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Analysis Of Sustainable Resources Of Skipjack Fish In Bone Gulf, Indonesia

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This study aims to determine the sustainable potential of skipjack fisheries in the waters of Bone Gulf based on the location of fishing based in Luwu Regency, Sinjai Regency and Bone Regency. This research was conducted in Bone gulf by taking locations in three regency that were used as fishing bases, namely Luwu Regency, Bone Regency and Sinjai Regency. Data sources used in this part of the study are secondary data, namely capture fisheries production data based on skipjack fisheries commodities and the number of trips carried out by skipjack fishermen in Luwu Regency, Bone Regency and Sinjai Regency. Economically, the decline in the catch will also reduce the profits of the fishermen's business as a whole, because the revenue obtained is no longer proportional to the costs incurred. The loss of profits gained from the use of skipjack fish resources can also be caused by the high cost of catching per unit of effort to catch. With high fishing costs, profits will automatically be reduced even though the catches obtained have not exceeded the level of MSY (Maximum Sustainable Yield). the comparison between sustainable catches with actual catches that the catches obtained each year are still below the sustainable potential. But the number of arrest attempts has exceeded the optimum capture effort. The fishing effort that exceeds the optimum effort should be a limitation of the fishing effort and there should be no additional fishing effort for skipjack fishing in the Gulf of Bone waters.

Keywords: Skipjack Tuna, Sustainable, CPUE, MSY

INTRODUCTION

Bone gulf was one area that has a high potential of fishery resources and one of them is skipjack commodity. The waters of Bone Bay are part of the 713 Fisheries Management Area in addition to the Makassar Strait, Flores Sea and Bali. Uktoselja et al. (1989) stated that the potential of skipjack tuna in southern Sulawesi was estimated at 61,800 tons / year. Based on the results of the study of Widodo et al. (2003) reported that the potential for large pelagic fish resources in WPPI 713 where the management area of Bone Bay is covered has a potential of 193,600 tons / year with a utilization rate of 43.96%. The types of fish that are still prospective to be developed in Bone Bay are small pelagic fish, tuna, skipjack and mackerel. Skipjack fishing activities in the waters of Bone Gulf which were open access cause this type of commodity was easy to develop because it not only has high economic value, it is also able to absorb a lot of labor because it can be done with simple technology. This gives freedom to the coastal communities in South Sulawesi to be able to carry out skipjack fishing in the waters of the Gulf of Bone. The high enough skipjack fishing activity is able to influence the existence of skipjack fish resources and the ability of Bone Bay waters to supply these fish commodities. This study aims to determine the sustainable potential of skipjack fisheries in the waters of Bone Gulf based on the location of fishing based in Luwu Regency, Sinjai Regency and Bone Regency.

MATERIALS AND METHODS

Research sites

This research was conducted in Bone gulf by taking locations in three districts that were used as fishing bases, namely Luwu Regency, Bone Regency and Sinjai Regency.

Data Source

Data sources used in this part of the study are secondary data, namely capture fisheries production data based on skipjack fisheries commodities and the number of trips carried out by skipjack fishermen in Luwu Regency, Bone Regency and Sinjai Regency.

Data Analysis

- **Maximum Sustainable Yield Analysis**

Maximum Sustainable Yield (MSY) analysis using the Schaefer model approach. The steps taken are as follows: (1) Compile the production data of weight units (tons) and capture effort in trip units, time series based on the type of fishing gear The general form of the Schaefer model is:

$$\frac{Ye}{f} = a - bf$$

Where:

a and b = constants
Ye = Catch (unit)
f = effort (unit)

- **Analysis of Catch Per Unit Effort**

In determining the optimum effort to catch tuna landed in Luwu Regency, Sinjai Regency and Bone Regency using Catch per Unit Effort (CPUE) analysis which is a reflection of the value of fishing gear productivity used to catch tuna resources in Bone Bay. CPUE value is obtained by rationing the value of production and effort in 2009-2017. CPUE values can be formulated as follows (Fauzi and Anna, 2005):

$$\mathbf{CPUE} = \frac{\mathbf{Catch}}{\mathbf{Effort}}$$

Where:

CPUE = Catch of unit effort (ton / trip)
Catch = catch of fishing gear (tons)
Effort = arrest attempt (trip)

RESULTS

Result

The production of skipjack in the Bone Gulf conducted by fishermen from several districts in South Sulawesi Province creates a high level of insensitivity in these fishing activities. Based on the Capture Fisheries Statistics of South Sulawesi Province (2018) shows the average fishing trips that make skipjack fish as the main target, has a total of 2,000 to 6,000 trips per year. This can affect the condition of the availability of skipjack fish resources in Bone Gulf. Following are the results of an analysis of the level of sustainable potential of skipjack fisheries resources that concentrate on 3 districts, namely Luwu Regency, Bone Regency and Sinjai Regency.

Catch Per Unit Effort

Cactch per unit effort is the annual capture rate of fisheries obtained using time series data for a minimum of five years. In this study, the determination of time series data was carried out using secondary data from South Sulawesi Province's Capture Fisheries statistics for 9 years (2009 - 2017) by focusing on the types of fishing gear of each Regency namely trolling (Luwu), Purse seine (Sinjai Regency)), Rawai Fishing Line (Sinjai Regency). Following are the results of the CPUE of the three types of fishing gear presented in the following figure:

Based on the figure above shows the CPUE value of skipjack fish production in each district has fluctuated in the last nine years. In Bone Regency the highest CPUE value in 2010 was 0.71 tons / trip while the lowest in 2014 and 2015 was only 0.21 tons / trip. Unlike the case with the CPUE value in Luwu Regency, the highest value was in 2015 which reached 1.74 tons / trip and the lowest in 2012 only reached 0.19 tons / trip. In Sinjai Regency the trend graph shows a declining trend in which in 2009 the value of CPUE was able to reach 2.71 tons / trip and in the following year decreased where in 2012 only reached the value of 0.06 tons / trip. The decline in CPUE values in Bone and Sinjai districts has decreased significantly each year. This decrease was due to fishing efforts that have increased every year.

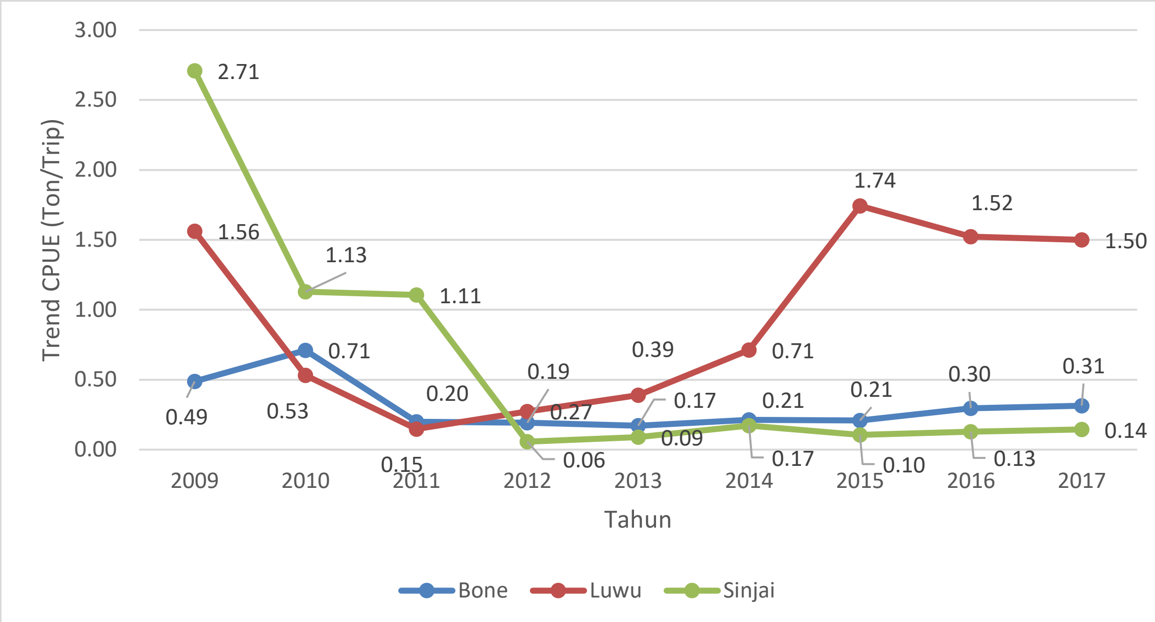

Figure 1. Graph of Average CPUE Trend in 2009-2017 Skipjack Commodity in Luwu Regency, Bone Regency and Sinjai Regency

The results in Bone Regency of the analysis produce a linear equation y = -0,0005x + 0.617, this shows that the constant (a) of 0.617 states that if there is no effort, then the potential available in nature is still at 0.617 tons / trip. Regression coefficient (b) of -0,0005 states a negative relationship between production and effort that each reduction of 1 trip will cause CPUE to increase by 0,0005 tons / trip, and vice versa. The coefficient of determination (R2) of 0.6657 or 66.57% states that the ups and downs of CPUE 66.57% are influenced by the value of effort, while 24.43% is influenced by other factors not discussed in this study. This indicates that CPUE and effort have a strong closeness. In Luwu regency showed the results of the analysis produce a linear equation y = -0,0003x + 1.4526, this shows that the constant (a) of 1.4526 states that if there is no effort, then the potential available in nature is still 1.4526 tons / trip. Regression coefficient (b) of -0,0003 states a negative relationship between production and effort that each reduction of 1 trip will cause CPUE to increase by 0,0003 tons / trip, and vice versa. The coefficient of determination (R2) of 0.2803 or 28.03% states that the ups and downs of CPUE 28.03% are influenced by the value of effort, while 72.97% is influenced by other factors not discussed in this study. In Sinjai Regency showed the results of the analysis produce a linear equation y = -0.005x + 1.5644, this shows that the constant (a) of 1.5644 states that if there is no effort, then the potential available in nature is still at 1.5644 tons / trip. The regression coefficient (b) of -0.005 states a negative relationship between production and effort that each reduction of 1 trip will cause CPUE to increase by 0.005 tons / trip, and vice versa. The coefficient of determination (R2) of 0.6141 or 61.41% states that the ups and downs of CPUE 61.41% are influenced by the value of effort, while 39.59% is influenced by other factors not discussed in this study. This value shows a close relationship between catch per unit effort (CPUE) and skipjack fishing effort in Sinjai Regency.

Maximum Sustainable Yield Analysis

Based on the data of skipjack fish production in the last 9 years (2009 - 2017) it can be calculated that sustainable fisheries production or Maximum Sustainable Yield (MSY) using the surplus production method from Schaefer can know the value of sustainable potential and the optimum effort of skipjack in Bone Regency (figure 2) so that it can be determined when overfishing occurs by comparing effort and catch every year. Based on the Schaefer model, the optimum catch effort value is 7,712.5 trips per year and the maximum catch amount is 2,378 tons per year. When viewed based on the maximum sustainable catch value, the number of catches produced from 2009 - 2017 has not reached the maximum catch value (MSY). But the capture effort carried out has exceeded the optimum capture effort (Fopt). The use of skipjack fish in Bone Regency has exceeded the Total Allowable Catch (TAC) or the number of catches allowed (JTB). The average value of effort each year in Bone Regency is 8,280 trips per year which has exceeded the optimum effort limit of 7,712.5 trips per year.

In Luwu Regency (figure 3) based on the Schaefer model, the optimum catch effort value is 2,2421 trips per year and the maximum catch value is 1,758.37 tons per year. When viewed based on the maximum sustainable catch value, the number of catches produced from 2009 - 2017 has not reached the maximum catch value (MSY). The same thing happened to the fishing effort not exceeding the optimum fishing effort (Fopt).

In Sinjai Regency (figure 4) the optimum catch attempt value is 26,073 trips per year and the maximum catch amount is 20,394.6 tons per year. When viewed based on the maximum sustainable catch value, the number of catches produced from 2009 - 2017 has not reached the maximum catch value (MSY). The same thing happened to the capture effort which had exceeded the optimum capture effort (Fopt). Increasing the effort of skipjack tuna every year results in a decrease in the amount of skipjack tuna.

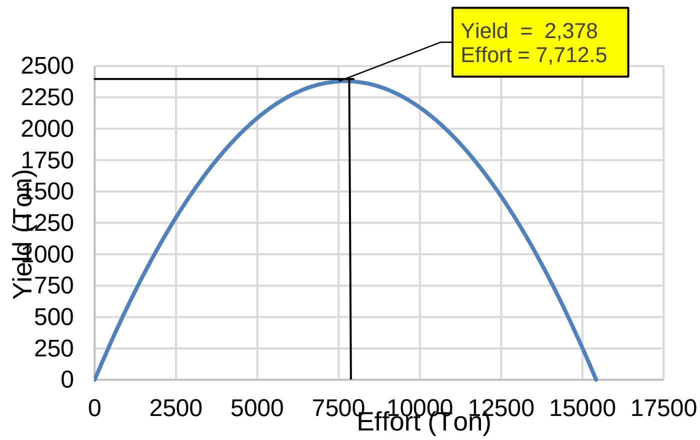

Figure 2. Maximum Sustainable Yield (MSY) Fishing Based in Bone Regency

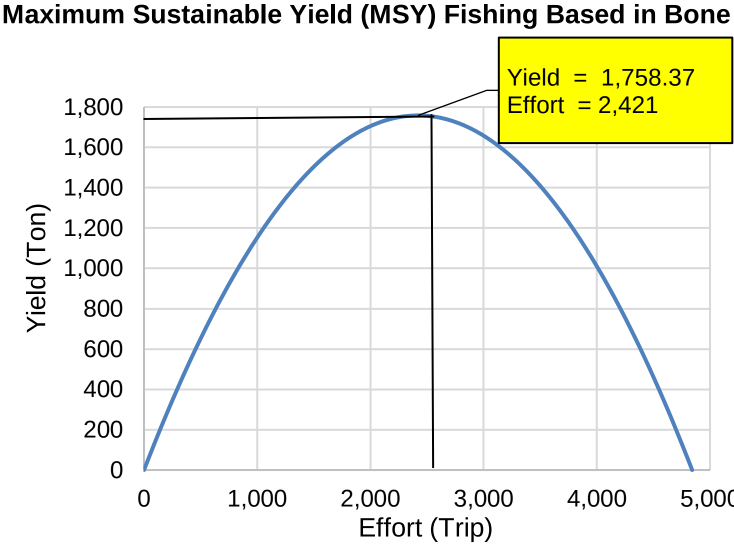

Figure 3. Maximum Sustainable Yield (MSY) Fishing based in Luwu Regency

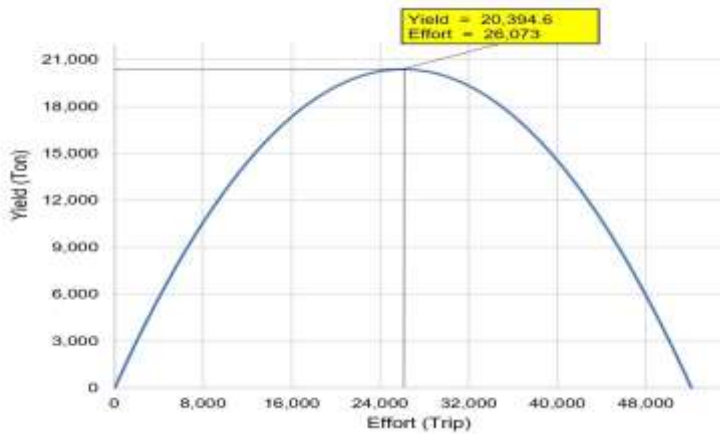

Figure 4:Maximum Sustainable Yield (MSY) Fishing based in Sinjai Regency

Based on the comparison between sustainable catches with actual catches that the catches obtained each year are still below the sustainable potential. But the number of arrest attempts has exceeded the optimum capture effort. The fishing effort that exceeds the optimum effort should be a limitation of the fishing effort and there should be no additional fishing effort for skipjack fishing in the Gulf of Bone waters.

DISCUSSION

Utilization of fisheries resources is generally based on the concept of Maximum Sustainable Yield (MSY) developed by a biologist named Schaefer in 1957. The core of the MSY concept is to maintain the biological balance of fish resources so that they can be maximally utilized for a long time. As quoted from Effendi (2002), that MSY is an effort in fisheries to determine balanced but maximum fishing. The strength of the concept of Maximum Sustainable Yield (MSY) is that only limited data is needed, simple to analyze, and easy to understand by anyone, including policy makers. Based on the results of the analysis of the CPUE described in the previous section, then proceed with the calculation of sustainable potential (MSY) based on the Schaefer production surplus.

Catching effort can be said to be the application of a number of over-fishing efforts to a fish stock and divided into two categories, namely overfishing affecting overgrowth and overfishing that affect the recuitment. Overfishing affects growth, if the effort is so high that the total catch decreases with increasing effort. Fish are caught before they can grow to a size large enough to support biomass (Spare and Vennema, 1999).

Economically, the decline in the catch will also reduce the profits of the fishermen's business as a whole, because the revenue obtained is no longer proportional to the costs incurred. The loss of profits gained from the use of skipjack fish resources can also be caused by the high cost of catching per unit of effort to catch. With high fishing costs, profits will automatically be reduced even though the catches obtained have not exceeded the level of MSY (Maximum Sustainable Yield). On the other hand, fishery resources which are intended for utilization even though classified as resources can recover, but if the utilization exceeds the natural ability to recover from these resources, then it can threaten its sustainability. Therefore, in order to make optimal use of it, it is necessary to determine the optimum level of capture effort.

CONCLUSION

The optimum catch effort value is 7,712.5 trips per year and the maximum catch amount is 2,378 tons per year. When viewed based on the maximum sustainable catch value, the number of catches produced from 2009 - 2017 has not reached the maximum catch value (MSY).

The activity of skipjack fishing in the waters of Bone Bay which is carried out by all fishermen in the South Sulawesi region requires a policy of limiting the level of fishing so that the condition of skipjack tuna resources remains in a sustainable condition and has high sustainability.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

All authors were involved in data collection, data analysis and compilation of this manuscript in accordance with their respective fields of expertise.

REFERENCES

Amir, F. dan Mallawa, A., 2014.*Pengkajian stok ikan cakalang(Katsuwonus pelamis) di perairan Selat Makassar*.Jurnal IPTEKS PSP, Vol.2 (3) April 2015: 208-217

Amiruddin.1993. *Analisis Penangkapan Cakalang dengan Pole and Line di Perairan Teluk Bone Hubungannya dengan Kondisi Oseanografi Fisik*. [Skripsi], Bogor : Fakultas Perikanan, IPB.

Angraeni, Rezkyanti, NI., Safruddin, dan Zainuddin, M., 2014.Analisis Spasial dan Temporal Hasil Tangkapan Ikan Cakalang (katsuwonus pelamis) dan Thermal Front pada Musim Peralihan di Perairan Teluk Bone.Jurnal IPTEKS PSP, Vol.

Bintoro, G. 1995. *Tuna Resources in Indonesia's Waters Status, Possible Management Plan, and Recomendations for The Regulation of Fishing Effort*.Being a Dissertation Submitted in Partial fulfillment of the Requirements for The Degree of Master of Science in Fisheries. University of Hull, UK.

Burhanuddin, Muljanto, R., Martosewojo, S. dan Jamali, A. 1984. *Tinjauan Mengenai Produksi Ikan Tuna, Cakalang dan Tongkol.* LON-LIPI, Jakarta.

Chambers, Robert. 1988 *Pembangunan Desa Mulai dari Belakang,* Jakarta: LP3ES

Charles AT. 2001. *Sustainable fishery systems*. Blackwell Sciences. London. UK

Charles AT., Boyd H, Lavers A, Benjamin C. 2002. *Measuring sustainable development application of the genuine progress index to nova scotia.* Management Science/Environmental Studies.Saint Mary's University. Halifax.

Cohrane, KL. 2002. Fisheries Management. In Cohrane KL, editor.*A Fishery Manager's Guidebook.Management Measures and Their Aplication*.FAO Fiheries 424. Rome, pp 1-20

Dinas Kelautan dan Perikanan Propinsi Sulawesi Selatan.*Laporan Statistik Perikanan*. Tahun 2012 - 2014.

Fauzi A. 2005. *Turning the Tide" Kebijakan Ekonomi Perikanan*. http://www. duniaesai.com/index.php/direktori/esai/42-lingkungan/220-qturning-the-tideq-kebijakan-ekonomi-perikanan.html [dikunjungi 8 Maret 2016]

Froose R and Pauly D. 2011, editors. Fishbase, www.fishbase.org version (03/2016) 1(1).

Gunarso W. 1985.*Tingkah Laku Ikan dalam Hubungannya dengan Alat, Metode dan Taktik Penangkapan*. Fakultas Perikanan IPB, Bogor

Jamal, M, Sondita, F.A, Wiryawan, B., dan Haluan, J.,2014. Konsep pengelolaan perikanan tangkap cakalang(Katsuwonus pelamis)di kawasan Teluk Bone dalam perspektif keberlanjutan.Jurnal IPTEKS PSP, Vol. 1 (2) Oktober 2014: 196-207

Jamal, M., 2011.*Analisis Perikanan Cakalang (Katsuwonus pelamis) di Teluk Bone: Hubunggan Aspek Biologi dan Faktor Lingkungan.*[Disertasi], Bogor : Sekolah Pascasarjana, IPB.

James Scott. (1993). *Perlawanan Kamu Tani*. Jakarta : Yayasan Obor Indonesia

Jenkins, Richard. 2010. *Membaca Pikiran Pierre Bourdieu*. Yogyakarta : Kreasi Wacana

Jufri, A., Amran, M.A., Zainuddin, M., 2014.*Karakteristik Daerah Penangkapan Ikan Cakalang pada Musim Barat di Perairan Teluk Bone.*Jurnal IPTEKS PSP, Vol. 1(1): 1-10.

Kadir, IR., 1994. *Suatu Studi tentang Potensi Sumberdaya Cakalang (Katsuwonus pelamis) di Perairan Teluk Bone.* [Skripsi], Bogor :Program Studi Ilmu Kelautan, IPB.

King M. 1995. *Fisheries biology, assessment and management*.Fishing News Books.A Division of Blackwell Science Ltd. London.

Loukos, H, Monfray P, Bopp L and Lehodey P. 2003. Potensial Change in Skipjack Tuna ((*Katsuwonus pelamis*) Habitat from a Global Warming Scenario : Modelling Approach and Preliminary Results. *Journal Fisheries Oceanography*, 12:4/5, 474-482p.

Mallawa, A., Amir, F., dan Zainuddin, M., 2014.Keragaan biologi populasi ikan cakalang (Katsuwonus pelamis) yang tertangkap dengan purse seine pada musim timur di perairan Laut Flores.Jurnal IPTEKS PSP, Vol. 1 (2) Oktober 2014: 129-145

Mallawa, A., Musbir, F. Amir, dan A.A. Marimba.2012. *Analisis Struktur Ukuran Ikan Cakalang (Katsuwonus pelamis) Menurut*

Musim, Daerah dan Teknologi Penangkapan Ikan di Perairan Luwu Teluk Bone, Sulawesi Selatan. Jurnal Sains dan Teknologi Balik Diwa Vol.3 No.2:29-38.

Mallawa. A., Sudirman 2004. *Tehnik Penangkapan Ikan*. PT Rineka Cipta. Jakarta.

Masrikat JAN. 2009. *Kajian Standing Stock Ikan Pelagis Kecil dan Demersal, serta Hubungannya dengan Kondisi Oceanografi di Laut Cina Selatan, Perairan Indonesia*. [Disertasi], Bogor : Sekolah Pascasarjana, IPB.

Matsumoto WM, Skilman RA and Dizon AE. 1984. *Synopsis of biological data on skipjack Tuna (Katsuwonus pelamis)*. NOAA Techical Report NMFS Circular No. 451 dan FAO Fihsries Synopsis No 136.Diterjemahkan oleh Fedi A. Sondita, 1999. Jurusan Pemanfaatan Sumberdaya Perikanan, IPB. Bogor.Jakarta.

Rosana, I. 1994. Pengaruh Perbedaan Jenis Ikan Umpan Terhadap Hasil Tangkapan Cakalang dengan Pole and Line di Bajoe, Kabupaten Bone.Sulawesi Selatan. [Skripsi], Bogor :Program Studi Pemanfaatan Sumberdaya perikanan, IPB.

Simbolon, D. 2011. *Bioekologi dan Dinamika Daerah Penangkapan Ikan.*Departemen Pemanfaatan Sumberdaya Perikanan, IPB, Bogor.

Somanje, Chifuniro and Muendo, Kavoi M., 2016. *Socio-Economic determinants of profitability ofcapture fisheries trade in Barotse floodplain of Zambia.* International Journal of Fisheries and Aquatic Studies 2016; 4(3): 367-371

Spare P and SC Venema. 1999. Introduksi Pengkajian Stok Ikan Tropis. Buku 1-Manual. Jakarta: Pusat Penelitian dan Pengembangan Perikanan. 438 hal.

Sugiyono, 2015.*Metode Penelitian Manajemen Pendekatan Kuantitatif, Kombinasi (Mixed Methods), Penelitian Tindakan (Action Research), Penelitian Evaluasi.*Penerbit Alfabeta, Bamdung.

Uktolseja, J. C. B., R. Purwasamita, K. Susanto, & A. B. Sulistiadji. 1989.Sumber daya ikan pelagis besar. *In* Widodo, J., K. A. Aziz, B. E. Priyono, G. H. Tampubolon, N. Naamin, & A. Djamali (eds). *Potensi dan Penyebaran Sumber Daya Ikan Laut di Perairan Indonesia*. Komisi Nasional Pengkajian Stok Sumber Daya Ikan Laut. Jakarta.

UNCLOS 1982.The Law of the Sea. New York: United Nations.

Wagey, T, Suparman A, Pranowo WS, Tisiana DAR, Hutahaean KA, Hendrajana B, Kusumah G, Mustikasari E, Prihatno H, Triwibowo H, Afiati, Adi RA, Novita S. 2004. *Kajian Daya Dukung Lahan Laut di Perairan Teluk Bone*. Laporan Akhir Kegiatan, Pusat Riset Wilayah dan Sumberdaya Non-Hayati, Badan Riset Kelautan dan Perikanan, Departemen Kelautan dan Perikanan Republik Indonesia, Jakarta, 20 Desember 2004.

Wiadnya NN, Nugroho D. (Eds). Prosiding Forum Pengkajian Stok Ikan Laut 2003. Jakarta, 23-24 Juli 2003. PUSRIPT-BRKP, Departemen Kelautan dan Perikanan, Jakarta

Widodo J. 2003. Pengkajian Stok Sumberdaya Ikan Laut Indonesia Tahun 2002. Di dalam : Widodo J,

Zainuddin, M., A. Nelwan, M.I. Hajar, A. Farhum, M. Kurnia, Najamuddin, Sudirman. 2013. *Pemetaan Zona Potensi Penangkapan Ikan Cakalang Periode April-Juni di Teluk Bone dengan Teknologi Remote Sensing*. Jurnal penelitian Perikanan Indonesia, Vol. 19(3): 167-173.