

RINGKASAN

FAJAR ABELLINO NAHERA. Studi Kondisi Lingkungan dan Dugaan Deteksi Kebisingan Bawah Laut Menggunakan Teknologi Pasif Akustik Di Perairan Pulau Bulan, Kota Batam. Dibimbing oleh ASEP MA'MUN dan MUJIYANTO .

Perairan Pulau Bulan, Kota Batam, memiliki potensi keanekaragaman hayati yang tinggi karena terletak secara strategis di jalur pelayaran internasional dekat Selat Singapura. Namun, tingginya mobilitas transportasi maritim di kawasan ini memicu peningkatan pencemaran polusi suara bawah air (*underwater noise pollution*) yang berisiko dapat mengganggu ekosistem serta kelangsungan hidup dari mamalia laut. Penelitian ini bertujuan untuk menganalisis kondisi rona lingkungan perairan, mengidentifikasi karakteristik sinyal akustik bawah air, serta mendeteksi dugaan keberadaan mamalia laut di Pulau Bulan, Kota Batam. Pengambilan data dilakukan pada Mei 2025 di tujuh stasiun menggunakan metode non-invasif berbasis teknologi pasif akustik (*Passive Acoustic Monitoring/PAM*) dengan perangkat hydrophone SQ26-H1, yang dikombinasikan dengan analisis parameter oseanografi fisik dan kimia air. Hasil analisis menggunakan perangkat lunak Audacity menunjukkan bahwa spektrum suara bawah air di perairan Pulau Bulan didominasi oleh kebisingan latar belakang (*noise*) yang berasal dari aktivitas antropogenik berupa suara mesin kapal pelayaran, serta suara alami seperti arus laut dan gelombang. Frekuensi dominan rekaman berkisar antara 800 Hz hingga 3.200 Hz dengan nilai frekuensi maksimum mencapai kisaran 43.000 Hz hingga 47.000 Hz. Selama periode pengamatan, tidak ditemukan adanya pola frekuensi spesifik yang mengindikasikan sinyal vokalisasi atau keberadaan mamalia laut. Ketiadaan deteksi ini diduga kuat dipengaruhi oleh intensitas kebisingan kapal yang tinggi sehingga memicu efek penutupan sinyal biologis (*masking effect*), serta durasi perekaman lapangan yang relatif singkat. Penelitian ini sangat penting dalam menyediakan data dasar (*baseline data*) mengenai kondisi lingkungan akustik perairan Pulau Bulan yang krusial bagi pengembangan strategi konservasi satwa laut serta pertimbangan tata kelola wilayah pesisir Batam di masa mendatang.

Kata kunci: *ambient noise level*, kebisingan antropogenik, *masking effect*, *passive acoustic monitoring*, *underwater noise*.

SUMMARY

FAJAR ABELLINO NAHERA. Study of Environmental Conditions and Underwater Noise Detection Using Passive Acoustic Technology in the Waters of Bulan Island, Batam City. Supervised by ASEP MA'MUN and MUJIYANTO.

The waters of Bulan Island, Batam City, have high biodiversity potential due to its strategic location on an international shipping lane near the Singapore Strait. However, the high mobility of maritime transportation in this area has triggered an increase in underwater noise pollution which risks disrupting the ecosystem and the survival of marine mammals. This study aims to analyze the condition of the aquatic environment, identify the characteristics of underwater acoustic signals, and detect the suspected presence of marine mammals on Bulan Island, Batam City. Data collection was conducted in May 2025 at seven stations using a non-invasive method based on passive acoustic monitoring (PAM) technology with an SQ26-H1 hydrophone device, combined with analysis of physical and chemical oceanographic parameters of the water. The results of the analysis using Audacity software show that the underwater sound spectrum in Bulan Island waters is dominated by background noise originating from anthropogenic activities in the form of ship engines, as well as natural sounds such as ocean currents and waves. The dominant frequency of the recordings ranged from 800 Hz to 3,200 Hz with a maximum frequency value reaching 43,000 Hz to 47,000 Hz. During the observation period, no specific frequency patterns were found that indicated vocalization signals or the presence of marine mammals. This lack of detection is strongly suspected to be influenced by the high intensity of ship noise which triggered a masking effect on biological signals, as well as the relatively short duration of field recordings. This research is very important in providing baseline data on the acoustic environmental conditions of Bulan Island waters which are crucial for the development of marine wildlife conservation strategies and considerations for future management of Batam's coastal areas.

Keywords: ambient noise level, anthropogenic noise, masking effect, passive acoustic monitoring, underwater noise