



# Alternative policies based on blue economy for the skipjack (*Katsuwonus pelamis*) fishery management of Jayapura City, Papua, Indonesia

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**Abstract.** The effort to realize a sustainable skipjack (*Katsuwonus pelamis*) fishery is by applying the concept of the blue economy in its management. The purpose of this study is to formulate alternative policies of skipjack fisheries based on the principles of the blue economy in Jayapura City. The approach to regulatory impact assessment developed by the Asian Development Bank (2003) is used to analyze it. The results showed that the second alternative policy in the form of making a new regional regulation (PERDA) concerning the blue economy of skipjack fisheries that is because it generates benefits of USD 149,397,546, greater than the costs incurred in the amount of USD 1,309,116. The concept of a blue economy is an embodiment of ecosystem-based sustainable development and can produce economic growth for the region.

**Key Words:** economic growth, economy-based ecosystem, policies, regional regulations, skipjack.

**Introduction.** Skipjack (*Katsuwonus pelamis*) fisheries are one of the commodities that are of interest to global consumers and have high economic value (Lumi et al 2013; Firdaus et al 2018; Tuli et al 2015; Tuli 2018; Suhana et al 2019; Yanglera et al 2016; Amir & Mallawa 2015; Soukotta et al 2017; Hutajulu et al 2019). Skipjack also produce economic contributions to the region (McCluney et al 2019; Johnson et al 2018; Hutajulu et al 2019). To develop the economic value that can continue and be produced by *K. pelamis* fisheries, a variety of appropriate policies are needed. The policies include fishing arrangements based on a standard size of 36.5-84.7 cm (Soares et al 2019; Nurdin & Panggabean 2017; Jamal et al 2011; Jadmiko et al 2015; Wang et al 2012; Asia et al 2015; Asia et al 2015; Kumar et al 2019; Nainggolan et al 2017; Miller et al 2017; Pillin & Tawari 2015). Another policy is to implement sustainable management and to use sustainable fishing gear, including hook and line/tonda fishing line, pole and line (huhate), tuna longline (tuna longline), hand line, kite line fishing etc. (Akmaluddin et al 2015; Akbar & Labenua 2018; Nugraha et al 2020; Khan et al 2019; Najamuddin et al 2017; Akbar et al 2016, Miller et al 2017; Mallawa et al 2018; Saputra et al 2014, Tadjuddah et al 2017).

One form of the efforts to achieve sustainable marine resource management, especially *K. pelamis* fisheries commodity, is to apply the concept of blue economy (Sari 2019; Purbani et al 2016; Nurhayati 2013; Ahmad 2016; Radiarta et al 2015; Sukarniati & Khoirudin 2017; Godfrey 2016; Lee et al 2020; Doyle 2018; Techera 2019; Sari & Muslimah 2019). The concept of a blue economy is a paradigm of economic development based on the principles of ecosystem management and can produce economic growth (Pauli 2010; Cavanagh & Benjaminsen 2017; Doyle 2016; Silver et al 2015).

This paper presents a regulatory impact assessment (RIA) approach which is associated with fisheries development policies based on the blue economy. RIA is a method that systematically and consistently studies the effects of government actions, communicating information to decision-makers (USAID & SENADA 2009; KPPOD 2013). This approach is used to see the benefits and disadvantages of implementing blue economy policies in *K. pelamis* fisheries management. The purpose of this paper is to formulate an alternative policy of skipjack fisheries based on the principles of the blue economy in Jayapura City.

**Material and Method.** This research was conducted in Jayapura City during the period of August-September 2017. The data used are Primary data, namely fish production data, wages and salaries, number of ships, fishing gear, fish prices, production costs, bank credit, fishermen income, fisheries investment, availability of fuel, equalizer freezer, machine oil, boat engine value, fuel oil, the amount of labor, consumption, electricity, business capital, licensing administration costs, the cost of providing wastewater treatment plants (WWTP), levies, supervision fees, environmental data, the retribution of fisheries. Secondary data is in the form of labor absorption, fish stocks, fishing facilities and infrastructure, fish marketing, fishery human resources, fish waste, water quality, government development programs, fisheries Gross Regional Domestic Product (GRDP), water pollution, business licensing. The analytical approach used is the Regulatory Impact Assessment (RIA).

RIA is a method used to assess the impact of a regulation that can help policymakers to determine the best alternative in the selection of policy and regulatory criteria to be carried out. Specific characteristics in this analysis involve consultation with stakeholders who will be affected if the policy or regulation is realized, as well as those that have a direct and indirect relationship with the planned blue economy implementation of *K. pelamis* fisheries in Jayapura City. The stakeholders include stakeholders directly involved in the development of *K. pelamis* fisheries in Jayapura City, which include: the Jayapura City Maritime Affairs and Fisheries Office, the Development Planning Agency at Sub-National Level (BAPPEDA) in Jayapura City, the Environment Office of Jayapura City, the Office of Cooperatives and MSMEs, Private/Fishery Entrepreneurs, Community Leaders, Experts/Academics/Professionals, NGOs in Fisheries. The purpose of the application is to be able to produce alternatives to overcome the management of *K. pelamis* fisheries that are unsustainable and pose a massive depletion of stocks.

The stages of RIA developed by the Asian Development Bank (ADB) Year (2003) are: 1) problem formulation, 2) policy objectives, 3) identification of alternative solutions to problems, 4) benefit and cost analysis, 5) communication (consultation) with stakeholders, 6) determining the best options (alternative policies), 7) formulating a policy implementation strategy.

## Results and Discussion

The problems that hinder the implementation of a blue economy regarding the *Katsuwonus pelamis* fishery of Jayapura City are the following:

- 1) Information about the benefits of the blue economy in the marine and fisheries regional organizations of Jayapura City and Papua Province is not evenly distributed.
- 2) Lack of understanding from regional development organization (OPD) related to the process and working process of the blue economy in *K. pelamis* fisheries.
- 3) Budget limitations of the relevant regional agencies in realizing the program.
- 4) The absence of tools and equipment based on the blue economy.
- 5) The high cost of technology and innovation to realize the program.
- 6) There is no knowledge between fishermen about the concept of a blue economy.
- 7) The level of education and expertise of fishermen is low.
- 8) The lack of willingness of fishermen to try to realize the concept.
- 9) There is no guidance to realize the concept of a blue economy.

- 10) The absence of technical rules for the implementation of the blue economy concept on a national and regional scale.
- 11) There is no socialization about the blue economy for fishermen and fishery entrepreneurs.

The absence of regional regulations regarding the blue economy of *K. pelamis* fisheries in Jayapura City and Papua Province is an opportunity to immediately compile these Regional Regulation documents. Therefore, this research is planned to make a regional regulation design about the blue economy of *K. pelamis* fisheries. The reference that can be used to make the design is the Law of the Republic of Indonesia Number 32 of 2014 concerning marine CHAPTER VI concerning marine management, part one in particular article 14 paragraph 1 which reads: "The Government and Regional Governments by following per under with their authority to conduct maritime management for the greatest prosperity of the people through the utilization and exploitation of marine resources using the principles of the blue economy". The existence of the Law of the Republic of Indonesia Number 23 of 2014 concerning regional governments explains the division of authority in the management of marine and fishery resources between the central, provincial and district/city governments. The context of drafting the blue economy regional regulation must create a close relationship between these stakeholders, because it involves their respective authorities.

**Formulation of policy objectives.** A problem sometimes cannot be solved by one policy and one agency, but close collaboration is needed between the parties involved. Public policy analysis must be able to identify the objectives to be achieved.

The question that arises in this analysis is what is the purpose and objective of the government to issue a policy? Is setting goals or targets to be achieved a solution to solve some or all phenomena and problems that occur? The analysis in this section discusses the level of authority of the local government in producing a regional regulation on the blue economy which must be tested for consistency and relevance to the central government's policy on the implementation of the blue economy in the fisheries sector. Efforts to achieve these goals, describe some specific goals, namely:

- 1) Efforts and strategies implemented in realizing the blue economy of skipjack fisheries in Jayapura City.
- 2) Development and utilization of local potentials and advantages in the context of the realization of the blue economy of skipjack fisheries.
- 3) Guaranteed availability of facilities and infrastructure based on a well-identified blue economy.
- 4) Guaranteed successful implementation of the blue economy program and the benefits felt by the fisheries stakeholders implementing the program.
- 5) Determination of guidelines, standardization of equipment, and equipment that makes it easy for fishermen and entrepreneurs to understand and realize them.
- 6) The certainty of those who finance the implementation of the blue economy.
- 7) Clarity regarding the involvement and forms of participation that fisheries must carry out in implementing the blue economy.
- 8) Determination of special institutions authorized to handle the program, to facilitate coordination, supervision, and evaluation of implementation.

**Identifying alternative solutions to the problem.** Identification activities of alternative approaches and strategies to be chosen are expected to produce the effective and efficient application of formal regulations. Another choice is an approach outside the formal rules that can solve the main problem by the Asian Development Bank (2003). Alternative types of problem-solving in making regulations and implementing the blue economy of *K. pelamis* fisheries such as:

- 1) Do nothing. This choice as a basis and prerequisites in making a basis or baseline for conditions if the government as the regulator does not take any action. This means that the regional regulation of Jayapura City Number 1 of 2008 concerning Fishery Business Permits continues. This condition becomes a comparison material if the

local government is involved in solving the existing problems and in achieving the expected goals.

- 2) Acting by issuing rules to ensure problem resolution and the realization of the identified objectives by including alternative implementations of the blue economy according to Dahuri (2015), namely:
  - a) Setting the rate of fishing in the waters of Papua and the City of Jayapura and the provincial Fisheries Management Area (FMA) so as not to exceed the potential for sustainable production (MSY).
  - b) Strengthening and developing industrial technology for handling and processing the results of capture fisheries.
  - c) Development of the biotechnology industry and nano waters technology.
  - d) Strengthening and developing domestic and export markets, to increase fish prices at a more favorable rate.
  - e) Application of the use of technological innovations without waste and carbon emissions.
  - f) Open access to fishermen, marine and fisheries entrepreneurs concerning access to capital and quality fisheries production facilities.
  - g) Improvements to basic infrastructure and fisheries, transportation, connectivity, and logistics including new development if they are not yet available.
  - h) Increasing the capability of fishery human resources (HR).
  - i) Development and increase in the amount of research funding and development (R&D).
  - j) The certainty of the investment in the fishery and marine sector is easy and conducive.

**Analysis of benefits and costs.** This stage is particularly important in the determination, endorsement to implementation of a rule as a basis for reviewing a rule. The results of the analysis provide an overview of the extent to which the benefits will be received from the existence of a regional regulation as well as the benefits of efforts to revise a regional regulation. Costs become a reflection of the amount that must be borne by the government in the election to revise existing regional regulations or make new regional regulations.

The results of the comparison of benefits and costs become a basis for the regional government of Jayapura City in deciding to choose alternative options to be chosen to realize the blue economy of skipjack fisheries. Another benefit of this stage is that it is a material or tool for clarifying the stages of identification, formulation of the problem until the goal of establishing existing rules is in line with the expectations of all parties. Application of rules that are not based on an appropriate basis, the occurrence of various deviations in the field to the rejection made by the local community will have an impact on the difficulty of evaluating at the same time measuring the success of the rules as well as the benefits and costs of an existing rule (ADB 2003). Alternative policy options in realizing the blue economy of skipjack fisheries in Jayapura City are divided into 2 (two) choices which include the following policies.

**Policy Option 1, do nothing.** Alternative options do not take any action to overcome the problem of inequality of information about the benefits of the blue economy in the relevant stakeholder environment. This alternative can be used as a basis in overcoming the risks that will arise later if this option is chosen, it can be used as a reference in estimating the benefits and costs that arise at a later stage.

The first policy choice recommendation is to carry out continuous dissemination of information to all relevant stakeholders. The Research and Development Center for Maritime Affairs and Fisheries, Ministry of Marine Affairs and Fisheries (2014) recommends a comprehensive and continuing socialization and education about the blue economy concept of capture fisheries. The amount of the cost of implementing the blue economic policy for skipjack fisheries is guided by the Regional Government Performance Accountability Report of the city of Jayapura, specifically the Maritime Affairs and Fisheries-OPD 2015-2018, and the annual report 2015-2018 (Table 1).

Table 1

Policy option 1, do nothing with the implementation of the blue economy for Fishery business of *K. pelamis* fisheries in Jayapura City (US\$)

No.	Stakeholder	Types of Benefits / Costs	Alternative I (Do nothing)	Economic quantification (US\$)	Source		
1	Fisherman	The benefits are immeasurable	The development program by the regional government is still ongoing	14,976	Data processed (2019)		
			Development of Capture Fleet, Fishing Equipment, and Catching aids.	88,059			
			Strengthening and Development of Fishery Product Marketing	23,780			
		Measurable benefits	Wages and salaries	3,372			
			Short-term benefits	Fish prices have remained stable		2	
				Facilities and infrastructure assistance for fish marketing		57,126	
		Long-term benefits	Fishing activities continue	4,496			
			Fishermen's welfare stable	14,906			
		The loss is immeasurable	measurable losses	The decline in fish stocks		2,725,073	
				The amount of bank credit is small		720	
				Limited human resource capabilities of local fishermen		1,080	
		Short-term loss	Long term loss	The decreased income of fishing communities		25,043	
				Fish waste is high and wasted		269,510	
				Declining water quality		122,813	
		Fishing using fishing equipment is not environmentally friendly and hazardous materials	30,973				
2	Department of Marine and Fisheries (DKP)	The benefits are immeasurable	Fisherman Development Program	16,355	DKP Jayapura City (2015-2018)		
			Measurable benefits	Retribution of fisheries business continues		3,218	
				Short-term benefits		Availability of fishing business employment	11,836
						Long-term benefits	The competitiveness of skipjack fishery products is still low
			The loss is immeasurable	measurable losses			GRDP of fisheries
						Development of human resources in the marine and fisheries service environment	37,945
						Socialization likes to eat fish	10,809
						Monitoring / Evaluation and Provision of Marine and Fisheries Data / Information	13,007
						damage to ecosystems and the environment is high	540,505
						Water and air pollution continues	176,235
						<i>K. pelamis</i> fisheries business is not efficient yet	10,110
						Supervising operating costs are expensive and with less effective results	9,306
						The amount of fish catch is not sufficient for local consumption	24,027,887
			Short-term loss	Long-term losses		Provision of employment will be reduced	7,890
Decreasing the amount of retribution from fishery business	3,218						
		Limited facilities and infrastructure for good <i>K. pelamis</i> fisheries management	5,224				
3	Private / Fishery businessman	The benefits are immeasurable	Business and HR Development and Fisheries Development Program (Fishermen and Internal of DKP)	38,048	Data processed (2019)		

		Measurable benefits	High business production	71,963	
		Short-term benefits	The certainty the amount of retribution of business	48	
		Long-term benefits	The certainty of business continues (business license)	37	
		The loss is immeasurable	Fisheries that are difficult to develop	34,503	
		measurable losses	The decline in production and an operating profit	14,906	
			Difficulty getting credit/loans from banks	7,206	
		Short-term loss	High business production costs	57,056	
		Long-term losses	The production of <i>K. pelamis</i> fisheries is not stable	70,164	
			The quality of local fisheries production is unable to compete with global fish production	10,133	
			Limited investment in capture fisheries due to the low quality of <i>K. pelamis</i> fisheries	34,071	
4	NGOs / Experts / Academics	The benefits	Can support local governments to develop <i>K. pelamis</i> fisheries	22,767	Data processed (2019)
		The loss	It is difficult to get data on fishery management	13,115	
5	Agency of regional development	The benefits	Able to evaluate the DKP program on skipjack fisheries development plans	10,809	
		The loss	Unable to intervene in the implementation of fisheries development programs	2,702	
6	Regional House of Representatives of Jayapura City	The benefits	Legalization of regional regulations regarding fishery management	18,015	Bappeda Jayapura City (2017)
		Kerugian	unable to help accelerate the development of <i>K. pelamis</i> fisheries	1,801	
		The benefits			40,833,632
		The cost			28,230,081
		Difference			12,603,551

**Policy option 2, actions in the form of making a new regional regulation (PERDA) concerning the blue economy of skipjack fisheries.** The management of capture fisheries that have been taking place all this time in Jayapura City shows problems: ecosystem damage, pollution, decreasing fish stocks, and low welfare of fishermen. The various problems above greatly affect the sustainability of skipjack fisheries. Therefore, the urge to make regional regulations on the blue economy is a necessity that can be a solution in solving these problems. Information about Policy Option 2 is presented in Table 2:

Table 2  
Policy option 2, making a new regional regulation (PERDA) concerning the blue economy implementing the blue economy of skipjack fisheries in Jayapura City

No.	Stakeholder	Types of Benefits/Costs	Alternative II (Making regional regulations for new blue economy)	Total economic quantification (US\$)	Source
1	Fisherman	The benefits are immeasurable	Ecosystem and environmental quality increases	686,748	Data processed (2019)
			Increasing awareness of fishing communities to preserve ecosystems and fisheries and environmental resources	122,813	Data processed (2019)
			Reducing fishing conflicts among fishermen	21,618	Data processed (2019)
		Measurable	Increase in wages and salaries	4,496	Data

		benefits			processed (2019) Data
			The amount of bank credit increased	21,618	processed (2019) Data
			The activity of processing fish waste into food and fish fertilizer adds to income	394	processed (2019) Data
			The number of fish catches increased	51,754	processed (2019) Data
		Short-term benefits	The price of fish increased	3	processed (2019) Data
			Assistance in catching fish processing and processing facilities and infrastructure	85,689	processed (2019) Data
		Long-term benefits	Fisherman welfare has increased	8,209	processed (2019) Data
			Water and air pollution can be reduced to near zero	52,870	processed (2019) Data
			Fish waste decreases	80,853	processed (2019) Data
			Water quality is increasing	61,406	processed (2019) Data
		The loss is immeasurable	Difficulties in operating new fishing gear	1,080	processed (2019) Data
		measurable losses	Difficulty in getting type B-20 fuel oil	4	processed (2019) Data
		Short-term loss	Difficulties in obtaining solar cell engine	43,309	processed (2019) Data
		Long-term losses	Certainty to work highly depends on the merger of several business units to run a pole and line capture fishery business	15,132	processed (2019) Data
2	Department of Marine and Fisheries (DKP)	The benefits are immeasurable	Processing of fish waste until it reaches zero	394	DKP Jayapura City (2015-2018)
		Measurable benefits	Increasing the amount of retribution from skipjack fishery business	16,979	DKP Jayapura City (2015-2018)
		Short-term benefits	The use/exploitation of fish is increasingly efficient and sustainable	100,749	DKP Jayapura City (2015-2018)
		Long-term benefits	Skipjack fish stocks have increased	70,693,593	DKP Jayapura City (2015-2018)
			Gross Domestic Regional Product is increasing	72,061,684	DKP Jayapura City (2015-2018)
			Time management of skipjack tuna is sustainable	4,925,406	DKP Jayapura City (2015-2018)
		The loss is immeasurable	Ecosystem damage and low environment	459,429	DKP Jayapura City (2015-2018)

		Difficulties in getting human resources who understand the blue economy	1,080	DKP Jayapura City (2015-2018)
	measurable losses	Costs of socialization about the blue economy to all stakeholders of capture fisheries in Jayapura City	16,213	DKP Jayapura City (2015-2018)
		The costs of surveillance operations are decreasing and with very efficient and effective results	7,445	DKP Jayapura City (2015-2018)
		The high cost of training borne by the government to understand new fishing technologies for internal human resources, entrepreneurs, local fishermen and NGOs/academics	14,412	DKP Jayapura City (2015-2018)
		The number of fish catches increases and can meet local consumption	51,754	DKP Jayapura City (2015-2018)
		Efforts to supply B-20 fuel oil continuously and closely at fish landed base (PPI) Hamadi	43,237	DKP Jayapura City (2015-2018)
	Short-term loss	Capital difficulties for replacing equipment and fishing equipment based on the blue economy	57,056	DKP Jayapura City (2015-2018)
		Increasing the amount of retribution of skipjack fishing business	16,979	DKP Jayapura City (2015-2018)
	Long-term losses	Difficulties in providing operational costs for the technical team implementing the blue economy	12,250	DKP Jayapura City (2015-2018)
3	Private / Fishery businessman	The benefits are immeasurable	15,165	Data processed (2019)
	Measurable benefits	Increasing the number of fish caught	71,963	Data processed (2019)
		Optimal business production	89,954	Data processed (2019)
	Short-term benefits	Increase in business revenue	32,777	Data processed (2019)
		Increase in operating profit	18,633	Data processed (2019)
		Low business production costs	22,822	Data processed (2019)
	Long-term benefits	The quality of local fisheries production has the competitiveness and can compete with global fish production	28,464	Data processed (2019)
		Operational sustainability continues with the support of increased fish stocks	70,693	Data processed (2019)
		The company's operating costs decreased	28,528	Data processed (2019)
	The loss is immeasurable	The availability of human resources who understand and operate new fishing equipment based on the blue economy is limited	380,485	Data processed (2019)
	measurable losses	Difficulties in obtaining a loan from the Bank	36,030	Data processed



				(2019)	
		Short-term loss	Difficulties in obtaining sustainable type B-20 fuels	50,846	Data processed (2019)
		Long-term losses	The high investment costs for purchasing a large ship complete with main engines, additives, navigation equipment, fishing gear and others based on the blue economy	79,845	Data processed (2019)
4	NGOs / Experts/ Academics	The benefits	Can help the government to train human resources and technical teams about the blue economy	10,448	Data processed (2019)
		The loss	Budget limitations provided by local governments to develop blue economy-based capture technology	18,015	
5	Agency for Regional Development	The benefits	Can evaluate the DKP program on the development plan of <i>K. pelamis</i> fisheries based on the blue economy	10,809	Bappeda Jayapura City (2017)
		The loss	Real support from the government to research the application of the blue economy and to create technological innovations for fishing based on the blue economy	2,702	
6	Regional House of Representatives of Jayapura City	The benefits	The legislative function can be accelerated, to support the implementation of the blue economy	18,015	Data processed (2019)
		The loss	Cannot intervene further about the implementation of the blue economy until the evaluation and effectiveness and efficiency of the implementation of the blue economy program	1,801	Data processed (2019)
The benefits				149,415,561	
The cost				1,309,116	
Difference				148,106,444	

The table above explains that the application of the blue economy in skipjack fisheries provides enormous benefits for economic development and can improve the welfare of fishing communities. The biggest benefit value is an increase in the stock of skipjack fish which is significant in the long term, the value is USD 70,693,593 and an increase in the amount of Gross Regional Domestic Product (GRDP) by  $\pm$  45%, namely USD 72,061,684. The increase in value is caused using environmentally friendly fishing gear, which is a more efficient fishing gear (pole and line), using fuel oil of type B-20 (bio solar), as well as machines using solar cells, thereby reducing the amount of waste and pollution.

Comparison between benefits and costs for the second option, namely the value of benefits amounting to USD 149,415,561, while the total cost is of USD 1,309,116. The value of the first option generates a total benefit of USD 1,480,476,068 while the total cost is USD 801,243,473 and is very feasible to implement. The results of both studies show that *K. pelamis* fisheries in Jayapura City is very feasible to be developed optimally to improve the welfare of fishing communities and support regional economic growth.

**The results of the calculation of the selection of policy recommendations using the RIA.** The calculation of each aspect in the choice of policy analysis for the first and second options is analyzed based on the sum of the economic value of benefits and costs produced by each option. The two options will be compared between the benefits and the costs generated. Options that generate greater benefits are options that will be chosen in the context of implementing the blue economy of *K. pelamis* fisheries in Jayapura City (Table 3).

Table 3

Calculation of the selection of policy recommendations using RIA (US\$)

No	Aspect	First option (US\$)	Second option (US\$)	Source
1	The benefits	40,833,632	149,397,546	DKP Jayapura City (2015-2018)
2	The cost	28,230,081	1,309,116	DKP Jayapura City (2015-2018)
3	Difference	12,603,552	148,088,429	DKP Jayapura City (2015-2018)

The calculation results in the table above show that the second policy option has the greatest benefit value compared to cost. The Regional Autonomy Implementation Monitoring Committee (KPPOD) study (2013) chose the third option because the measurable benefits of fishery sales received by fishermen in East Belitung province in Indonesia were greater than the costs incurred. The meaning of the two studies shows that if the *K. pelamis* fisheries and other capture fisheries businesses are professionally managed and sustainable, it will generate income for the community and economic growth for the region.

**Communication (consultation) with stakeholders.** The results of communication (consultation) are expected to receive constructive recommendations in the context of improving the quality of local regulations on the blue economy. The results of suggestions from various relevant stakeholders such as:

- 1) The blue economy can preserve the ecosystem and capture fisheries resources.
- 2) The government is expected to make a pilot project so that it can see the difference in benefits and losses before and after the implementation of the blue economy.
- 3) Providing credit/loans by the government to entrepreneurs for the procurement of new fleets and fishing equipment.
- 4) Providing incentives and subsidies for fisheries businesses that want to try to develop a blue economy.
- 5) The government is building networks and cooperation with banks so that they are willing to finance the implementation of the project.

**Determination of the best option (alternative policy).** The analysis shows that the best option chosen is the second option, namely the preparation of regional regulations concerning the blue economy of skipjack fisheries. For the Regional Regulation to run well, it is necessary to establish a special agency or work group tasked with handling and running the program, as well as giving consideration and reviewing various policy options. Before the choice is finalized, it is necessary to conduct public consultations with various relevant fisheries actors in Jayapura City.

For the implementation of the blue economy program of skipjack fisheries to run well and smoothly, the fishing groups, fisheries entrepreneurs, and industries that are interested, it is necessary to be given incentives and subsidies. The results of interviews with fisheries stakeholders, they are very enthusiastic and want to try to implement the blue economy. Several benefits and costs arising from the second choice that will result from the approach:

- 1) The legal basis in the form of regional regulations on the blue economy is very precise and relevant to the basic principles of national regulation (Law).
- 2) The increasing desire of fisheries businesses to immediately apply the concept of the blue economy.
- 3) The creation of excellent fishery management standards in Jayapura City.

- 4) The increasing level of sustainability of fisheries and ecosystem resources is getting better.
- 5) Increasing the number of fish caught by fishermen.
- 6) The realization of regional development in the environmental field.
- 7) The creation of a good and sustainable ecosystem.
- 8) Long-term reduction in production costs.
- 9) Reducing air and water pollution and various other benefits.

The results of the comparison between options produce several important things, namely: the first option does not do anything that means fishing activities remain in conventional and unsustainable conditions, thus it does not produce any benefits because the local government does not yet have an interest in implementing the technology. The second option is to develop a regional regulation on the blue economy. The advantages of implementing the blue economy are business efficiency and increasing the number of fish caught, improving the quality of the ecosystem, increasing fish stocks, community welfare, and economic growth in the city of Jayapura. The value of the benefits is greater than the costs incurred from applying the concept of the blue economy.

***The strategy of implementing the blue economic policy of skipjack fisheries in Jayapura City.*** The successful implementation of the blue economy of skipjack fisheries in Jayapura City lies in the implementation strategy developed at this stage. The following will explain the implementation strategy, i.e.:

- 1) Replacement of purse seine and troll fishing gear with special pole and line fishing gear for catching tuna and is more efficient in its operation. The strategy is carried out by conducting socialization for fishermen and fisheries entrepreneurs, so they want to switch to using other fishing gear. The method of procuring fishing gear can be through the assistance of regional governments, or cooperation between the government and fishery entrepreneurs, as well as government cooperation with national banking.
- 2) Replacement of shipbuilding materials from wood to fiberglass or made from fibers that are more environmentally friendly.
- 3) Conversion of fossil fuels (B<sub>0</sub>) into fuel oil B<sub>20</sub> (vegetable) which is more environmentally friendly. The implementation strategy is cooperation by DKP of Jayapura City and PT. Pertamina in the Papua Regional Region in Jayapura City for the problem of supplying fuel oil to the depot located at fish landing base (PPI) Hamadi.
- 4) The use of environmentally friendly energy (solar cells) to replace the use of conventional electricity and kerosene.
- 5) Making a new regional regulation (PERDA) concerning the blue economy to replace PERDA of Jayapura City Number 1 of 2008 concerning Fishery Business Permits.

**Conclusions.** The results of the analysis of the regulated impact assessment (RIA) show that alternative policies of *K. pelamis* fisheries based on the selected blue economy are the second option, namely the making of a new regional regulation (PERDA) on the blue economy of skipjack fisheries because it provides benefits of USD 149,397,546 greater than the costs borne by amounting to USD 1,309,116.

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## References

- Ahmad M., 2016 [Development of marine business in the eastern coastal region of North Sumatra]. *Journal of agricultural dynamics* 32(2):125-134 [in Indonesian].
- Akbar N., Labenua R., 2018 [Genetic diversity of skipjack fish (*Katsuwonus pelamis*) in the waters of the North Maluku Sea]. *Depik Journal of aquatic, coastal, and fisheries sciences* 7(2):164-176 [in Indonesian].

- Akbar M. A., Suryanto, Triharyuni S., 2016 [Analysis of huhate fisheries in Larantuka waters, Flores]. *Journal of Indonesian fisheries research* 22(2):115-122 [in Indonesian].
- Akmaluddin, Najamuddin, Musbir, 2015 [Fishing gear performance on skipjack tuna in Bone Bay District Luwu]. *Journal of Octopus 4 fisheries science* (2):399-404 [in Indonesian].
- Amir F., Mallawa A., 2015 [Assessment of skipjack fish stocks (*Katsuwonus pelamis*) in the Makassar strait waters]. *Journal of Science and Technology of PSP* 2(3):208-217 [in Indonesian].
- Asia, Sudirman, Budimawan, Nessa N., 2015 [Size composition of skipjack tuna (*Katsuwonus pelamis*) in three Region fisheries management in Bitung Ocean Fishery Port]. *International journal of scientific & technology research*. 4(1):358-360 [in Indonesian].
- Cavanagh C. J., Benjaminsen T. A., 2017 Political ecology, variegated economies, and the foreclosure of alternative sustainabilities. *Journal of political ecology* 24:200-341.
- Dahuri R., 2015 The blue economic program towards Indonesia becomes the world's maritime axis. [www.kompasiana.com](http://www.kompasiana.com) (accessed on April 18<sup>th</sup> 2019).
- Doyle T., 2016 Indian oceans and seascapes blue economies and communities or race to the bottom of the sea. Book chapter. Cambridge scholars publishing.
- Doyle T., 2018 Blue economy and the Indian Ocean Rim. *Journal of the Indian ocean region* 14(1):1-6
- Firdaus M., Fauzi A., Falatehan A. F., 2018 [Depletion of tuna and skipjack resources in Indonesia]. *Journal of Socio-Economic Marine Fisheries* 13(2):167-178 [in Indonesian].
- Godfrey S. S., 2016 Defining the blue economy. *Journal of the National Maritime Foundation of India* 1-7.
- Hutajulu H., Imran Z., Budiharsono S., Kusumastanto T., 2019 Economic structure analysis in the development of skipjack tuna (*Katsuwonus pelamis*) fisheries industry in Jayapura City, Papua, Indonesia. *AAFL Bioflux* 12(5):1726-1737.
- Hutajulu H., Imran Z., Budiharsono S., Kusumastanto T., 2019 [Economic policy in the development of capture fisheries in Jayapura City]. *IOP Conference Series: Earth and Environmental Science*. 241:1-7 [in Indonesian].
- Jadmiko I., Hartaty H., Bahtiar A., 2015 [Biological reproduction of skipjack fish (*Katsuwonus pelamis*) in Samudera Hindia Bagian Timur]. *Bawal* 7(2):87-94 [in Indonesian].
- Jamal M., Sondita M. F. A., Haluan J., Wiryawan B., 2011 [Utilization of biological data of skipjack fish (*Katsuwonus pelamis*) to manage responsible fisheries in the Gulf of Bone waters]. *Jurnal Natur Indonesia* 14(1):107-113 [in Indonesian].
- Johnson J., Allain V., Bell J., Lehodey P., Senina I., 2018 Effects of climate change on ocean fisheries relevant to the Pacific Islands. *Science review* 2018:177-188.
- Khan A., Rizal A., Dewanti L. P., Apriliani I. M., Junianto., Supriyadi D., Ghiffary W., Nasution A. M., Gray T. S., Mill A. C., Polunin N. V. C., 2019 [Skipjack (*Katsuwonus pelamis*) tuna pole-and-line marketing supply chains in Indonesia: case study in Pulau Bacan]. *AAFL Bioflux* 12(2):636-641 [in Indonesian].
- KPPOD (Komite Pemantauan Pelaksanaan Otonomi Daerah), 2013 Policy making guide (Investment friendly local regulations). Ford Foundation & KPPOD. Jakarta.
- Kumar R., Sundaramoorthy, Neethiselvan N., Athithan S., Kumar R., Rahangdale S., Sakthivel M., 2019 Length based population characteristics and fishery of skipjack tuna, *Katsuwonus pelamis* (Linnaeus, 1758) from Tuticorin glasses of water, Tamil Nadu, India. *Indian journal of geo marine sciences* 48(1):52-59.
- Lee K. H., Noh J., Khim J. S., 2020 The blue economy and the United Nations sustainable development goals: challenges and opportunity. *Environmental international* 137:1-6.
- Lumi K. W., Mantjoro E., Wagyu M., 2013 [Economic value of fisheries resources in North Sulawesi (a case study of skipjack tuna, *Katsuwonus pelamis*)]. *Scientific journal of Platax*. 1(2):74-80 [in Indonesia].

- Mallawa A., Amir F., Safruddin, Mallawa E., 2018 [Sustainability of skipjack fishing technology (*Katsuwonus pelamis*) in the waters of the Gulf of Bone, South Sulawesi]. *Marine fisheries* 9(1):93-106 [in Indonesian].
- McCluney J. K., Anderson C. M., Anderson J. L., 2019 The fishery performance indicators for global tuna fisheries. *Nature communications* 10:1-9.
- Miller K. I., Nadheeh I., Jauharee R., Anderson R. C., Adam M. S., 2017 Bycatch in the Maldivian pole-and-line tuna fishery. *PloS one* 12(5):1-21.
- Nainggolan C., Suwardjo D., Hutajulu J., Suharyanto., Syamsuddin S., Effendy A., Basith A., Yusrizal, Handri M., Nugraha E., Krisnafi Y., Matheis A., Irwansyah, Irwan, Khoerul, Novianto D., 2017 [Analyses of pole and line fishery: catch composition and use of live bait for catching skipjack tuna *Katsuwonus pelamis* and yellowfin tuna *Thunnus albacares* in Fisheries Management Area 715, Indonesia]. *AACL Bioflux* 10(6):1627-1637 [in Indonesian].
- Najamuddin, Baso A., Musbir., Akmaluddin., Nelwan A., Sudirman, Hajar I., Palo M., Zainuddin M., 2017 [Performance of fishing gear on skipjack tuna *Katsuwonus pelamis* in South Sulawesi, Indonesia]. *AACL Bioflux* 10(2):164-171 [in Indonesian].
- Nugraha E., Yudho G. S., Jaenudin A., Yusrizal., Kusmedy B., Kusdinar A., Husen E. S., 2020 [Relationship between length and weight of skipjack tuna (*Katsuwonus pelamis*) purse seine catching in the Maluku Sea, Indonesia]. *AACL Bioflux* 13(1):330-345 [in Indonesian].
- Nurdin E., Panggabean A. S., 2017 [Catching season and size structure of skipjack (*Katsuwonus pelamis* Linnaeus, 1758) around the FADs in Palabuhanratu waters]. *Journal of Indonesian Fisheries Research* 23(4):299-308 [in Indonesian].
- Nurhayati S., 2013 [Blue economy policy and their impact on Indonesia community welfare]. *Journal of economics and business* 12(1):37-42 [in Indonesian].
- Pauli G., 2010 *The blue economy 10 years 100 innovations 100 million jobs inspired by nature*. Paradigm Publications. Taos, New Mexico.
- Pillin J. B., Tawari R. H. S., 2015 [The difference in length size based on catching time and the long-weight relationship of skipjack fish (*Katsuwonus pelamis*) in the South of Seram Island]. *Amanisal Journal of PSP Unpatti FPIK Unpatti-Ambon* 4(1):47-54. [in Indonesian].
- Purbani D., Damai A. A., Yulius, Mustikasari E., Salim H. L., Heriati A., 2016 [The development of the fishing industry in the waters of West Sumatra is based on a blue economy]. *Journal of humans and the environment* 23(2):233-240 [in Indonesian].
- Radiarta I. N., Erlania, Haryadi J., [Analysis of the development of aquaculture based on the blue economy with the Analytic hierarchy process approach (AHP)]. *Journal of socio-economic marine fisheries* 10(1):47-59 [in Indonesian].
- Saputra A., Sompie M. S., Manoppo L., 2014 [Analysis of the trend of catches of skipjack fish (*Katsuwonus pelamis*) with purse seine and pole and line fishing gear (Case study at Bitung Ocean Fisheries Port)]. *Journal of science and catching fisheries technology* 1(6):204-208 [in Indonesian].
- Sari D. A. A., 2019 [Integrated governance of sustainable marine development policies]. *Journal of rechtsvinding of media for the development of national law* 8(2):147-165 [in Indonesian].
- Sari D. A. A., Muslimah S., 2019 [Blue economy policy for sustainable fisheries in Indonesia]. *IOP conference series earth and environmental science* 423:1-8 [in Indonesian].
- Silver J. J., Gray N. J., Campbell L. M., Fairbanks L. W., Gruby R. L., 2015 Blue economy and competing discourses in international oceans governances. *Journal of environment dan development* 24(2):135-160.
- Soares J. B., Neto C. M., Costa M. R. D., Martins R. R. M., Vieira F. C. D. S., Tubino M. F. D. A., Bastos A. L., Tubino R. D. A., 2019 Size structure, reproduction, and growth of skipjack tuna (*Katsuwonus pelamis*) caught by the pole-and-line fleet in the southwest Atlantic. *Fisheries research* 212:136-146.

- Soukotta I. V. T., Bambang A. N., Sya'rani L., Saputra S. W., 2017 [Estimation of MSY and MEY of skipjack tuna (*Katsuwonus pelamis*) fisheries of Banda Sea, Moluccas]. *AACL Bioflux* 10(2):435-444 [in Indonesian].
- Suhana, Kusumastanto T., Adrianto L., Fahrudin A., 2019 [Economic model of skipjack resource management in Indonesia]. *Jurnal Sosial Ekonomi Kelautan dan Perikanan*. 14(1):23-36 [in Indonesian].
- Sukarniati L., Khoirudin R., 2017 [Institutional analysis of the application of the concept of the blue economy in shrimp ponds (case study in Ngntak Hamlet, Poncosari Village, Srangkap District, Bantul Regency)]. *Journal of development economics* 3(2):52-65 [in Indonesian].
- Tadjuddah M., Anadi L., Mustafa A., Arami H., Abdullah., Kamri S., Wianti N. I., 2017 [Growth pattern and size structure of skipjack tuna caught in the Banda Sea, Indonesia]. *AACL Bioflux* 10(2):227-233 [in Indonesian].
- Techera E., 2019 Achieving blue economy goals: the need for improved legal frameworks across the Indian ocean. *Seychelles research journal*. 1(2):5-14
- Tuli M., Boer M., Adrianto L., 2015 [Analysis of skipjack fish resources (*Katsuwonus pelamis*) in the waters of Pohuwato Regency, Gorontalo Province]. *Marine Fisheries* 6(2):109-117 [in Indonesian].
- Tuli M., 2018 Skipjack fisheries. Ideas Publishing. United States Agency for International Development. Gorontalo.
- Wang X., Xu L., Chen Y., Zhu G., Tian S., Zhu J., 2012 Impact of fish aggregation devices on size structures of skipjack tuna *Katsuwonus pelamis*. *Aquatic ecology* 46(2):2012.
- Yanglera A., Nur A. I., Mustafa A., 2016 [Study of some characteristics of skipjack biology (*Katsuwonus pelamis*) in the Menui Waters of Morowali Regency, Central Sulawesi]. *Journal of water resource management* 1(3):285-298 [in Indonesian].
- \*\*\* ADB (Asian Development Bank), 2003 Technical assistance (finance by the government of the United Kingdom) to the Republic of Indonesia for preparing the provincial small and medium industrial sector development program. [www.adb.org](http://www.adb.org) (accessed on May 20<sup>th</sup> 2018).
- \*\*\* BAPPEDA (Regional Development Planning Agency in Jayapura City), 2017 Jayapura City in 2016 Numbers. Regional Development Planning Agency in Jayapura City, Jayapura, Indonesia.
- \*\*\* Balitbang KP KKP (Maritime Research and Development Agency of the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia), 2014. Regulatory impact assessment (RIA) Regulation of the Minister of Maritime Affairs and Fisheries Number 57 the Year 2014 concerning the second amendment to the Regulation of the Minister of Maritime Affairs and Fisheries number PER 30/MEN/2012 concerning capture fisheries business in the territory of the Republic of Indonesia fisheries management. Final report of RIA-Series: regulation of the minister of marine and fisheries No. 57 of 2014. Balitbang-KP, KKP.
- \*\*\* DKP (Maritime Affairs and Fisheries Office in Jayapura City), 2015 [Annual report of the Jayapura City Marine and Fisheries Service]. Maritime Affairs and Fisheries Office in Jayapura City. Jayapura, Indonesia [in Indonesian].
- \*\*\* DKP (Maritime Affairs and Fisheries Office in Jayapura City), 2016 Annual report of the Office of Maritime Affairs and Fisheries of Jayapura City. Maritime Affairs and Fisheries Office in Jayapura City. Jayapura, Indonesia.
- \*\*\* DKP (Maritime Affairs and Fisheries Office in Jayapura City), 2017 Annual report of the Office of Maritime Affairs and Fisheries of Jayapura City. Maritime Affairs and Fisheries Office of Jayapura City. Jayapura, Indonesia.
- \*\*\* DKP (Maritime Affairs and Fisheries Office of Jayapura City), 2017 Annual report of the Office of Maritime Affairs and Fisheries of Jayapura City. Maritime Affairs and Fisheries Office of Jayapura City. Jayapura, Indonesia.
- \*\*\* DKP (Maritime Affairs and Fisheries Office of Jayapura City), 2018 Annual report of the Office of Maritime Affairs and Fisheries of the City of Jayapura. Maritime Affairs and Fisheries Office of Jayapura City. Jayapura, Indonesia.

- \*\*\* PERDA (Regional Regulation Number 1 of 2008 concerning Fisheries business permits).
- \*\*\* USAID (United States Agency for International Development) & SENADA Indonesia Competitiveness Program. 2009 Regulatory impact assessments and the private sector in Indonesia.
- \*\*\* Law of the Republic of Indonesia Number 23 of 2014 concerning regional governments.
- \*\*\* Law of the Republic of Indonesia Number 32 of 2014 concerning marine regulations.

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