

# UNDERWATER ACOUSTIC MAPPING AT BELUM-TEMENGGOR LAKE

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**SUMMARY:** This study aims to investigate lakebed characteristics of Belum –Temenggor man-made lake using underwater acoustic sonar technology. Two types of underwater acoustic sonar gears were deployed at five different locations within the lake areas; the first system measured depth and was also capable to predict lakebed cover types. The latter system was used to construct intensity image of the lakebed at a better coverage and resolution. Results indicated that both systems were capable to provide sufficient information of lakebed cover types. This information will be useful to study in details how lakebed cover types affect the distribution of other aquatic species.

**Keywords**—acoustic, sonar, underwater mapping, habitat map, lakebed types

## INTRODUCTION

Man-made lakes in Malaysia are not only important for water supply and hydro-electric energy but also formed as vital ecosystem for freshwater fish and other aquatic species. Due to these high biodiversity values, effective conservation and management plans are needed to protect endangered and threaten species [1]. One of the steps is to map the spatial distribution of sediment/cover types can later be used to infer the distribution of aquatic habitats. Assessing information underwater using conventional method such as diving is challenging and extremely difficult. To overcome this, remote approach is preferable as it is not only safe but capable to cover large areas. One of the approaches is the use of underwater acoustic sonar technology to investigate lakebed sediment property or cover types. The technology has been used widely in marine environment for mapping the seafloor depths [2], object detection [3], and lately in the field of marine habitat mapping [4] to investigate the distribution of benthic habitats. This research attempts to investigate how sonar technology can be used to study the characteristics of lakebed property such sediment or cover types as well as identifying objects.

## 2. MATERIALS AND METHODS

Belum-Temenggor Lake is the second largest lake in Peninsula Malaysia after Kenyir Lake in Terengganu, Malaysia. It was created after the construction of Temenggor Dam to generate electric power. The lake is located about 45 km from the Hulu Perak district capital, Gerik [5]. There is a man-made island, Banding Island (Pulau Banding) and Lake Temenggor Bridge on the East-West Highway which crosses the lake. Five (5) locations were chosen as our study sites (Tasik Banding, Sg. Kenarong, Sg. Papan, Sg. Ruok and Temenggor Fish Farm). The acoustic mapping campaign was completed from 22 – 25 September 2014.

In this study, acoustic sonar technique using two systems were deployed at five different locations in Belum-

Temenggor areas to explicitly investigate the physical characteristics of lakebed cover. The first approach used a single beam echo sounder to estimate lakebed cover types based on statistical classification of two important acoustic parameters (i.e. roughness and hardness). The latter technique used a side scan sonar instrument to remotely ‘taking photos’ of the lakebed surface. Classification or habitat maps were then constructed from single beam echo sounder using built-in classification technique (i.e. using two main parameters, hardness and roughness). No classification maps were produced for side scan sonar image and results were only based on feature appeared in the image.

## 3. RESULTS

Classification maps produced by single beam echo sounder listed seven (7) dominant classes of lakebed cover types; 1- gravel, 2- small stone, 3- logs and dead trees, 4- mud and fine sand, 5- coarse sand, 6- hard pack soil, and 7- silt and clay. For most of the sites, the percentage of class 1 –gravel and 7- log and dead trees were the highest as compared to other cover types.

Side scan sonar produced high resolution image of the lakebed and managed to discriminate and identify underwater trees (submerged), tracks (believed to be trace from underwater logging activities). The image from the side scan sonar has also revealed and discriminated areas located below fish farms in Temenggor.

## 4. DISCUSSION

This study demonstrated how acoustic technology can be applied to produce spatial map of sediment/cover types at Belum-Temenggor Lake. Results suggested that logs/dead trees are the dominant class because underwater logging was previously done in this region. This was shown by the highest percentage of this class in the classification maps produced by the single beam echo sounder whilst appeared in the side scan sonar image. This information will be

useful in the future to study how aquatic habitat depends on these cover types.

Although two acoustic sensors were deployed at the study sites, results from both systems still needs ground observation for validation. This is true especially for sites with deeper depth as habitat class calibration cannot simply use classes from visual inspection (i.e. in the case of single beam echo sounder). In shallow water and where water clarity is high, number of classes can be determined directly. For depth beyond this range, it is suggested that validation is made through drop or underwater video observations which will be the focus of the author's future research.

The results in this study not only important to provide existing lakebed sediment types but can also be useful to investigate how lakebed sediment change overtime. For example, any alteration in land areas or upstream will introduce lake sedimentations. Movements of sediments (i.e. sediment loads) can be a huge problem in the lake environment if it could destroy fish spawning habitats and cause loss of biodiversity [6]. Therefore details investigation and conservation program is needed if this major problem exists in this area.

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