

## **SOUNDINGS.....**

This short article is being titled "Soundings" in recognition of a newsletter named "*Soundings*" which was produced and promulgated by the Dominion Hydrographer's office many years ago. Coincidentally this article is about real "soundings".

It is our intention to publish, on a regular basis, this article covering a subject which we hope will stimulate interest and discussion within the hydrographic community. We invite your comments.

As co-editor of LIGHTHOUSE, I am pleased to have the opportunity to present some thoughts, which hopefully will stimulate the interest of our readers. Some of the subject matter that you will find in future editions may be new and some you may have heard discussed previously. Each article of "Soundings" will have a discussion on one issue only.

The "theme" of this article is "*What is Bottom?*".

Over the past decade I have posed this question on numerous occasions but do not recall receiving a satisfactory answer.

This question relates to depths that we show on charts and exactly what the numbers mean. We all know, or perhaps assume, that the numbers show how deep the water is at a particular location and we likely all agree that the depth is the distance from the water surface to the bottom. The number on the chart is also adjusted to the appropriate vertical datum for the area.

When we say "distance to the bottom", what exactly do we mean? What is bottom? In cases where the bottom is composed of soft material and gradually gets harder as depth increases - where are we measuring to? If you were measuring the depth with a measuring tape - where would you place the end of the tape?

There is no debate when the bottom is bedrock or some other hard bottom. The "bottom" in these cases is clear. But when the bottom of the water area is something else, like mud or other material like sawdust or grain, then where is the bottom?

Some decades ago I enjoyed Scuba diving and some of these dives were in areas with a silt bottom. My dictionary defines silt as "A sedimentary material consisting of fine mineral particles found at the bottom of bodies of water". When diving in these areas of silt you can move through the material and as you descend the material becomes more dense, and at some point you can move no further. In this case where is bottom?

Like divers, ships can also move through silt or sawdust covered bottoms but I suspect the ship operators would like to know. I'm sure that most of us have seen ships leave a mud or other coloured wake. In these cases they are quite likely moving through the silty, muddy or sawdust covered "bottom". We have heard of areas where tugs are used to dredge channels for small craft. They are obviously and literally moving the bottom. The question of "What is Bottom" becomes even more relevant.

Most hydrographers, at least those in Canada, know that over the years echo sounders have evolved and the frequency of the sound waves they emit varies considerably.

Many soundings of Canadian waters shown on charts have been collected with sounders having a frequency of 30 Khz and many have been collected with frequencies of 200 Khz. Other soundings were taken with frequencies in between the above two numbers and some at a lower or higher frequency. They are all considered valid depths - the distance from the water surface to the "bottom".

We all are aware that where the bottom is "soft" or silty, the sound waves generated by different frequencies will be reflected by a different "bottom". The high frequency will likely show the bottom as the top of the silt. The lower frequency will likely show no signs of the silt but will show a bottom that is reflected from some denser material. In many cases two bottoms will be shown. In either case, I'm not sure we know how dense the bottom is when a particular sound wave is reflected.

Hydrographers have been aware of this for many years and have even devised solutions to the problem where the depth of the high frequency sounder did not agree with the leadline. In silty waters, it is safe to assume the leadline penetrates the silt and stops at some unknown level of dense material. To resolve this concern, plates were built on the end of the leadline so it would not penetrate as far into the silt. Presumably this resulted in better agreement with the sounder depth. But we still did not know just how dense that material was or if a ship could move through it.

How does the shipping community want the bottom to be shown on charts in cases where the bottom is soft? I suspect, for a variety of valid reasons, they would like to know how deep the silt is? Can we tell them? No, I don't think we can, even in those cases where we have a sounder record with a double bottom. We don't know the hardness of either returned sound wave.

Does the era of digital or multibeam sounding systems resolve this concern? No it does not - but it may make the problem less obvious because only one bottom is recorded. However, we still don't know which bottom!

Over the years, there have been many discussions about the accuracy of soundings. We have heard concerns about water temperature, differing layers within the water column, boat squat and other factors which may affect the accuracy of depth measurements. I do not recall a great deal of discussion about the type of bottom.

Am I way off base? Have I been away too long? I invite your comments and they may be published in the next issue of our journal.

Earl Brown  
Hydrographer (retired)