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Fish Stock Estimation by Using the Hydroacoustic Survey Method in Sikka Regency Waters, Indonesia

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Abstract

Sikka regency waters including fishery management with a high utilization status so that the necessary stages of an intensive monitoring and research potential of fish resources. This study aimed to obtain the estimated value of stock biomass and density of fish resources with the acoustic method. Quantitative data obtained will be a source of current information on the state of fish resources in the Sikka regency waters, Indonesia. The research was conducted in May 2015. Acoustic data retrieval, using instruments CruzPro fish finder PcFF-80 with sound velocity of 1516 m/s, power 2560 Watt, and method in survey acoustic use hydroacoustic long transect. Horizontal distribution shows fluctuations striking at research location has the highest salinity levels in the range of 29.3-29.8 psu. Total biomass of fish in this study showed more the number is at a depth of 11-20 m that is 2,008 tons/Km and at a depth of 1-10 m have the total fish biomass is 12.33 tons/Km, single detection is done using a single target hidroacoustic show more dominance at a depth of 11-20 m in Sikka regency waters, MTB, Indonesia in May 2015. Number of data from results obtained by looking at the relationship between the number of the data with the total biomass in keadalam 1-10 m has equation Y=0.0967 x+0.0486 with R2 is 0.0464 (4%), while at a depth of 11-20 m has a regression equation is Y=0.0003 x+0041 with the R2 is 0.0091 (0.9%). Variations in the data or the detection of single targets have variations over the data that is at a depth of 11-20 m with regression low percentage is 0.9%.

Keywords: Hydroacoustic; Salinity; Biomass; Estimation stock; Sikka regency waters

Introduction

Quantitative estimation on the size of fish populations is needed in the development and management of fish resources. Utilization of resources fish resources can be optimally when stocks and distribution of fish resources known for certain that the policy measures of exploitation can be done properly without endangering its sustainability. Sikka regency waters has significance for the business activities of fisheries which exploit small pelagic fish resources. Ala talat fishing is the widely used gill nets and longlines. Sikka regency waters, good information about the fishery such as the availability of resources, distribution and types of fish and oseanografinya parameter has not been widely studied.

In science of acoustic there is passive and active acoustic method. In passive acoustic method usually with namely is bioacoustic, and this mehod described in researching [1,2]. In active acoustic with hydroacoustic method are increasingly being used in all kinds of aquatic ecosystems in order to acquire detailed information about aquatic life, and stock estimation about fish [3]. Quantifying sea bottom surface backscattering strength with echosounder and identifying bottom fish by using the hydroacoustic method most recently in the years 2003-2015 is [4,5], while research about acoustic backscatter quantification of seabed in refs. [6-8]. The hydroacoustic method too use in estimation of zooplankton [9].

The aim of this study hydroacoustic survey was estimation for the total biomass of fish in sikka regency waters, and using sampling patterns: long transects (Figure 1), and using calculation methods of biomass [10,11]. the results of the analysis in this study are presented in map form density distribution for each stratum depth.

Materials and Method

The research was conducted May 2015 in Sikka regency waters, MTB, Indonesia. Collecting data in this research using the local fishing boats. Acoustic data retrieval is done using instruments CruzPro fish finder PcFF-80 with sound velocity of 1516 m/s and power 2560 Watt (Figure 2). Acoustic data acquisition done in the afternoon until the evening in six days during a period fishing boad at speeds ranging between 6-7 knots. Trails include a data acquisition area of an area that allows the analysis of spatially created with the form of long transect according to [3] with the length of each transect approximately 12 km from the boundary islands outwards. Overview of the research sites in Sikka regerncy waters and acoustic tracking can be seen in (Figure 3).

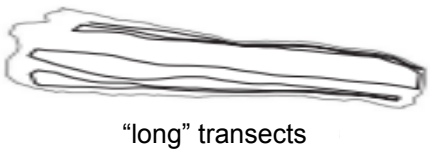

Figure 1: Sampling points and "long" transect in hydroacousticsuvey method.

Figure 2: Hydroacoustic Instruments CruzPro fish finder PcFF-80 with a) Pc/Computer, b) Interface, c) Hand GPS, d) Transducer (Single beam echosuonder) personal documentation.

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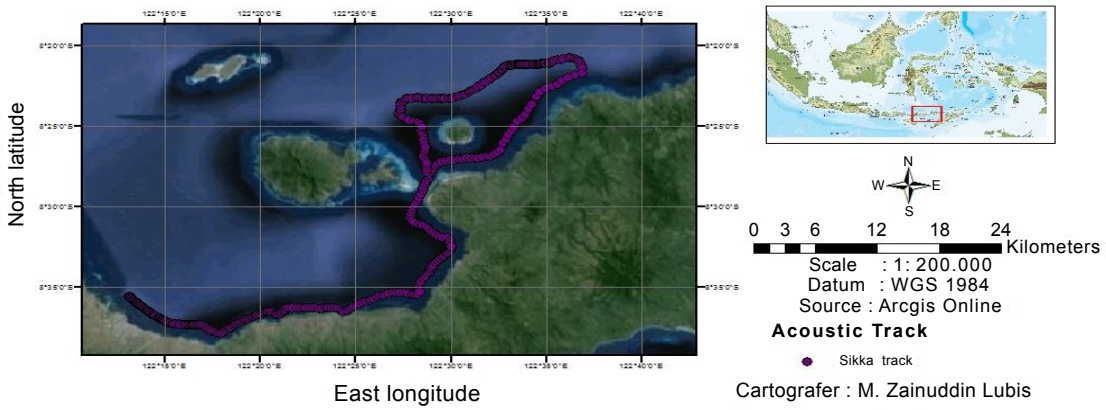

Figure 3: Research location and acoustic tracking.

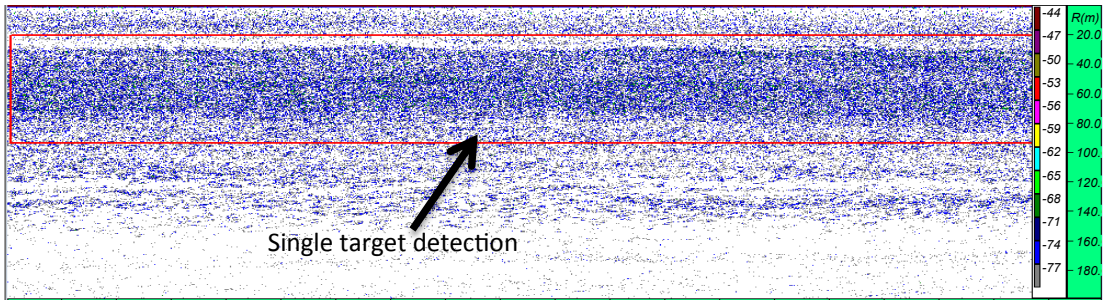

Figure 4: Single target echogram in depth 1-10 m.

Data processing and analysis

Acoustic data were processed using Sonar software ver.4 and Matlab R2008b. Analysis to estimate fish is done starting from a depth of 1-10 m, with units of fish biomass yield is (tail/1000m^3). In this study using a formula acuostic namely Target strength (TS) bore the ability of the target to reflect a sound about it. Based domain is used, the target strength is defined into two, namely in the form of Intensity Target Strength (TSi) and Energy Target Strength (TSE). Targeth logaritmic strength can be defined as the quotient between the value of the intensity of the noise coming about the target and multiplied by the number of ten (10) [12].

$$\text{Tsi} = 10 \log \frac{Ir}{Ii} \quad (1)$$

$$\text{Tse} = 10 \log \frac{Er}{Ei} \quad (2)$$

Description:

Tsi: Intensity of target strength

Ii: Intensity of sound on targets

Ir: intensity of the reflected sound energy targets

Tse: Target Strength

Ei: Energy sound on targets

Er: Energy reflection sound at a distance of 1 meter from the target

In addition [11] has a long and weighs equation to convert length into weight alleged allegations are as follows:

$$Wt = \left\{ \sum_{1}^{i1} .\text{ni}(\text{Li} + \ddot{A}\text{L}/2).^{b+1} - (\text{Li} - \ddot{A}\text{L}/2).^{b+1} \right\} / \left\{ (b+1)\ddot{A}\text{L} \right\} \quad (3)$$

Description:

Wt=total weight (g)

Al=class interval length (cm)

Li=the midpoint of the long-th grade (cm)

Ni=number of individuals in the i-th grade

a, b=constants for certain species

Result and Discussion

Values obtained estimation of fish stocks is the amount of biomass of the fishery resources to the extent of the observed area. The estimation of the stock acquisition value has not reflected the condition of the actual fish resources, because according to the nature of life there are fish in groups (schoals) and alone (solitary). Single target echogram in depth 1-10 m, can be seen in Figure 4.

Analysis of the spatial distribution is useful to know the pattern of aggregation of fish resources in the waters observed so that can know the condition of the existence of fish resources actually closer in nature. Vertical distribution of salinity in Sikka regency waters can be seen in Figure 5, and the spatial distribution of resources fish. Acoustic detection results at the time of the survey showed that in Figures 6 and 7.

At a depth of 1-10 have the results of the spatial distribution of fish distribution (6) Very little it is expected due to dilution by the relatively

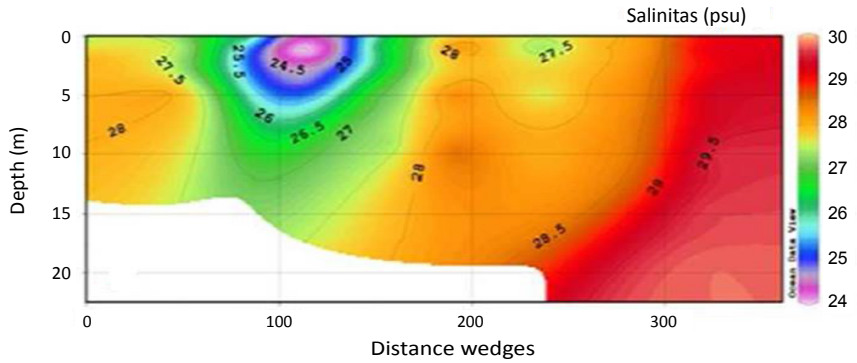

Figure 5: Vertical distribution of salinity in Sikka regency waters.

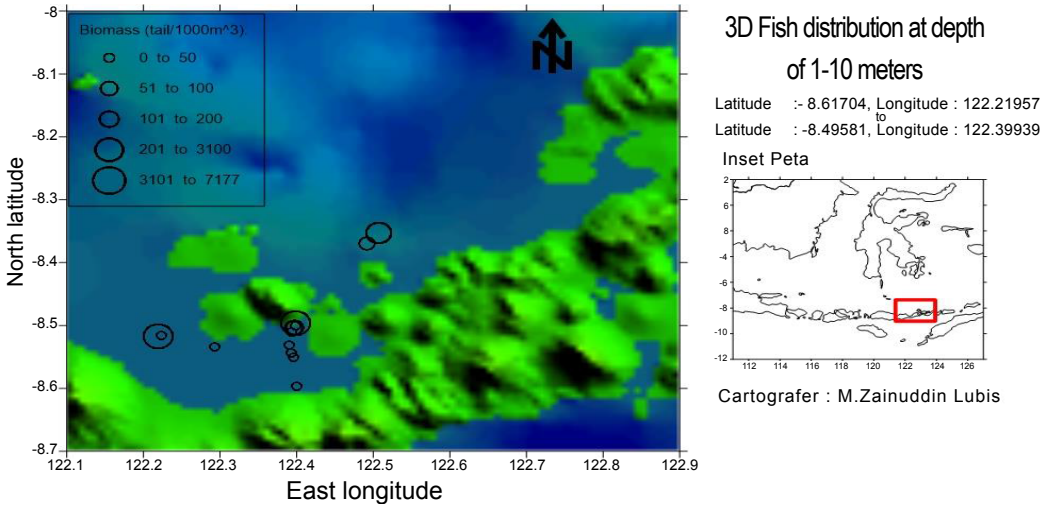

Figure 6: 3D Spatial distribution of fish at depth of 1-10 meters.

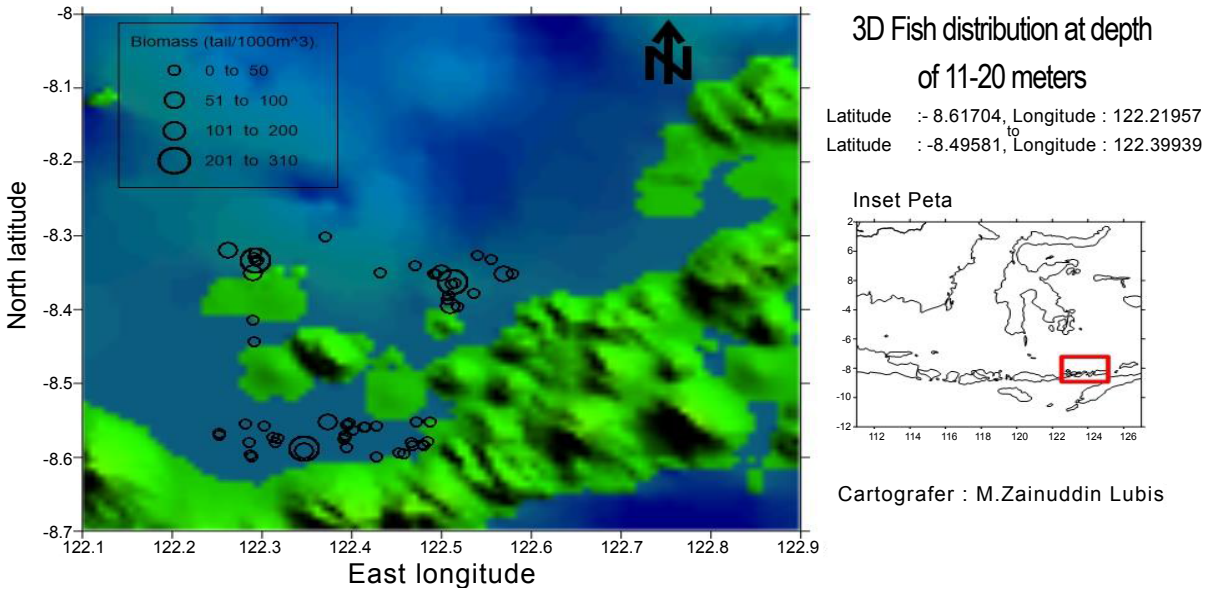

Figure 7: 3D Spatial distribution of fish at depth of 11-20 m.

higher rainfall in May. In Figure 5, it shows the vertical distribution of salinity, horizontal distribution shows fluctuations striking at research location has the highest salinity levels in the range of 29.3-29.8 psu. In 3 D Spatial distribution of fish at depth of 1-10 meters (Figure 6) show more fish biomass values were in the range of 0 to 50 (tail/1000 m^3), whereas the biomass was highest, namely 3101 to 7177 (tail/1000 m^3). This clearly provides that the distribution of information or estimate the fish at depths of 1-10 m in sicca has very little biomass (Tables 1 and 2).

Fish stock estimation of biomass results obtained at a depth of 11-20 meters has a spatial distribution that is more than the depth of 1-10 meters (Figure 6), these results can be seen in (Figure 7) in the 3 D spatial distribution of fish at the depth of 1-10 meters, dengan sebaran terbanyak yaitu 0 to 50 (tail/1000 m^3), sebaran spasial yang paling merata yaitu 51-100, dan sebaran paling sedikit yaitu pada biomassa 201-310 (tail/1000 m^3).

The total biomass of fish in this study showed more the number is at a depth of 11-20 m that is 2,008 tons/Km and at a depth of 1-10 m have the total fish biomass is 12.33 tons/Km with a total different single target detection, the results obtained are the actual results of the tool hydroacoustic a single beam and do not use the fishing gear for example aids gillnet is not the same with other research [13,14], Single detection is done using a single target hydroacoustic show more dominance at a depth of 11-20 m in Sikka regency waters, MTB, Indonesia in May 2015.

Number of data from results obtained by looking at the relationship between the number of the data with the total biomass in keadalam 1-10 m has equation Y=0.0967 x+0.0486 with R^2 is 0.0464 (4%) (Figure 8), while at a depth of 11-20 m has a regression equation is Y=0.0003 x+0041 with the R^2 is 0.0091 (0.9%). Variations in the data or the detection of single targets have variations over the data that is at a depth of 11-20 m with regression low percentage is 0.9% (Figure 9).

Conclusion

Fish stock estimation by using the hydroacoustic method have

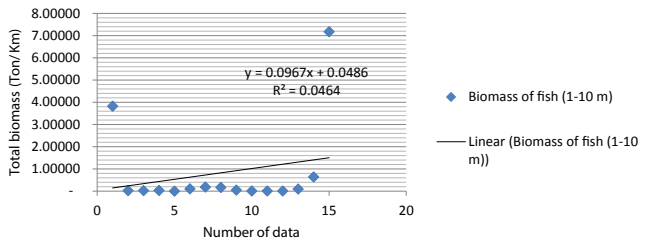

Figure 8: Relationships between number of data with total biomass (Ton) in depth 1-10 m.

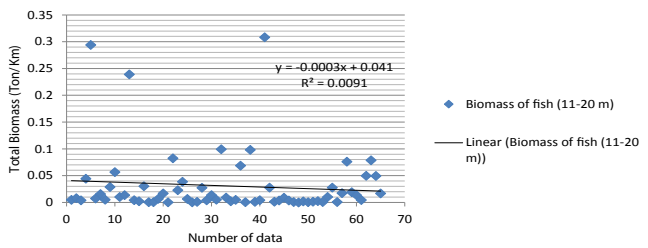

Figure 9: Relationships between number of data with total biomass (Ton) in depth 11-20 m.

A	Latitude	Biomass (Tons/Km)
122.21957	-8.51704	3.82266
122.22368	-8.51561	0.02488
122.29318	-8.53414	0.02487
122.40081	-8.59689	0.03478
122.39901	-8.5009	0.00146
122.39796	-8.50294	0.10224
122.39796	-8.50295	0.18051
122.3966	-8.50494	0.16814
122.3928	-8.51017	0.04713
122.39069	-8.53182	0.00373
122.39319	-8.54317	0.00501
122.39593	-8.55063	0.00936
122.49183	-8.36976	0.09491
122.50689	-8.35369	0.63692
122.39939	-8.49581	7.17615
Total biomass of fish		12,33,275

Table 1: Biomass estimation of fish (Ton) in depth 1-10 m.

Longitude	Latitude	Biomass (Ton)	Longitude	Latitude	Biomass (Tons/ Km)
-8.68669	122.5065	0.004703047	-8.58455	122.47989	0.0089812
-8.67783	122.5356	0.007950297	-8.58325	122.47823	0.0021885
-8.66572	122.5104	0.003881807	-8.58001	122.2853	0.0048741
-8.66478	122.5154	0.044239808	-8.5785	122.4839	0.0686429
-8.66274	122.5125	0.29413167	-8.56349	122.40122	0.0006445
-8.65238	122.5554	0.007264844	-8.49462	122.50921	0.0980554
-8.651974	122.5687	0.015669971	-8.5544	122.28167	0.0010076
-8.651424	122.5786	0.005101958	-8.57246	122.39305	0.0043289
-8.49566	122.5177	0.028750929	-8.58132	122.50869	0.3085433
-8.63428	122.2926	0.056522535	-8.57009	122.25294	0.0277057
-8.63414	122.2925	0.010249706	-8.58783	122.25292	0.0012409
-8.63414	122.2925	0.01356654	-8.57563	122.3911	0.0037266
-8.63414	122.2932	0.239153825	-8.5745	122.31706	0.0089333
-8.63325	122.2956	0.004363717	-8.57973	122.31514	0.0036359
-8.62993	122.2918	0.002127022	-8.57309	122.3122	0.00076
-8.62698	122.5402	0.030258324	-8.5708	122.39244	3.49E-05
-8.62337	122.2909	0.000642236	-8.58775	122.39419	0.0018203
-8.61207	122.2902	0.000568804	-8.55711	122.39471	0.0003978
-8.6089	122.2898	0.006831018	-8.55652	122.3953	0.0012533
-8.60864	122.3468	0.016908005	-8.55598	122.39588	0.0024093
-8.60859	122.3466	0.000236513	-8.55408	122.39655	0.0006952
-8.60442	122.4678	0.082532458	-8.55237	122.37278	0.0101071
-8.60313	122.4662	0.022970984	-8.3018	122.37074	0.0276023
-8.60254	122.4658	0.038551478	-8.320001	122.26257	0.0006898
-8.60086	122.4316	0.006540752	-8.55975	122.41352	0.0174307
-8.60047	122.4711	0.000141708	-8.55967	122.41536	0.0762437
-8.59993	122.4275	0.001094629	-8.55786	122.4279	0.0190004
-8.59987	122.4279	0.027525912	-8.5527	122.47206	0.0137233
-8.59902	122.288	0.003843321	-8.55771	122.30225	0.004437
-8.59667	122.2878	0.013636692	-8.552286	122.48718	0.0496706
-8.59608	122.4578	0.005058431	-8.551544	122.49152	0.0788079
-8.59378	122.4526	0.099454253	-8.551298	122.49312	0.0494329
-8.550493	122.4998	0.016970998	Total Biomass of fish : 2,008		

Table 2: Biomass estimation of fish (Ton) in depth 1-10 m.

horizontal distribution shows fluctuations striking at research location has the highest salinity levels in the range of 29.3-29.8 psu. Total biomass of fish in this study showed more the number is at a depth of 11-20 m that is 2,008 tons/Km and at a depth of 1-10 m have the total fish biomass is 12.33 tons/Km, single detection is done using a single

target hidroacoustic show more dominance at a depth of 11-20 m in Sikka regency waters, MTB, Indonesia in May 2015.

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