How to use a fish finder/echo sounder.

I have written this article to give you, the reader a clearer understanding how the echo signals from fish and bottom structure are recorded in different colours and to explain why echo sounders that transmit vertical sound waves into the water column don't show the exact location of fish targets recorded on a display screen.

Before the development of colour echo sounders, fishers used paper recorders to record the echo signal from fish and bottom structure. When the technology of colour television became available, echo sounders were manufactured to record on a screen in colour. What the reader will find is that the information recorded on a paper recorder is not that dissimilar to what is recorded on a coloured screen. If you have had experience using both types, then you will understand why.

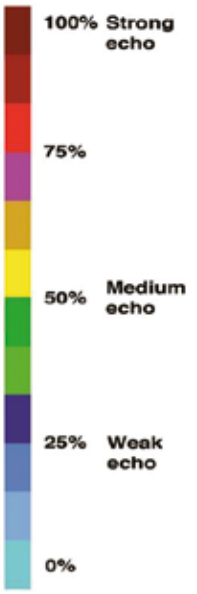
The acoustic image recorded on a display screen is the direct past history of a recording of an underwater situation, taken within a segment of time whilst the fish are swimming and the boat is underway. When the echo sounder is on, the recording of the picture continually scrolls from the left to the right of the display screen. The picture to the right of the screen is the most recent history of the recording.

As the boat arrives at the fishing grounds it is important to set the boat speed and picture speed to its most optimal setting for fish detection. This will ensure that an expanded detailed view of the bottom and fish targets is recorded. This is achieved by reducing the boat speed, i.e. 10 knots, and increase the picture speed, i.e. 70 - 80 %. This will expand the time period of the recording over the ground and will result in the greatest amount of detail being recorded on the display screen. If the boat speed is set too fast and the picture speed is set too slow, then the picture will become compressed in the time span of the recording and the amount of detail recorded on the display screen will be reduced.

This explains why some times the echo signals from single fish or schools of fish will unexpectedly appear as hyperbolic shaped arches on the display screen. The recording of these arches are determined by the boat speed, picture speed the angle at which the fish or school of fish are passing through the sonar beam.

Echo sounders that transmit sound waves vertically into the water column are unable to give precise information about the location of fish recorded on the display screen. They can only give an approximation of where the fish or bottom structure may be located according to the coverage of the transducers beam angle. This is further explained. For example, if the recorded water depth is 80 metres and the transducer beam angle is 45 degrees, then the detection area of the bottom will be 63 metres in diameter. Any fish targets recorded on the display screen will have come from targets detected within the circumference of the beam, some may be located at the front of the boat, others to the side or at the rear or at the very outer edges. Yet, the echo signals from those fish will all show on the display screen at the same time, scrolling across the display screen as past history.

Forward looking sonar systems have the capacity to accurately detect the position of fish schools relative to the boats position. They can also track the direction the fish are heading, estimate their speed, depth, and bio-mass within the water column. These systems are used by large commercial fishing vessels for detection of pelagic fish near the surface. To understand the concept of this system requires specific training, which is not within the scope of this article, which is aimed at recreational fishers.



The images of fish and bottom structure recorded on the display are recorded in many different colours according to their signal strength, also known as target strength.

The colours of the echo signals recorded on the display screen are determined by the echo sounder's colour palette. Colour palettes can range from 8 to 64 colours. The colours that are recorded on the display screen are proportionally divided into units of signal strength received from the return echo.

The signal strength of the returning echo varies according to the target strength of the bottom surface and the objects detected within the water column. For example, a school of fish has higher target strength than a single fish, a large fish has higher target strength than a small fish, and a rocky bottom has higher target strength than a softer sandy bottom.

In most systems, the stronger dark colours represent a stronger signal and the weaker colours such as light blue represent a weaker signal. In figure (1) the colour bar signal strength intensity is proportionally divided into 12 colours. Interpretation of the colour on the display screen can give some understanding of the factors that influence signal strength.

Screen capture No1 and 2 are images a small boat wreck positioned above the bottom echo signal. In each image the same school of fish has been detected above the wreck using different colourer palettes.

Screen capture No 1 has been selected to show a full screen view of the water column from depth range 0-25 metres. The colour of the bottom echo signal recorded on the display, indicates the strongest signal within the palette, which in this recording is dark red and the weakest signal recorded is light blue.

Screen capture No 2 has been selected to show a zoomed view of the water column from depth range 23-26 metres. The colour of the bottom echo signal recorded on the display, indicates the strongest signal within the palette, which in this recording is bright yellow and the weakest signal recorded is light blue.

My preference when selecting colour palettes is to select a palette with the highest number of different colours, as in screen capture No 1,from my perspective this makes it easier on the eyes to distinguish the signal strength of the many targets (fish) record on the display screen.

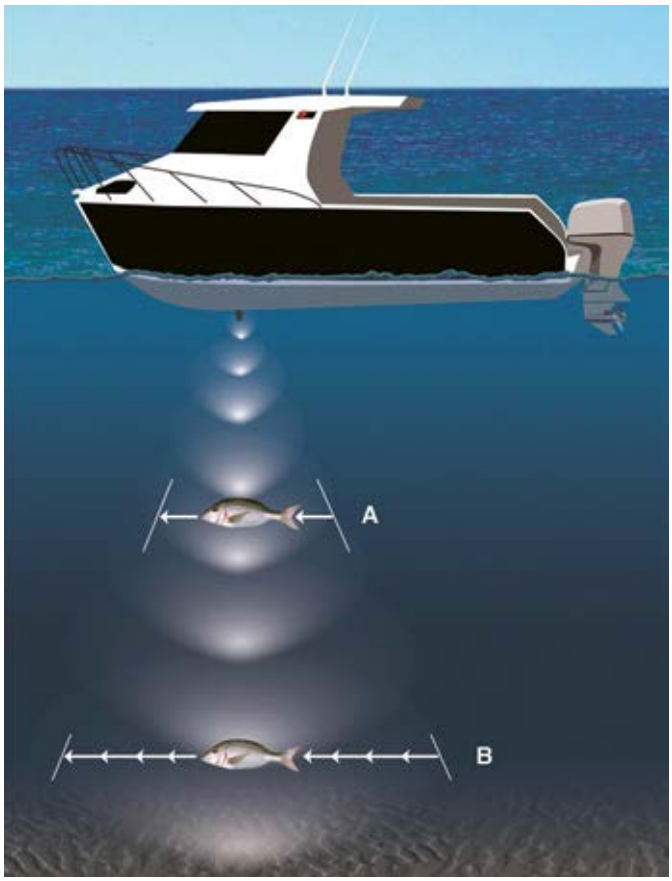
When the sound wave strikes the body of a fish, the amount of acoustic energy reflected from the fish will determine its target strength and therefore the size and shape of the echo signal recorded on the display screen. The body of a fish often has a poor reflective surface since it is commonly elliptical in

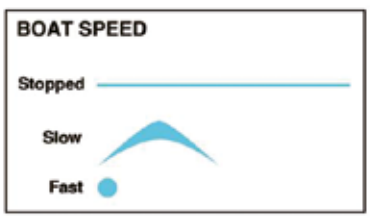
shape and the flesh density is similar to that of water. Therefore the gas content and volume of the swim bladder significantly contributes to the amount of acoustic energy reflected from the fish. Large fish such as dhufish have high target strength and produce a stronger echo signal because they have a bigger mass, have a large swim bladder, bigger bone structure and will have large, heavy scales. Smaller fish have lower target strength because of their smaller size and structure.

Evidence suggests the swim bladder contributes probably 50 % of the acoustic energy reflected from the fish, yet the swim bladders size only contributes approximately 5% of the fish's body mass.

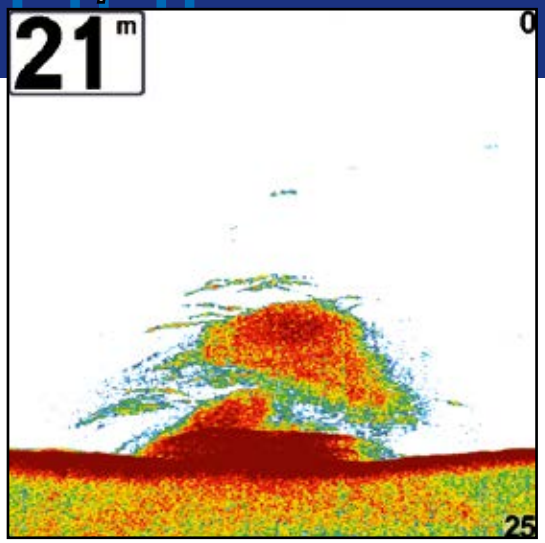
The time period a fish spends in the sound beam is determined by the speed of the boat and the fish and by the position of the fish in the beam. These all influence how the echo signal or echo signature from the fish is recorded on the display screen.

For example, the left part of figure (Two) shows how the echo signals is recorded when a boat is stopped and when it is moving. When both the boat and the fish are stationary the fish is recorded as a continuous line. When the boat is stationary and a fish swims slowly through the beam, it will be recorded as a hyperbolic shaped arch. A fish passing through the beam while the boat is traveling at a high speed will be recorded as a dot.

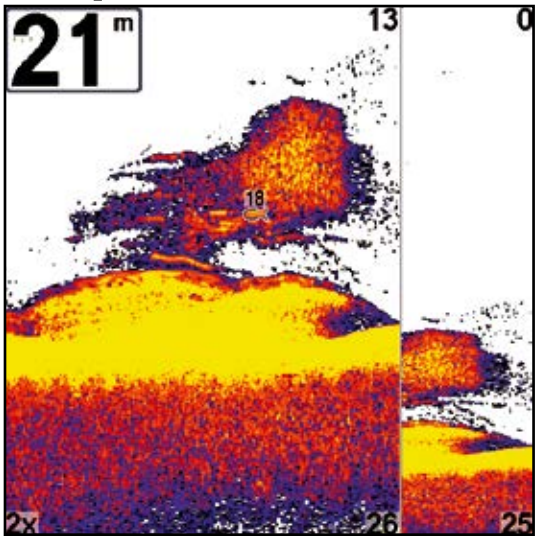




Screen capture No 1



Screen capture No 2



Since the maximum intensity of the sound waves is concentrated in the centre of the beam as shown in figure (Three), fish targets detected in the beam at A will be recorded as a stronger colour than similar fish detected on the outer limits of the beam at B. Therefore, a large fish detected at the edge of the beam will be recorded as a much weaker signal than if it had been detected in the central axis of the beam

The same principles apply to fish schools detected on the outer edges of the beam, which may produce low target strength and produce a weak colour. This can fool the skipper into thinking the fish in the school are small, when in fact they may be large. To further check this out, would require the skipper of the boat to do a small grid search of the area and try to position the centre of the sound beam directly above the school. This may surprisingly increase the colour intensity and target strength of the fish and give a more realistic indication of their size. Then a clearer decision can be made to commence fishing on the location or not.

To learn more about Echo Fishing you can purchase my new book on line titled How to use an Echo Sounder /Fish-finder by going to www.howtouseafishfinder.com

I hope you will enjoy learning about echo sounding as much as I have.
John Adams
Fremantle Boat School.