Data Descriptor

Split-Beam Echosounder Data from Puck Bay

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Abstract

The acoustic data was collected in 2018–2019 in the Bay of Puck in the seasons: autumn, winter, spring. The data was collected during the day and night using three split-beam echosounders with frequencies of 38 kHz, 120 kHz and 333 kHz at a designated study area not far from the city of Hel, while the ship was sailing. To ensure data quality, the echosounders were calibrated and passive noise was measured.

Keywords: echosonda; puck bay; southern Baltic

https://doi.org/10.34808/x55q-sz53_dyr_roz29

Specification table (data records)

Subject area	Hydroacoustic study
More specific subject area	Hydroacoustic biological research in the Bay of Puck. Study of pelagic water
Type of data	Raw acoustic data
How the data was acquired	Using echosounder mounted on ship, while the ship was sailing and also was anchored
Data format	.RAW
Experimental factors	-
Data source location	MOST Wiedzy Open Research Catalog, Gdańsk University of Technology, Gdańsk, Poland
Data accessibility	CC-BY-NC

Background

The data were collected as part of a doctoral thesis with the goal of sonar imaging pelagic concentrations in the Gulf of Puck .

The implementation of this goal has a significant practical dimension, allowing for more precise monitoring of the ecosystem in the Bay of Puck (its external part). This will also help to understand the behaviour of organisms residing in the most isolated part of the Gulf of Gdansk in their interaction with the environment. In order to understand the functioning of such a specific area of sea as the Bay of Puck, a representative amount of data is needed covering as many days as possible for each season of the year, and taking into account all times of the day.

Methods

The research work was carried out from the R/V Oceanograf. It is a steel construction catamaran designed for interdisciplinary maritime research. The main advantage of the ship, having a significant impact on the quality of the collected data, is the DP dynamic positioning system. Thanks to this system, the ship – in combination with the precise GPS RTK positioning system – can move with high accuracy along the given measurement profiles, and also maintain a fixed position at a research site. These conditions can be met with the sea state even up to 4 on the Douglas scale, with a favourable wind direction.

Description of hydroacoustic equipment

The basic tools used in the hydroacoustic research were 3 split-beam SIMRAD EK80 echosounders by Kongsberg Maritime. These are broadband sonars with central frequencies of 38kHz, 120kHz and 333kHz. The transducers for these sonars are divided into independent working parts: three for the 38 kHz sonar and four for the other two transducers. Such a structure allows for the possibility of determining the position of scattering targets in the sonar beam and the direction of their movement (e.g. for marine organisms). This is possible because, knowing the differences in the phases of the wave scattered from the object for the individual parts of the transducer, it is possible to determine the position of the scattering target in relation to the transducer beam.

The sonars were used in "continuous wave" (CW) mode, working in one non-modulated central frequency.

Research conducted with the use of three sonar sounders with acoustic frequencies of 38 kHz, 120 kHz and 333 kHz if effective for detecting organisms, respectively greater than 6 mm, 1.9 mm and 0.7 mm. These dimensions were calculated based on the scattering target detection condition ka > 1 (Simmonds and MacLenennan, 2005). Using sonars with different frequencies also allows the frequency response of scattering objects, such as fish assemblies, to be determined. This characteristic may be useful in the classification of these objects (Simmonds and MacLenennan, 2005).

Data records

Study area

The external Puck Bay, which is part of the Gdańsk Bay in the southern part of the Baltic Sea, was selected as the research area. The research area, with dimensions of 3 km by 2 km, the central part of which is in the position described by the coordinates: 54.60° N 18.74 ° E, was located in the Gulf of Puta not far from the city of Hel. The depth in the entire area varies from 52.0 m in the eastern part to 47.0 m in the western part.

Studies of the spatial distribution of organisms during day and night hours.

Data collected during the day and night were used to determine the distribution of organisms clusters in the water. Data was collected on the go. The measuring speed varied between 4.0 and 6.6 knots.

Echosounder calibration

The main purpose of sonar calibration is to adapt it to new hydrological conditions, changing e.g. due to the change of the season or the change of the research reservoir. The basic principles of calibration described by Foote et al. (1987), are still valid today, although some practical aspects have changed. Calibrations should be performed with standard calibration balls with known target strength. The choice of the calibration ball depends on the frequency at which the sonar is working. When calibrating the sonar, the ball should be placed directly under the transducer at the appropriate depth (in the far zone of the transducer). It is important that this depth remains as constant as possible throughout the calibration process. The ball should be suspended with the thinnest possible lines so that they do not affect the echo strength the ball target. The ball should be suspended from three points located on both sides of the ship in such a way that it can be freely moved in a plane parallel to the bottom. Thanks to this, during the calibration process, it will be possible to collect data from the entire horizontal cross-section of the transducer beam by properly moving the calibration ball under it. (Demer et al., 2015)

The software that we use to control echo sounders also has a calibration module. Using the data collected during the calibration, the software updates the system of gain settings and calculates the settings with a given directional characteristic of the transducer, which affects the sonar directionality functions and the precision of measuring the backscatter volumetric force of the returning acoustic signal.

Due to the fact that the weather was not conducive to calibrating the echosounders in the study area during the cruises and due to the limited cruise time, we calibrated them in the port at the beginning of the cruise, before starting the research. We decided to calibrate in the port because it was located relatively close to the study area and the hydrological conditions at the calibration site did not differ significantly from the conditions in the study area.

Noise measurements

In addition to collecting data in active mode, i.e. the standard operating mode of the sonar (transmitting an acoustic impulse and recording a returning echo), in accordance with ICES recommendations (Simmonds and MacLennan, 2005), data was also collected during the measurement sessions in the so-called passive mode. In this mode, the transducers only recorded the signals that reached them on their own, without transmitting acoustic pulses. The surrounding noise was recorded. In passive mode, data was collected over a period of approximately 10 minutes. Then, during the subsequent data analysis, this noise was eliminated from the data collected with the sonar in active mode.

Data quality and availability

In order to ensure the highest quality of data, the sonars were calibrated, and passive noise was recorded, which can be subtracted from the raw data.

Datasets DOI:
10.34808/b7sh-rt35
10.34808/ffm6-zk97

References

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