

I. ТЕОРЕТИКО-МЕТОДОЛОГІЧНІ ДОСЛІДЖЕННЯ

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LIMITATIONS OF THE SUSTAINABLE THAI FISHERIES RESOURCES
MANAGEMENT MODEL

The article aims to examine sustainable resource management (SRM) models and provide recommendations for fisheries development based on economic rent analysis. The results of the study revealed that Thailand's bio-economic model for sustainable resource management does not contribute to a sustainable approach to marine bio-resource management because the sustainability of the fishery economy and society is neglected. The model used does not specify the maximum economic yield (MEY) and other parameters affecting the fisheries sector development and failure to ensure the fair use of marine bio-resources and the creation of national wealth and prosperity. Therefore, the estimation method for fishery rent tax by each fishery area should be shifted to a reasonable total production and solving problems on the difference in catch costs by extracting income from excess profits through the accumulation of surplus rents in the form of a sustainable fisheries fund for the development of future fisheries economy projects.

Keywords: sustainable, Thailand, fisheries, bio-economic.

Introduction. The fishing industry is a complex economy sector and is a problem facing the fishing industry regarding how to utilize natural resources and how to ensure sustainable use of natural resources. Over the past few decades, fishing activity has expanded rapidly across worldwide countries, together with innovative catch technologies affecting resource propagation rates. The questions raised include how the balance of natural resource assurance is pursued to create a return on investment and improve the livelihoods of fishermen. The ambiguous state policies without economic mechanisms may cause the capital-intensive economic activities in key production assets such as fishing fleets to be of high risk, unpredictable future, deteriorating fishing industry. According to studies, fisheries activities have been in crisis with a failure to maintain production and processing, failure to create investment incentives. In addition, increasing assets in the manufacturing sector cause a migration to the different manufacturing sectors. If customer confidence and a new climate cannot be improved due to ineffective management of economic organization mechanisms in the support to the fishing industry (Suwan-achariya, 2020). Targeting the reduction in the number of fishing vessels and taking measures that precluding the fisheries from inspection and a high fine is known as 'freeze-drying' measures on the legalization of fisheries according to the EU recommendations and the regulation of sustainable use of marine bio-resources, which is one of the state's important concerns. The determination of fishery resource is subject to the parameters such as the number of fishing vessels, when calculated, fishing capacity must not exceed the maximum sustainable yield (MSY) for the initial environmental assessment of marine bio-resources. However, until today, the approach adopted by the state has no positive effect on fisheries development. The objective of this study is to analyze the state's SRM models and to provide recommendations for fisheries development based on economic rent.

Literature Review. Sustainability in aquatic resource management is perceived as the way of sustaining marine resources for the next generation. Sustainability goals in fisheries cover three domains – biologically, socially, and economically: 1) Biologically – conservation of marine biodiversity and resources, 2) Socially – a fair distribution of marine biological resources among multiple users and employment in fisheries, 3) Economically – revenues and

labor productivity growth, marine bio-resource sustainability, sustainable reserves maintenance of commercial marine bio-resources, biodiversity maintenance, and marine ecosystems health. The socio-economic objectives are to ensure the long-term, social and economic well-being of fisheries (Titova, 2007). The fisheries production sector is different from the general production sector because fisheries productivity depends on natural resources primarily, namely resources can be depleted and recycled concurrently. The supply curve in the aquatic market from time to time is inconsistent with the supply rule if it occurs a situation of overfishing and the saturation of the fishing industry. The supply curve may pass a tipping point while the number of fishing attempts increases and the efficiency of catching fish decreases, thereby leading to increased average costs.

Also, the total volume of catch and population of aquatic resources in addition to the direct environmental destruction like overfishing may lead to significant economic losses in the fishing industry. The loss of renewable resources has not been compulsory but occurs when fishing vessels use larger amounts of aquatic resources per unit time than natural regeneration capabilities. Meanwhile, long-term resource loss leads to lower resource utilization and lower resource profitability in the long run. A level of profitability and a stable number of resources can be achieved with a sustainable approach (Podoshvelev, 2017).

It's noted that a concept of establishing a market economy does not work if demand in consumption and production are expanded to the level of market saturation. The decline in production results, because the fishery income generated from the use of natural resource-based production factors, which vary with each fishery group, determines the quality of the resource. Quantitative indicators of aquatic fauna depend on ecosystems with yield the maximum value in a given condition, diversity, and species. If entrepreneurs' technology capital is incorporated with ecosystem and marketing may induce the difference in product values. So, the varying fishery rent from locality to locality is due to natural variables, that is, when investments arise locally, the return may differ accordingly, especially, excess profits. Thus, the types of fishery rent can be used to determine the conditions of various economic factors. Type I fishery rent represents a fishery area with optimal productivity. Type II fishery rent

represents a more intense fishing method. The productivity is determined by the use of advanced fishing equipment, the availability of skilled sailors, modern and well-equipped fishing boats, and so on (Samoylenko, 2020).

The sources of fishery rent vary in terms of production costs and profits. Thus, free access to aquatic resources in highly competitive markets cannot create excess profits in fisheries activities. One of fishery resource management models is the production and economic development materially. On the other hand, payment for natural resources as the main sources of government revenue is an economic relation development between owners of natural resources and users of the economic mechanisms of natural management. If resource management has been neglected, sustainable management of aquatic bio-resources is impossible. The proposed solutions for aquaculture resource management, using a model for sustainable aquatic resource management which was originally developed from a bio-economic model, have been implemented since the the1950s, leading to the understanding of the necessity to regulate fisheries for optimizing production and economic productivity, referred to the Gordon-Schafer model (Gordon, 1953; Shaefer, 1954). Later, further examinations demonstrated that the system "Reserve-Catch" enables the country to achieve maximum catch in monetary terms. Maximum Economic Yield (MEY) is better than conservation-oriented approaches, thereby bringing forth the integrity of the ecosystem rather than the increased catch of aquatic animals (Witherell, 1999). The government has adopted the Gordon-Schafer model to analyze problems of Thai fisheries, which it should shift from "free" to "limited" fishing under the regulation of the government, provided that fishing licenses and fishing vessel permits must be granted

in the line with the number of aquatic animals, fishing gear efficiency, and the environmental impact. Fisheries implementation and fisheries resources management must be executed sustainably. Gordon-Schafer model has still been subject to a debate on sustainability and consistency of the use of aquatic bio-resources on an academic basis.

Methodology. In the present study, the research method is based on the critical logic of identifying conflicts through the theoretical and methodological analysis of scholars' work on bio-economic models, parameters, and impact. Literature review and academic journals. The scope of the study scope covers information on the Thai fisheries economy since the introduction of the bio-economic model for sustainable resource management in 2018.

Result and Discussion. 1. Analysis of the maximum sustainable yield criterion. The commercial biological criteria were adopted to achieve the maximum sustainable yield (MSY). The value of MSY was estimated using the relationship between balanced production and quantities. In this case, a regressive bio-production model of the shift in catch per unit effort was used to determine the MSY. The officials believe that when unregulated fisheries are accessed freely, it will lead to an overuse of resources, thereby resulting in dramatically reducing natural production or destabilizing reserves. Restricting access to aquatic resources can prevent overexploitation in which government agencies believe that aquatic resources are never or equal to zero. (Term of 'fishing' refers to the number of fishing vessels, the number of trawling hours, or the number of fishing days, as the case may be). When the amount of unit fishing increases, aquaculture productivity increases accordingly. However, when the fishing effort increases, the MSY remains to some extent only. If fishery investment continues to increase, aquaculture production will decrease (Fig. 1).

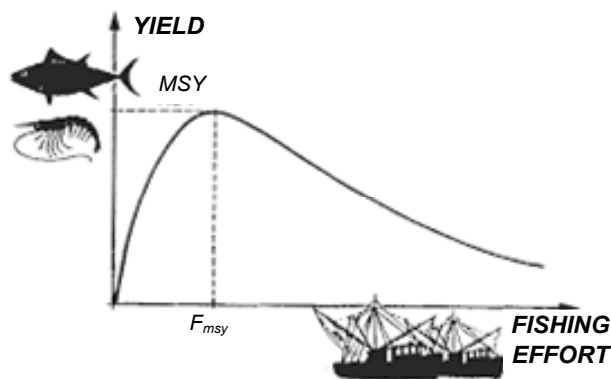


Fig. 1. shows the theory of the relationship between unit fishing and yield (Fisheries Resource Assessment Group Marine Fisheries Research and Development Division, 2018)

Due to the limited quantity of aquatic animal resources in nature, if overused, it leads to a continual decrease in the aquatic animal and a decrease in aquatic animal productivity. Therefore, to find a reference point for balancing utilization with natural products, it is imperative to use MSY to determine a reference point based on the Fisheries Management Plan (Fisheries Management Plan: FMP), guidelines for issuing fishing licenses appropriately with fishing capacities, and the MSY of aquatic animals sustainably, based on the principle of determining the number of fishing days for each type of fishing gear currently used (240 days) and the number of fishing licenses granted, etc. In the 2018 fishing year, fishing licenses for all fishing vessels must specify the number of fish allocated to the fishing vessel for which this volume is assessed by the MSY, and the determination of total allowable catch (TAC), the

TAC is then allocated to each fishing boat. However, the TAC allocated is not used to control the catch, but a throttling method shall be implemented to control fisheries labor and the number of fishing days determined by the Department of Fisheries, based on database, similar to fishery economy shifting from a market economy to a "bio-economy". This developed economic model by the government consists of two main components: the number of fish resources and the timing of the catch, regardless of the appropriate returns. Because the government has no database, where does the number of fish catch, 240 days, come from? It's required by laws that fishing vessel operators shall record the information of fish caught into a fishing logbook and delivered it to the fishing vessel control center. When the ship arrives at the port, the fish's weight is checked again by the fish raft or the buyer, and data is then

analyzed for the MSY to determine the number of fishing days for each year and the number of vessels that will be granted a fishing license in the next fishing year. Of course, we don't think it makes sense that the catch of small-scale fisheries at the center of a fishing organization applies to the different principles. First, it is necessary to identify the qualitative and quantitative elements to ensure the highest annual growth rate (and catch). What are the qualitative and quantitative composition of the fisheries stabilization of the required herd composition like? On this basis, an action plan of the fishery establishment should be prepared, including places, time, a kind of fish, and the number of fishes permitted to be caught (Norinov, 2006). This problem is similar to the model's direction for marine bio-resources. The government understands that fishing vessels are required to comply with regulations and rules if they exploit marine bio-resource reserves to contribute to sustainable development. Without the cooperation of fishing boats, this may lead to excessive use of marine bio-resources. Noted that state practices on fishing vessels do not cover conservation rights and obligations to protect the resources they use. On the other hand, it strictly focuses on compliance with government orders, violation and penalties are the same as that of freezing measures, regardless of the facts of bio-economic behavior.

This method of catch management was intended that fishing vessels demonstrating labor and financial records shall be granted access to catch ahead of others. Consequently, the value of marine reserves is lower than the MSY, a key indicator for sustainable fisheries development, for the most profitable fishing vessels. Access to resources at different times results in different economic costs among the fisheries operators, thereby resulting in reduced future profits.

As a result, fishing vessels have attempted to catch more fish excessively to ensure their economic value. If catching fish is lower than MSY, the fishery reserve is sustained and the reproduction is improved. However, according to official information regarding the MSY and fishing days, as exhibited in Figure 1, it's obvious that the sole aim of this model targets a fixed and balanced fishing effort where governments assumed that fishermen's income is equal to the market value of fishing catch and fishing costs is proportional to the total fishing effort. (More effort → more fishing catch → more cost).

Although the above said criteria can be easily adjusted to suit the ultimate fishing catch goals in the practical long term, for example, annual catch stabilization and average long-term catch optimization. However, the CPUE (catch per unit effort) was not shown. The results from official regulations may cause problems with the MSY value. (Fisheries Sustainability Indicators, Methods for Integrating Sustainability Criteria).

Bio-economic assessment and appropriate modeling: as the determination of MSY is targeted to the maximum economic yield (MEY), as exhibited in Figure 1, MEY value was unknown and never specified by the state that it reasonably determines the actual UPUE for the fishing amount and appropriate demand of fishing boats. The maximum sustainable yield (MSY) at the propagation level can be achieved when the MSY is equal to the annual MSY at the specified level of exploitation. If compared with the requirements, "Set the level of reproduction" and "Set the level of utilization" are required to specify, because the varying level of reproduction and utilization are unstable [7]. The model introduced by Thai authorities assumes that the number of exploited species tends to be stable. In other words, it is a tendency that overall increases are equal to the equilibrium capture. The concept of modeling is favorable with long-term data collection, fish are assigned with the age of each species, and fishery rent is determined. Because a general concept of reserve and catch and fishing effort has been adopted, however, problems may arise if there is no permit for the long-term data collection on fish catching. The fisheries economy model that determines the sustainability of the aquatic resource is highly questionable of the extreme points and MSY value. In addition, this criterion is directly linked to the fishery selection and impact, poor economic efficiency of fisheries in terms of the fishing industry development, inappropriate use of the MSY, and other fisheries biological criteria (Kantemirova, 2004), if measuring the indirect effect of the economic fishery gains. The measurement can identify the state reserve and the variables such as the size of the area and the reserves and so on. Also, the effective advice on the fishery return is a response to ensuring sustainable fisheries with a social and economic balance in the fishery industry. Namely, aquatic resources are considered as a production factor, however, provided that how to balance them in the ecosystem. It's required that the exhibition demonstrates the CPUE, catch at the market price, and the total fishery cost as well. In this study, it's obvious that fishery catch depends not only on the fishing days but also on the fisheries industry's effort to achieve the highest levels of annual catches. The Department of Fisheries states that resources are allocated to fishing boats it is only a definition of 'maritime territories, 3 nautical miles from the coastline and 1.6 nautical miles from the coastline. In the coastal zone, local fishing boats have the right to access aquatic resources, and offshore in the area for commercial fishing boats. However, this allocation fails to determine the appropriate production cost and volume of vessels to determine the actual value of fishery productivity at the MEY level.

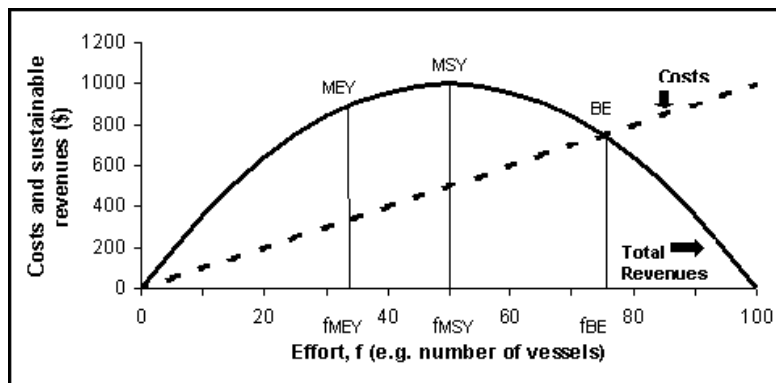


Fig. 2. Sustainable Income Curve (Cochrane, 2002)

The economy model for fisheries proposed by the Thai authorities must be developed together with predictive behavior and optimization. The predictive behavior is to predict future fisheries system developments based on fish population and labor resource dynamics that are attributed to sustainable management while the following economic parameters must be taken into account: total unit fishing costs, unit price, capital and labor market conditions, demand for goods, resource costs, etc. Therefore, the general economic profitability is directly related to the reserve status and the parameters that determine the current reserve status (reserving aquatic population, size of the area, commercial replenishment of fishing boats, etc.). Importantly, the optimizing model should focus on key sustainable fisheries strategies and optimization criterion such as

C-Seafood insurance for average consumption per capita.

P-Providing an acceptable income for fishermen (Motivation and Value)

L-maintaining employment in fisheries

Gross income from fisheries is a function of production and production efforts. The total cost is proportional to the unit fishing, then the total economic profit (revenue) is equal to the difference between the total profit and the unit fishing cost. All fishery income is plotted on the U-shaped curve representing the amount of catch in terms of value. The straight line represents a fishing catch. A gradual curve represents the fish per commercial unit area. The stability of fishing effort depends on the optimization objectives for biological stabilization of the integration of efforts and fishing catch within the U curve. The volume of catch at the BE point represents the loss of reserves of the catch after the initial extinction. This graph reflects the catch effort levels corresponding to the four optimization objectives: zero effort – no catch. It can be seen that the level of aquatic resources has decreased with increasing effort levels and different optimization goals.

$$0 < F_{MEY} < F_{MSY} < F_{BE}$$

The bio-economic model introduced by the Thai authorities fails to develop sustainable fisheries management by definition for many reasons; including a lack of the eco-social sectors of fisheries, neglecting capital-labor and intensive fisheries efforts, and investment in fishing fleets fails to reflect the price of goods, income and the use of appropriate fishing technology, and the quality of life of fishermen and the fishing industry as a whole (Titova, 2008). Fisheries regulation implemented by the government has resulted in the reduced number of fishing fleets and increased dissolution of fisheries operations (Suwan-achariya, 2020). In other words, efforts of optimizing annual catch, MSY, maximizing fishermen employment, and maximizing economic income, rent, and MEY are parameters for fisheries optimization, depending on the target set to achieve socially sustainable rewards.

2. Recommendations for the regulation of aquatic resources. The concept of natural and sustainable fisheries based on the MSY valuation and the determination of the total number of permissible fishing catches have been criticized widely. This is because it does not provide direct advice to fisheries about reallocating new fishing efforts. The notion of MSY provides only analysis of fishing yields but neglects the relationship between supply and reserve. The pursuit of maximum productivity tends to require substantial values of

catch concentrations, which may result in overfishing. The interpretation of the term "MSY" is just a point of issue. The MSY in the terms of fishing effort is to reduce the number of catches as much as possible. It is an unaccepted method for its application in marine resource analysis (Shibaev, 2015). For this reason, in many countries, especially in the European Union, it gives greater attention to fisheries management along with the total fishery effort quota (TAP) and duration of fishing. Meanwhile, the optimal value of fishery efforts is estimated using bio-economic models (Borodin, Efimov, Vasilyev, 2010). This is also a property model of private ownership transfer of resources based on the distribution of all permitted catches among fishermen according to the 240 fishing days law and free trade authorization, which affects only fishing vessel owners and puts an end to overfishing. However, this could not help reveal the true market value of marine bio-resources. The fishery rental income based on natural capital is synonymous with national wealth or national property, therefore, as representatives of state owner, it has the right to receive rent from owners of natural resources for the benefit of the owner. The national wealth is considered a result of the continuous accumulation of social labor, knowledge, and other capital assets. There are two methods for assessing the national wealth:

1. Estimating the accumulated wealth (lost) in the form of capital assets over some time.

2. Evaluating the economic efficiency of the use of multiple assets annually, for example, the assessment of the new creation (or loss) at present.

The formula of regenerated wealth = return on investment (company profit) + wages, fees + natural rent" (Titova, 2008). The introducing concept of economic rent aims to establish the basic conditions for the activities of various economic actors. Therefore, Type I fishery rent in terms of a catch is associated with the most productive catch areas, and Type II fishery rent stems from more intense fishing methods. Such results were determined by the use of advanced fishing equipment, the availability of more qualified sailors, more modern and well-equipped vessels, and so on (Fadееv, 2005). The observed distinction was that the Type I fishery rent stems from an ecological monopoly that results in an irreplaceable surplus of resources while the duo-ecosystem fishery rent is not fertile, it requires more capital and technology to make use of the resources.

What needs to be done is to use assets to estimate fishery rents, such as calculating the productivity (catch volume, fish processing, etc.) of the fishing vessels. A review of the cost structure in the price of new aquatic resources as natural capital is based on different economic rents. Therefore, the rental tax system should be adopted as a base for determining profit margins, which may vary depending on the area and fishing time. If there is a profit margin, it means a profit that is higher than the general average profit, as indicated by the monthly profitability indicator. The excess profit in the form of rental income should be drawn into the acquisition of financial resources for the state budget in the form of the Sustainable Fisheries Fund, which is dissimilar to the Thai government method. Calculating rental income is recorded for each fishery in each district and each year, and the value of the indicators is analyzed in the fishing year. However, if there is a difference in the catch cost, it should be noted that the

value that determines the rental income shall not only include the difference in the type I fishery rent, but also the type II fishing rent, indicating an unfair catch. Therefore, extracting fishing rental income necessitates calculating Type II fishing rent. In addition, the fisheries rental tax policy must be reasonable, thereby leading to the appropriate use of all inputs and income. The existing lease is suitable for developing fisheries.

Therefore, the fishery rental rate for different use of marine biological resources should be the basis for extracting rental income based on estimates to achieve the goal for calculating the potential of each natural fishery, establishing an effective tool system of organizational and economic mechanisms for the appropriate use of aquatic resources. The fisheries cluster model is presented to ensure its effective implementation and, if rents collected from the surplus profit in the form of the Sustainable Fisheries Fund, are accrued, it becomes a source of funding for fisheries clusters. Investment Funds and Sources of Financing, long-term continuous investments for domestic shipbuilders, manufacturing and repairing equipment, and ship modernization will develop a new fishery fleet of the applicable existing structure (Dyachkova, 2013).

Therefore, to ensure the appropriate use of marine biological resources, the establishment of economic mechanisms is required to accommodate the transactions among economic actors, innovatively integrating information, labor, materials, and financial resources for efficient performance and creating conditions for the appropriate use of natural resources. The most effective performance in the form of fisheries clusters (development of coastal fisheries processing bases by associations, organizations, and fisheries processing industry, fisheries, and fishing vessel repair). The Fisheries Sustainability Fund determines the investment projects more effectively than financial institutions, academic lending, production, processing, and products because its decision is based on the principle of paying economic rent to the fishery sector.

Conclusion. Although the Department of Fisheries has established guidelines for developing sustainable resource management, using a model of the bio-economy based on the concept of fishery reserves, labor days, it does not contribute to sustainable management of marine bio-resources due to the lack of emphasis on sustainability in the fisheries economy and society. The model adopted did not specify the MEY and other variables including, production costs, profits, incomes, and the use of appropriate fishing technology and impact concerning the improved quality of life of fishermen and the fishing industry as a whole, as well as the fishery authorization based on the total number of catches, has not been accepted, no guarantee of fair use of marine bio-resources, and creating national wealth has raised much criticism. Therefore, the method of estimating rental taxes should be altered. The fisheries shall execute a reasonable total production and the existing rental income should be plausible to improve fisheries' quality of life and appropriate use of natural resources. The most efficient operation as a fisheries cluster can be transformed into a

modern fleet through the accumulation of surplus rents in the form of a sustainable fisheries fund.

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ГРАНИЦІ МОДЕЛІ УПРАВЛІННЯ СТАЛИМ РОЗВИТКОМ РИБНИХ РЕСУРСІВ

Метою статті є дослідження моделей сталого управління ресурсами та надання рекомендацій щодо розвитку рибного господарства на основі аналізу економічної ренти. Результати дослідження показали, що існуюча у Таїланді біоекономічна модель управління рибними ресурсами не сприяє сталому підходу до управління морськими біоресурсами, оскільки стійкість рибного господарства та суспільства не є у ній визначальним чинником. Використана модель не передбачає максималізацію економічного прибутку й інші показники доходності, що безпосередньо впливають на розвиток рибного господарства, та які не забезпечують справедливого використання морських біоресурсів, а отже створення національного багатства на основі суспільного процвітання. Тому пропонується запровадити нарахування диференційованого податку на ренту за використання наявних морських біоресурсів за кожним рибогосподарським районом країни з метою впровадження засад сталого розвитку заради розв'язання проблеми різниці у витратах на вилов риби шляхом вилучення доходу від надприбутку за рахунок накопичення надлишкової ренти у фонді сталого рибальства, що дозволяє накопичити кошти для розвитку в майбутньому проєктів сталого рибного господарства.

Ключові слова: стійкий розвиток, Таїланд, рибальство, біоекономіка.

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ГРАНИЦЫ МОДЕЛИ УПРАВЛЕНИЯ УСТОЙЧИВЫМ РАЗВИТИЕМ РЫБНЫХ РЕСУРСОВ

Целью статьи является исследование моделей устойчивого управления ресурсами и предоставление рекомендаций по развитию рыбного хозяйства на основе анализа экономической ренты. Результаты исследования показали, что существующая в Таиланде биоэкономическая модель управления рыбными ресурсами не способствует устойчивому подходу к управлению морскими биоресурсами, поскольку устойчивость рыбного хозяйства и общества не является в ней определяющим фактором. Используемая модель не предусматривает максимализацию экономической прибыли и другие показатели доходности, непосредственно влияющие на развитие рыбного хозяйства, не обеспечивающие справедливого использования морских биоресурсов, а следовательно создания национального богатства на основе общественного процветания. Поэтому предлагается ввести начисление дифференцированного налога на ренту за использование имеющихся морских биоресурсов по каждому рыбохозяйственному району страны с целью внедрения основ устойчивого развития ради решения проблемы разницы в расходах на лов рыбы путем изъятия дохода от сверхприбыли за счет накопления избыточной ренты в фонде устойчивого рыболовства, что позволяет накопить средства для развития в будущем проектов устойчивого рыбного хозяйства.

Ключевые слова: устойчивое развитие, Таиланд, рыболовство, биоэкономика.