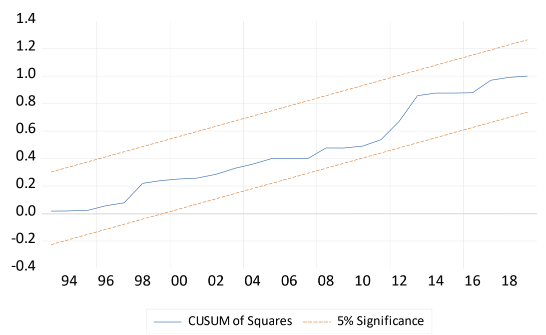

Figure 3: Plots of CUSUMSQ recursive residuals.

3.5 Robustness Check

Following Hadi & Chung (Hadi & Chung, 2022) and Guan et al. (Guan, Kirikkaleli, Bibi, & Zhang, 2020), this paper employed the dynamic OLS (DOLS) developed by Stock & Watson (Stock & Watson, 1993) for the robustness check of the long-run parameters. As shown in Table 6, the estimated coefficient of capture fisheries production growth in the DOLS method is consistent with previous findings in the ARDL-Bounds testing. In this result, it is concluded that blue economic resources play a significant role in marine fisheries production as a contributor to economic growth.

Table 6: DOLS estimates.

Variables	Coefficients
FISH	0.421553*** (0.164746)
C	8.069757* (4.361412)
P	1.104130 (1.100320)
I	-0.260790*** (0.028311)
Constant	4.894521*** (0.993151)
R-square	0.937676
Adj. R-square	0.902062

Note: * and *** denote significance at 10 and 1% levels.

4 CONCLUSION

The present paper aims to estimate the linkage between capture fisheries and economic growth in Indonesia between 1984 and 2019, using the extension version of the Solow growth model. The order of integration and dynamic connections can be checked using breakpoint unit root and ARDL-Bounds testing. All the variables used are stationary at their level and there is a cointegration relationship among them. The results denote that capture fisheries production growth has a beneficial role on GDP growth since its sign is positive and significant in the long run. Thus, it can be noted that the blue economy resources, i.e., marine fisheries, are an engine of growth. Moreover, it is favourable and pivotal for Indonesia to augment the productivity of its capture fisheries sector given that it significantly advances

GDP. For the record, the empirical finding is robust with the alternative method such as DOLS.

REFERENCES

Adaramola, O. A., & Dada, O. (2020). Impact of inflation on economic growth: Evidence from Nigeria. *Investment Management and Financial Innovations*, *17*(2), 1–13. https://doi.org/10.21511/imfi.17(2).2020.01

Africa, S. (2020). Causality E ff ects among Gross Capital Formation , Unemployment and Economic Growth in South Africa.

Agboola, M. O., Bekun, F. V., Osundina, O. A., & Kirikkaleli, D. (2022). Revisiting the economic growth and agriculture nexus in Nigeria: Evidence from asymmetric cointegration and frequency domain causality approaches. *Journal of Public Affairs*, *22*(1). https://doi.org/10.1002/pa.2271

Alharthi, M., & Hanif, I. (2020). Impact of blue economy factors on economic growth in the SAARC countries. *Maritime Business Review*, *5*(3), 253–269. https://doi.org/10.1108/MABR-01-2020-0006

Ardhani, I. (2021). Indonesia and The Criminalization of Illegal, Unregulated, and Unreported Fishing in The Global Level. *Jurnal Hubungan Internasional*, *9*(2), 165–177. https://doi.org/10.18196/jhi.v9i2.10374

Asian Development Bank. (2014). *State of the Coral Triangle: Indonesia*.

Ceccarelli, D. M., Lestari, A. P., Rudyanto, & White, A. T. (2022). Emerging marine protected areas of eastern Indonesia: Coral reef trends and priorities for management. *Marine Policy*, *141*, 105091. https://doi.org/https://doi.org/10.1016/j.marpol.2022.105091

Eyüboğlu, S., & Akmermer, B. (2023). The Relationship between Economic Growth and Fisheries Production in Türkiye. *Aquaculture Studies*, *24*(2). https://doi.org/10.4194/AQUAST1017

Guan, J., Kirikkaleli, D., Bibi, A., & Zhang, W. (2020). Natural resources rents nexus with financial development in the presence of globalization: Is the "resource curse" exist or myth? *Resources Policy*, *66*(January 2020), 101641. https://doi.org/10.1016/j.resourpol.2020.101641

Hadi, S. N., & Chung, R. H. (2022). Estimation of Demand for Beef Imports in Indonesia: An Autoregressive Distributed Lag (ARDL) Approach. *Agriculture*, *12*(8), 1212. https://doi.org/10.3390/agriculture12081212

Hassan, S. T., Xia, E., Latif, K., Huang, J., & Ali, N. (2020). Another Look at the Nexus Among Energy Consumption, Natural Resources, and Gross Capital Formation: Evidence from Pakistan. *Natural Resources Research*, *29*(4), 2801–2812. https://doi.org/10.1007/s11053-019-09607-0

Ilyas, F., Gillani, D. Q., Yasin, M., Iqbal, M. A., Javed, I., Ahmad, S., & Nabi, I. (2021). Impact of Livestock and Fisheries on Economic Growth: An Empirical Analysis from Pakistan. *Sarhad Journal of Agriculture*, *38*(1), 160–169. https://doi.org/10.17582/journal.sja/2022/38.1.160.169

Jaunky, V. C. (2011). Fish exports and economic growth: The case of SIDS. *Coastal Management*, *39*(4), 377–395. https://doi.org/10.1080/08920753.2011.589210

Kent, G. (1997). Fisheries, food security, and the poor. *Food Policy*, *22*(5), 393–404. https://doi.org/https://doi.org/10.1016/S0306-9192(97)00030-4

Kurohman, F., Wijayanto, D., & Jayanto, B. B. (2020). The strategy of capture fisheries development in Pamekasan regency, Madura Island. *AACL Bioflux*, *13*(5), 2816–2827.

Liu, Y., Amin, A., Rasool, S. F., & Zaman, Q. U. (2020). The role of agriculture and foreign remittances in mitigating rural poverty: Empirical evidence from Pakistan. *Risk Management and Healthcare Policy*, *13*, 13–26. https://doi.org/10.2147/RMHP.S235580

McClanahan, T., Allison, E. H., & Cinner, J. E. (2015). Managing fisheries for human and food security. *Fish and Fisheries*, *16*(1), 78–103. https://doi.org/https://doi.org/10.1111/faf.12045

Moore, P. D. (2013). Impact of inflation on economic growth: A Case Study of Tanzania. *Asian Journal of Empirical Research*, *3*(4), 363–380. https://doi.org/10.1038/253011b0

Nathaniel, S. P., & Bekun, F. V. (2020). Environmental management amidst energy use, urbanization, trade openness, and deforestation: The Nigerian experience. *Journal of Public Affairs*, *20*(2). https://doi.org/10.1002/pa.2037

Oktavilia, S., Firmansyah, Sugiyanto, F. X., & Rachman, M. A. (2019). Competitiveness of Indonesian fishery commodities. *IOP Conference Series: Earth and Environmental Science*, *246*(1). https://doi.org/10.1088/1755-1315/246/1/012006

Oyakhilomen, O., & Zibah, R. G. (2013). Fishery production and economic growth in Nigeria: Pathway for sustainable economic development. *Journal of Sustainable Development in Africa*, *15*(2), 99–109.

Peristiwady, T. (2021). Ichthyological Research and Biodiversity of Marine Fishes in Indonesia. *IOP Conference Series: Earth and Environmental Science*, *789*(1). https://doi.org/10.1088/1755-1315/789/1/012009

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616

Rehman, A., Deyuan, Z., Hena, S., & Chandio, A. A. (2019). Do fisheries and aquaculture production have dominant roles within the economic growth of Pakistan? A long-run and short-run investigation. *British Food Journal*, *121*(8), 1926–1935. https://doi.org/10.1108/BFJ-01-2019-0005

Ridzuan, N. H. A. M., Marwan, N. F., Khalid, N., Ali, M. H., & Tseng, M. L. (2020). Effects of agriculture, renewable energy, and economic growth on carbon dioxide emissions: Evidence of the environmental

Kuznets curve. *Resources, Conservation and Recycling*, *160*(January), 104879. https://doi.org/10.1016/j.resconrec.2020.104879

Sahoo, P., & Dash, R. K. (2012). Economic growth in South Asia: Role of infrastructure. *The Journal of International Trade & Economic Development*, *21*(2), 217–252. https://doi.org/10.1080/09638191003596994

SEAFDEC. (2020). *Fishery Statistical Bulletin of Southeast Asia 2020*.

Solarin, S. A., & Shahbaz, M. (2015). Natural gas consumption and economic growth: The role of foreign direct investment, capital formation and trade openness in Malaysia. *Renewable and Sustainable Energy Reviews*, *42*, 835–845. https://doi.org/https://doi.org/10.1016/j.rser.2014.10.075

Stock, J. H., & Watson, M. W. (1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Econometrica*, *61*(4). https://doi.org/https://doi.org/10.2307/2951763

Sugiawan, Y., Islam, M., & Managi, S. (2019). Global Marine Fisheries with Economic Growth. In *Wealth, Inclusive Growth, and Sustainability* (1st ed., p. 48). Routledge.

Tartiyus, E. H., Dauda, M. I., & Peter, A. (2015). Impact of population growth on economic growth in Nigeria (1980-2010). *IOSR Journal Of Humanities And Social Science*, *20*(4), 115–123.

Tinoco-Zermeño, M. Á., Venegas-Martínez, F., & Torres-Preciado, V. H. (2014). Growth, bank credit, and inflation in Mexico: Evidence from an ARDL-bounds testing approach. *Latin American Economic Review*, *23*(1). https://doi.org/10.1007/s40503-014-0008-0

Usman, O., Iorember, P. T., & Olanipekun, I. O. (2019). Revisiting the environmental kuznets curve (EKC) hypothesis in india: The effects of energy consumption and democracy. *Environmental Science and Pollution Research*, *26*(13), 13390–13400. https://doi.org/10.1007/s11356-019-04696-z

Wijayanto, D., Wibowo, B. A., & Setiyanto, I. (2021). The strategy of capture fisheries development in rembang regency. *AACL Bioflux*, *14*(3), 1786–1800.

Wilmoth, J., Menozzi, C., & Bassarsky, L. (2022). *Why population growth matters for sustainable development. Policy Brief No. 130*.

Wollie, G. (2018). The Relationship between Inflation and Economic Growth in Ethiopia. *Budapest International Research and Critics Institute (BIRCI-Journal) : Humanities and Social Sciences*, *1*(3), 264–271. https://doi.org/10.33258/birci.v1i3.73

Zivot, E., & Andrews, D. W. K. (1992). Further Evidence on the Great Crash, the Oild-Price Shock, and Unit-Root Hypothesis. *Journal of Business & Economic Statistics*, *10*(3), 251–270. https://doi.org/https://doi.org/10.2307/1391541