Echo Processing and Identifying Surface and Bottom Layer with Simrad Ek/Ey 500

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Abstract

Simrad Ek/Ey 500 Scientific 38-kHz and 120-kHz echo sounding system in the acoustics lab will be turned on during all scientific operations and should be monitored regularly for the presence of unusual acoustic signals or heavy fish sign. In the acoustic system, split beam processor is one of the acoustic devices that can help to echogram processing. The hardware required in the form of hardware, SIMRAD Ek 500, and software, SIMRAD Echo EP 500. Processor 500 can be used for the calculation of the density of fish from fish or fish group. In echogram there are 12 scale color representing the image signal strength emitted by the object affected. Range Sa value on surface layer is -10 dB - (-4) dB, range Sv value on surface layer is 0 dB - (-89) dB, range Sa value on bottom layer is 15 dB - (-2) dB, range Sv value on bottom layer is -57 dB - (-74) dB. The total value Sa (dB) produces the extraction of data on surface layer using simple linear regression equation which produce y=0.0961x - 6.4388, R²=0.9159, with alpha value is 5, the results obtained shows the relationship between the value Sa obtained by looking at the percentage value that is 91%. In this paper the result there is a difference between the processing value Sa and Sv, where the value of Sv.

Keywords: Simrad EK 500; Frequency; Scattering area (Sa); Scattering volume (Sv); Processor 500

Introduction

Indonesia is a maritime country in need an instrument or method to get information about the surrounding seas. Oceanographic observation is needed to be able to provide a wide range of useful information among others, to determine the spread of the abundance of fish, mapping the distribution of organisms, an observation of fish behavior, as well as the depth of the bathymetry of the ocean. Instruments used in oceanographic observations in the past have been minimal so that the costs used more and more. In the acoustic system, split beam processor is one of the acoustic devices that can help to echogram processing. Research on the echogram with acoustic instrument or instruments (Hydroacoustic) never done before by Akbar H and Moniharapon D [1,2], research of hydroacoustic with used single beam echosounder (Cruzpro fishfinder) according to Lubis MZ [3]. Quantifying sea bottom surface backscattering strength and identifying bottom fish habitat by quantitative echo sounder according in Manik H and Manik H et al. [4,5]. Effects Of grain size, roughness, and hardness of sea floor on back scattering value based on hydroacoustic detection according to Pujiyati S et al. [6].

Simrad Ek/Ey 500 Scientific 38-kHz and 120-kHz echo sounding system in the acoustics lab will be turned on during all scientific operations and should be monitored regularly for the presence of unusual acoustic signals or heavy fish sign. The bridge should notify the scientific watch on duty if any unusual sign appears on the bridge echo sounder. The hardware required in the form of hardware, SIMRAD Ek 500, and software, SIMRAD Echo EP 500. Processor 500 can be used for the calculation of the density of fish from fish or fish group, carried out by integrating the detected echo in the vertical direction on each layer waters and averaged in the horizontal direction along the track [7]. EP 500 is used to set the path that has been used against targets that are not flocking observations EK 500 [7-9]. Echogram a depth chart of recording the results of conventional echosounder (ITB Central library). Ping is a pulse issued by each transducer [10]. The coefficient of back-scattered area (Sa) is a measure of the energy that is returned from the seam between the two depths in the water column while Backscattering Strength (Sv) is the ratio between the intensity reflected by a group of single target diinsonifikasikan instantaneously measured at a distance of 1 meter from target with a sound intensity that hit the target [11]. Target Strength (TS) is a reflection of the strength of the echo (echo), or decibel measure of sound intensity returned by the target [12]. This paper was made aiming to analyze the target surface, pelagic, and bottom waters with EP 500.

Research Methods

Area backscattering coefficients (Sa)

When the target individual is very small and a large amount within the sample volume, echo-echo signal received combined to form a continuous basis with varying amplitude. It is no longer possible to separate the individual target, but the intensity of the echo is still the size of the biomass in the water column. Measurement of acoustic base is back-scattered coefficient of volume, Sv, which is obtained from the integration of echo formulated as follows:

\[
Sv = 2\sigma_s / N_i
\]

According to Simmonds J [13], the coefficient of back-scattered area (Sa) is a measure of the energy that is returned from the seam between

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the two depths in the water column. \(S_v\) is defined as the integral of which is connected to a depth which passes through the layer. \(S_a\) is an important parameter in fisheries acoustics because most of the echo-integrators providing data integration with one or more layers. Because \(S_a\) \(S_v\) and is the result of the distance, then \(S_a\) dimensionless. This makes it difficult to show \(S_a\) numerical values clearly different when the scale factor is applied. 1 base unit for \(S_a\) should be written as \((m^2/m^3)\) which means integration obs per square meter of the surface layer. Many of the various versions of \(S_a\) commonly used, especially Nautical Area Scattering Coefficient (NASC) for the symbol \(S_a\). Although \(S_a\) is dimensionless, it is very important to show the scale of the current quote numerical values.

**Scattering volume (\(S_v\))**

Backscattering Strength (\(S_v\)) is the ratio between the intensity reflected by a single target group instantaneously measured at a distance of 1 meter from the target to the intensity of noise about the target [11]. Scattering volume (\(S_v\)) is the ratio between the intensity of the sound is reflected by a single target group at a certain volume of water (1 m\(^3\)) and measured at a distance of 1 meter from the target group is concerned with the intensity of sounds on targets (incident intensity). The calculations are done vertically i.e., per strata depth. To overcome the depth of integration at a divided by an interval of 1 meter. The higher the value, the greater the \(S_v\) alleged group size fish. To overcome the depth of integration at a distance \(R_1-R_2\) for the transmission of a measure of the intensity \(S_v\) alleged group size fish. Many of the various versions of \(S_a\) commonly used, especially Nautical Area Scattering Coefficient (NASC) for the symbol \(S_a\). Although \(S_a\) is dimensionless, it is very important to show the scale of the current quote numerical values.

\[
S_v = 10 \log \rho_v + TS
\]  
(2)

\(S_v\)=Volume Backscattering Strength  
\(\rho_v\)=densitas ikan per volume  
\(TS\)=Target strength

**Target strength (TS)**

In the estimation of fish stock with the acoustic method, the most important factor to be noted is the Target Strength. Target Strength (TS) is a reflection of the strength of the echo (echo), or decibel measure of sound intensity returned by the target, measured at a distance of one meter from the acoustic center, relative to the intensity of sounds on targets [14,15]. Meanwhile, according in Simmonds J [13], stating that the Target Strength (TS) is power of targets to reflect a sound and has a close relationship with the size of the fish, where there is a tendency of the greater size of the fish, the greater the TS obtained. Target Strength is also defined as ten times the logarithm of the intensity of the fish (\(I_i\)) [16]. Here is the formulation of TS:

\[
TS = 10 \log(I_i/I_e)
\]  
(3)

\(TS_i\)=intensity target strength  
\(I_i\)=intensity of the reflected sound is measured at a distance of 1 meter from the target  
\(I_e\)=intensity of sound that the fish are and based energy

Strength targets formulated as follows:

\[
TS_i = 10 \log(E_i/E_e)
\]  
(4)

\(TS_i\)=Energy Target strength  
\(E_i\)=reflected sound energy measured at a distance of 1 meter from the target  
\(E_e\)=energy target strength

According to MacLennan [16], TS is the scattering cross section of the target which returns a signal and is expressed in equation form:

\[
TS = 10 \log(o/4\pi)
\]  
(5)

Result and Discussion

In echogram there are 12 scale colors representing the image signal strength emitted by the object affected. Echo force is divided into twelve categories of color, the weakest is gray and the strongest echoes are represented by the brightest color (brown) (SIMRAD Kongsberg Company). Echogram movement on the screen is determined by the setting of parameter echogram speed (Display Menu) and the current ping interval used (Menu Operations). Color echogram presentation was mainly influenced by TS and minimum \(S_v\) chosen color and type of TVG (Display/echogram Menu). Echogram information can be seen in Figures 3 and 4.

In this paper used data sources 04191352.DT2 echogram taken in the area of Belitung. This data is then analyzed using EP 500 in each of the layers consisting of Surface layers, layers and Bottom layers resulting value \(S_a\) (dB) and \(S_v\) (dB) on each of the layers. The coefficient of backscattered area (\(S_a\)) is a measure of the energy that is returned from the beam between the two depths in the water column while Backscattering Strength (\(S_v\)) is the ratio between the intensity reflected by a group of single target instantaneously measured at a distance of 1 meter from target with a sound intensity that hit the target. Furthermore, the value \(S_a\) and \(S_v\) is made in the form of graphs that can be seen on the result sheet. Echogram surface layer in \(S_a\) (dB), and \(S_v\) (dB) surface layer can be seen in Figure 5 (Figures 5-8).

In the chart above there is a difference between each respective layer. This is caused by the difference in the depth of which is owned by each of the layers. Surface layers on data extracted from a depth of 4 meters, while for bottom layers taken from a depth of 12 meters.

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**Figure 1:** Flowchart of data processing.

**Figure 2:** Visualization of EK/EY 500 in monitor.
Figure 3: Echogram A) Pings 0-9898, B) Pings 1200-1800.

Figure 4: Echogram A) Pings 0-6344, B) Pings 1200-1800.

Figure 5: Surface layers a) Echogram surface layer in Sa (dB), b) Sa (dB) surface layer.
There are differences in the processing of value where value Sv and Sa previously had to be linearized first and then averaged and converted into a form dB.

Range Sa value on sufrace layer is -10 dB - (-4) dB (Figure 5b), range Sv value on sufrace layer is 0 dB - (-89) dB (Figure 6b). Range Sa value on bottom layer is 15 dB - (-2) dB (Figure 7b), range Sv value on bottom layer is -57 dB - (-74) dB (Figure 8b). Scattering value (Sa) of the area will be affected by the detection object detected by the pulse of the tool [17-20], it is apparent that the resulting value of the surface layer and bottom layer have a range of different values. Sv value will be affected by the depth and the target was detected [21-25].

Figure 5b on the total value Sa (dB) produces the extraction of data on surface layer using simple linear regression equation which produce \( y = 0.0961x - 6.4388 \), \( R^2 = 0.9159 \), with alpha value is 5, the results obtained
shows the relationship between the value $S_a$ obtained by looking at the percentage value that is 91%. Figure 6b on the surface layer shows the total value of $S_v$ have in common is $y=0.9012x - 67.687$ with alpha value is 5, the results obtained show little relevance or influence between $S_v$ value by looking at the percentage value that is 4%, and this percentage is still far from 95%.

Figure 7b on the total value $S_a$ (dB) produces the extraction of data on bottom layer using simple linear regression equation which produce $y=1.0468x + 4.7894 R^2=0.7793$, with alpha value is 5, the results obtained shows the relationship between the value $S_a$ obtained by looking at the percentage value that is 77%. Figure 8b on the bottom layer shows the total value of $S_v$ have in common is $y=0.9012x - 67.687 R^2=0.7732$, the results obtained shows the relationship between the value $S_v$ obtained by looking at the percentage value that is 77%.

**Conclusion**

In this paper capable of analyzing a target on the surface and bottom waters with EP 500 and find out about the echogram readings along with their parts, and as a result there is a difference between the processing value $S_a$ and $S_v$, where the value of $S_v$.

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