Evaluation of trophic status of Deudap Beach and Lhok Reudeup Beach, Nasi Island, Aceh Province, based on nitrate and phosphate concentration, and chlorophyll-a abundance.

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Abstract. The investigation of the trophic status based on the nitrate-phosphate correlation and chlorophyll-a abundance in Deudap beach and Lhok Reudeup beach, Pulau Nasi, Aceh were carried out in November 2018. Determination of sampling location based on purposive sampling method. The total nitrate, total phosphate concentration, and chlorophyll-a abundance determined by Ultra Violet-Visible (UV-Vis) spectrophotometre which was confirmed from the real-time NOAA database. The results of the chlorophyll-a abundance analysis showed that the abundance of chlorophyll-a in the surface layer ranges 0.7 - 0.11 µg / L. Total nitrate and total phosphate concentrations at deudap beach and lhok reudeup in the surface layer ranges 260 - 183 µg / L and 9.4 - 6.8 µg / L. Furthermore, the results indicate that the phenomenon of the chlorophyll-a abundance is closely related to the availability of the macronutrient of nitrate and phosphate. Based on the correlation between total nitrate-phosphate and chlorophyll-a abundance in deudap beach and lhok reudeup, Nasi Island are included in the category of oligotrophic waters.

1. Introduction
Phytoplankton is an autotrophic aquatic organism. Phytoplankton plays an important role in waters as a primary producer in the food chain. They are microscopic in size and live floating in the waters [1]. Chlorophyll-a is one type of chlorophyll that is owned by all plants autotrophs. The chlorophyll-a pigment content in water is used to determine the number of phytoplankton. Phytoplankton fis a
decoder inorganic into organic substances through photosynthesis and can be used to determine the productivity of water. High amounts of chlorophyll-a will support the lives of all biota in the waters.

Chlorophyll-a concentration is strongly influenced by nutrients, DO, and pH. Lack of nitrogen, magnesium and iron results in chlorosis. While the elements of Mn, Cu, Zn are needed in small amounts [2][3]. Nitrate and phosphorus are very important nutrients in primary productivity as elements used by phytoplankton in the process of photosynthesis and growth and development of cell tissue. The higher the concentration of nitrate and phosphorus, the higher the presence of chlorophyll-a in phytoplankton [4][5].

The presence of Dissolved Oxygen (DO) is very necessary for every organism including phytoplankton. DO functions as cell respiration in each phytoplankton which aims to process Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The higher DO concentration in water, the BOD and COD concentrations decrease, the waters are considered not polluted. Conversely, DO concentration in waters decreases, then the concentration of BOD and COD will increase so that the waters are considered polluted [6]. The degree of acidity (pH) and nitrate have an important role in the condition of the aquatic environment. Changes in pH affect the chemical processes and biological organisms in the water. The pH concentration affects the toxicity of a chemical compound in the water. The higher the pH concentration, the higher the chlorophyll-a phytoplankton content [7].

Nasi Island is located in Aceh Besar District, Aceh Province and is the second largest island after Breuh Island which included in the Aceh Island District. The island of Nasi is in the northwest of the island of Sumatra and precisely in the Indian Ocean. Indian Ocean is known as the hottest ocean in the world due to high temperatures. Therefore, the life of marine animals is limited because phytoplankton as food sources is difficult to grow. Ecological factors determining the presence of chlorophyll-a are also determined by the chemical nature of the waters, namely the level of salinity. Water in the Indian Ocean has the lowest and the highest level of salinity, this, of course, affects the growth of vegetation in these waters. Therefore, this study aims to determine the condition of nitrate and phosphate and chlorophyll-a in the waters of the island of nasi, Aceh Besar, Aceh.

2. Materials and Methods
The study was conducted in November 2018 at two locations, namely lhok reudeup beach and deudap beach. The purposive sampling method is used to determine the location based on differences in characteristics of an area so that it can represent the ecosystem in the area [1]. Analysis of chlorophyll-a abundance was carried out in the Chemistry Laboratory, Faculty of Agriculture, Syiah Kuala University. Data on nitrate and phosphate concentrations were collected from NOAA’s real-time database. The tools and materials used were UV-Vis spectroscopy Shimadzu UV-1700, PF-11 filter meter, universal 320 Hettich centrifuge, GPS, dark bottle, vacuum pump, Whatman GF / C filter paper 42 μm, 90% filtering flask and acetone.

3. Research Procedure
Analysis of chlorophyll-a was carried out by filtering 1 L of water samples using Whatman GF / C 42 μm filter paper with the help of a vacuum pump. Filter paper containing chlorophyll-a was folded four times to become a small piece and then wrapped with aluminum foil. Chlorophyll-a samples were stored in the refrigerator at 4°C for 1 day. Then, the filter paper is crushed until it is evenly crushed with the addition of 10 mL of 90% acetone and stored in the refrigerator at 4°C for 1 hour.

Extracted samples were put into a universal 320 Hettich centrifuge at 3000 rpm for 15 minutes [7][8]. Trophic status classification refers to [7]. Analysis using Shimadzu UV-1700 UV-Vis spectroscopy was carried out to determine the abundance of chlorophyll-a with a wavelength of 665 nm, 645 nm, and 630 nm and calculated using the [9] equation, as follows:

\[
\text{Chlorophyll (mg/L)} = \frac{Ca \times Va}{V \times d}
\]
Information:

\[ V_a = \text{Volume of acetone (10 mL)} \]
\[ V = \text{Volume of filtered water sample (mL)} \]
\[ d = \text{Cuvet Diameter (1 mm)} \]
\[ C_a = (11.6 \times E_{665}) - (1.31 \times E_{645}) - (0.14 \times E_{630}) \]
\[ E = \text{Absorbance at different wavelengths (corrected with a wavelength of 750 nm)} \]

### Table 1. Classification of trophic status

| Trophic Status | Oligotrophic | Mesotrophic | Eutrophic | Hypertrophic |
|----------------|--------------|-------------|-----------|-------------|
| Chl-a (µg/L)   | < 3          | 3 – 7       | 7 – 40    | > 40        |
| TN (µg/L)      | < 400        | 400 – 600   | 600 – 1500| > 1500      |
| TP (µg/L)      | < 15         | 15 – 25     | 25 – 100  | > 100       |

### 4. Results and Discussion

The results of the analysis of chlorophyll-a abundance at Deudap beach and lhok reudup, nasi island, Aceh Province showed relatively similar values. The abundance of chlorophyll-a in the surface layer ranges from 0.7 - 0.11 µg / L. The total nitrate and total phosphate concentrations at the port coast and lhok reudup ranged from 260 - 183 µg / L and 9.4 - 6.8 µg / L. The highest concentration of chlorophyll-a 0.7498 µg / L is found at station 1 while the lowest concentration is 0.1174 µg / L at station 2. Determination of trophic status at deudap beach and lhok reudup is based on total nitrate concentration, total phosphate, and total chlorophyll-a. The results show that the total nitrate, phosphate, and chlorophyll-a concentrations at deudap beach and lhok reudup are included in the oligotrophic category [10,11,12,13].

### Table 2. Chlorophyll content and physical-chemical parameters of the deudap beach and lhok reudup, Nasi island, Aceh Besar

| Station | Total Nitrate (µg/L) | Total Phosphate (µg/L) | Chlorophyll-a (µg/L) |
|---------|----------------------|------------------------|----------------------|
| 1       | 260                  | 9.4                    | 0.75                 |
| 2       | 183                  | 6.8                    | 0.12                 |

The known nitrate content in Pulo Aceh waters is 260 µg / L and 183 µg / L due to the diffusion that occurs in sediments containing nitrate. The total nitrate value <400 µg / L belongs to the oligotrophic category. The nitrate content in water is closely related to the chlorophyll-a abundance because nitrate is one of the limiting elements in the growth of phytoplankton.
Phosphate content is known to be 9.4 µg / L and 6.8 µg / L, the content lower than nitrate proves that nitrate has a greater influence on the abundance of phytoplankton. The total phosphate content of <15 µg / L is included in the oligotrophic category. The content of nitrate and phosphate in the water is influenced by the movement of water masses, water currents, and waste contained in the waters [14]. The low content of nitrate and phosphate in Pulo Aceh waters is related to the low phytoplankton in the waters so that the abundance of chlorophyll-a which is 0.75 µg / L and 0.12 µg / L are relatively low. Based on the total nitrate and total phosphate concentrations included in the oligotrophic category, it is certain that trophic status based on chlorophyll-a abundance indicators is also included in the oligotrophic category, because the abundance of chlorophyll-a is affected by total nitrate and total phosphate concentrations.

This is evidenced by the results of the abundance of chlorophyll-a of 0.75 µg / L on the Deudap Beach and 0.12 µg / L on the Reudup coast. Both of these results indicate the coast with an abundance.
of chlorophyll-a <3 and that value is included in the oligotrophic category. These results indicate that Pulo Aceh waters include waters with low fertility rates. The low level of fertility in the waters is also evidenced by the small number of fish that live in these waters and the abundance of waste around the waters [15].

5. Conclusions
The results showed an abundance of chlorophyll-a ranged between 0.7 and 0.11 µg / L with the highest abundance at station 1, namely at the seashore with concentrations of 0.7498 µg / L and the lowest abundance at station 2 namely at the coast of Reudup with a concentration of 0.1174 µg / L. The largest concentration of phosphate elements is at Deudap Beach which is 9.4 µg / L and on the Reudup coast which is 6.8 µg / L. The biggest nitrate nutrient concentration is at Deudap Beach, which is 260 µg / L while at the coast of Reudup it is 183 µg / L. Based on trophic status categories, at Deudap Beach and Lhok Reudup, Pulau Nasi, the Province of Aceh belongs to the oligotrophic category.

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