



**Ministry of Education  
Al Wusta Governorate  
Soqara Basic Education School (Grades 1-10)**

**Research titled:  
"The Effect of Water Temperature and Tides on Brown  
Algae Growth on the Coasts of Al Jazer"**

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### **Abstract**

This research aims to study a natural phenomenon present on one of the coasts of the Sultanate of Oman, specifically in the Wilayat of Al Jazer. It focuses on the impact of water temperature, tidal conditions, and marine currents on the growth and density of brown algae (Sargassum) on the coasts of Wilayat of Al Jazer Al Jazer Willet in the Sultanate of Oman.

#### **Research Question:**

- What is the relationship between water temperature, tidal conditions, and the growth of brown algae on the coasts of Wilayat Al Jazer?
- To what extent do sea water temperature, tidal movements, coastal surface nature, in addition to marine currents and waves, affect the growth, distribution, drifting, and accumulation of brown algae and Sargassum, and the appearance of this phenomenon on the coasts of Wilayat Al Jazer during the period (November–January)?

Field data were collected from November 2025 to January 2026 in two coastal areas differing in surface nature (rocky and small rocks), with photographic documentation of tidal conditions and weekly temperature measurements using a thermometer, in addition to field observations and interviews with local fishermen to support scientific analysis.

The results showed that algae density was higher during high tide periods compared to low tide, and their accumulation was linked to higher temperatures in November and December, gradually decreasing with the gradual drop in temperature by late December and January. Field photos also showed differences in algae accumulation between rocky areas and areas with small rocks, with higher density in rocky areas.

These results indicate a direct relationship between sea water temperature and tidal conditions in influencing the growth of brown algae, reflecting the dynamics of the coastal environment.

This research contributes to providing reliable scientific data to understand the relationship between changing environmental factors and the coastal ecosystem, and enhances the credibility of environmental studies in the region.

### **Basic Terms:**

- **Sargassum algae:** A type of floating or bottom-attached brown algae, common in tropical regions.
- **Sea surface temperature:** The temperature of the upper layer of seawater, measured at the surface.
- **Tides:** The periodic daily change in sea level due to the gravitational pull of the moon and sun.
- **Marine currents:** Horizontal movement of ocean water resulting from various factors such as winds and density differences.
- **Coastal ecosystem:** The area between land and sea, characterized by high biodiversity and environmental diversity.

### **Research Hypothesis :**

1. Does algae density increase during high tide periods compared to low tide, and does this effect increase with rising water temperature and marine current movement?

### **Research Questions:**

1. What are the reasons leading to the proliferation of Sargassum algae on sandy and rocky beaches, hindering fishing activities and the general appearance of the beaches?
2. What external factors affect the spread of brown algae and Sargassum in areas with high tides and their recession during low tides on these coasts?
3. To what extent do sea water temperature, tidal movements, coastal surface nature, in addition to marine currents and waves, affect the growth, distribution, drifting, and accumulation of brown algae and Sargassum, and the appearance of this phenomenon on the coasts of Al Jazer Wilayat during the period (November–January)?

### **Introduction and Literature Review :**

Brown algae, especially Sargassum, are essential components of the coastal ecosystem, playing a vital role in oxygen production and supporting food chains. They also serve as a sensitive environmental indicator for changes in water temperature and surrounding conditions. On the coasts of Al Jazer Wilayat, unusual accumulation of these algae was observed on sandy and rocky beaches during the winter period (November–January), distorting the aesthetic view, potentially hindering fishing activities, and emitting unpleasant odors upon decomposition.

The importance of this research lies in combining systematic scientific monitoring using GLOBE protocols with local knowledge from fishermen to study the interaction of key factors causing this phenomenon: water temperature, tidal movements, and coastal nature. The research presents a practical model for sustainable environmental monitoring, contributing to understanding the dynamics of Omani coasts and supporting efforts to manage and protect natural resources. Its results directly concern the local community, helping explain a phenomenon affecting fishermen's livelihoods and the attractiveness of tourist beaches, while enhancing environmental awareness among community members.

### **Research Objectives:**

1. Measure the relationship between changes in sea surface temperature and the apparent growth of Sargassum algae.
2. Analyze the impact of tidal states on algae distribution and movement between different coastal areas.
3. Interpret the seasonal drifting and accumulation of algae and link it to environmental factors (temperature, tides, coastal nature).
4. Integrate local fishermen's knowledge to understand algae transport mechanisms via currents and waves.
5. Provide a simplified environmental monitoring model according to "GLOBE" standards for tracking coastal ecosystem health.

### **Limitations of the Study**

This study was limited to a specific time period from November to January and only two sites on the coasts of Wilayat Al Jazer. It relied on observation and photographic documentation without precise quantitative measurement of algae quantities, which may affect the generalizability of results. Nevertheless, the findings provide an important practical indicator that can be built upon in future studies.

## Research Methods

### 1. Research Methodology

The research followed this systematic plan:

- Identification of the research problem through preliminary observation of algae accumulation on the wilaya's beaches.
- Collection of sufficient information from available books, the internet, and the learning resources center.
- Development of the research plan and timeline for implementing research procedures.
- Field planning and selection of study sites.
- Selection of the work team and role distribution.
- Field implementation: periodic visits and application of water, soil, and atmosphere protocols, with measurements (water temperature, PH, conductivity, transparency and salinity percentage).
- Collection of qualitative data: interviews with fishermen.
- Data analysis and extraction of results.
- Documentation and formulation of recommendations.

### Timeline Table and Proposed timeline for research (Table 1)

Month	Main Activity
October	Selection of research topic
November	Collection of information related to the research
December and January	Field visits to the research site and other sites and implementation of water protocol
January	Extraction and writing of results and recommendations
February	Review of the research and final output
February	Design of research poster
1- March	Submission of research

## Study Site

The field study was conducted at two different sites on the coasts of Al Jazer Wilayat, Sultanate of Oman, to compare the impact of surface nature along with water temperature and tidal movement on the growth and density of brown algae and Sargassum.

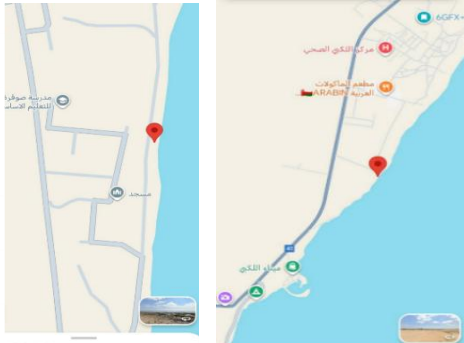


Wilayat Al Jazer is located approximately between latitudes  $18^{\circ}40'$  to  $19^{\circ}50'$  N and longitudes  $56^{\circ}10'$  to  $57^{\circ}30'$  E, and is directly influenced by currents of the Arabian Sea.

Observation points were determined using GPS for accuracy and future repeatability. The first observation point (rocky area) is at coordinates: longitude 56.5491740, latitude 18.1526690.

The second observation point (coastal area with surface rocks) is at coordinates: longitude 56.5522270, latitude 18.2011280.

These points were adopted as fixed observation points throughout the study period.



The first site is a clearly defined rocky area with stable exposed rocks during low tide, allowing algae to attach and grow directly



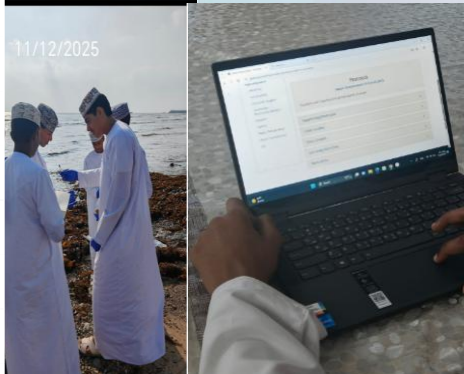
The second site is a coastal area with surface rocks that become more visible during low tide and less so during high tide due to submersion, making it a transitional environment between sandy and rocky surfaces.

### Tools for Collecting Quantitative Data



Using the water protocol application and tools such as (water temperature measurement, water transparency, water conductivity, pH),

GPS device for fixing observation points, mobile phone camera for documenting field conditions, and recording tables for data entry.



### Data Collection Methodology:

Water temperature was measured at the same time as possible during each field visit.

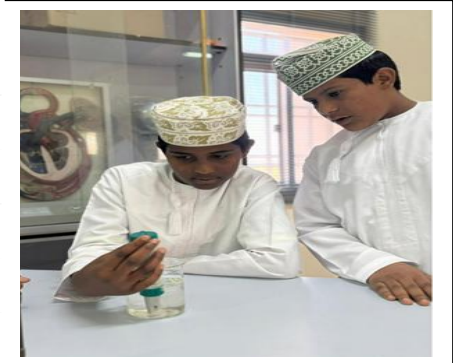
Tide conditions were recorded during the measurement.



Algal blooms were photographed to document density and distribution changes.

Local fishermen were interviewed, and tidal conditions were monitored.

Any unusual phenomena, such as stagnation, decay, or odors, were documented.



## Data Analysis Methodology:

Data was organized into time tables.

Graphs were created to illustrate temperature changes over time.

Photographs were analyzed in relation to tidal conditions.

Algal density was compared between different locations and under varying tidal conditions.

The relationship between temperature and changes in the spatial distribution of algal blooms was analyzed.

Qualitative observations from the interviews were combined to interpret the results.

## Safety Procedures:

Wear appropriate footwear for rocky areas.

Avoid slippery areas during high tide.

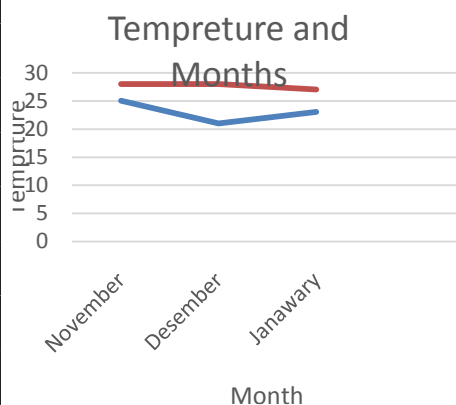
Work in teams and avoid going to the site alone.

Compliance with environmental safety guidelines.

## Results

### 1. Rocky Area Results

Field photographs taken regularly during the study period showed that the rocky area is a suitable environment for the growth of brown algae and Sargassum, as

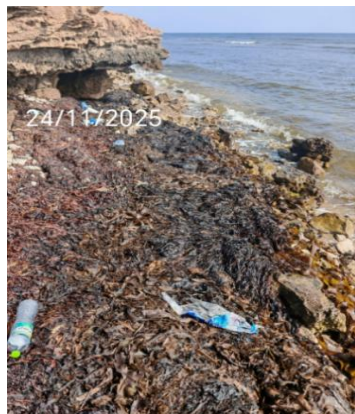


algae were observed to adhere strongly to rocky surfaces during both high and low tides.

During high tide, algae were partially submerged, remaining attached to rocks with sustained density and no significant drifting.

During low tide, algae appeared more clearly on exposed rocks, with increased visibility of algal clumps and cohesion, indicating the rocks' ability to stabilize algae and reduce the impact of water movement.

Photographs also showed the highest algae density during November and December, with a gradual decline toward the end of January.



(The Rocky area – December 16 showing clear attachment of algae to the Rocky area . This confirms that rocky surfaces are a suitable environment for the growth of algae compared to sandy areas with surface rocks

The Rocky area - low tide – November 24 . The image shows the exposure of coastal rocks and the accumulation of brown algae and sargassum on rocky surfaces, indicating that the tide provides a suitable environment for the emergence and growth of algae.

#### . Results of the Coastal Area with Surface Rocks:

Field photographs indicated clear differences in algae behavior compared to the rocky area.

During high tide, the area with unclear rocky surface showed algae spread along the beach without strong attachment, with potential movement by waves.

During low tide, water levels dropped, exposing some small rocks, and algae accumulated on the sandy surface in varying-sized clumps, with signs of drying and partial decomposition, plus decomposition odors in some locations.

Coastal area with surface rocks – high tide – December 16 showing submersion of shore with water and reduced visibility of rocks on surface; this reflects the effect of the tide in reducing the visibility of algae and redistributing them.



The coastal area with surface rocks - the low state of tide - dated December 30th. The image shows a relative decrease in algae density compared to the beginning of the season, indicating the beginning of the seasonal decline in algae growth.

### **3. Comparison Between the Two Areas**

The results showed that:

The rocky area retains algae more due to the hardness and stability of the surface.

The coastal area with surface rocks has less ability to stabilize algae, making it more prone to drifting and redistribution by tides and currents.

Low tide shows accumulation more clearly in both sites, while visibility decreases during high tide due to submersion.

Through analysis of field photographs from the two study points during November to December under high and low tide conditions, important environmental changes were observed.

During high tide, water covers most of the beach, reducing visibility of coastal rocks and submerging a large part of the algae. During low tide, water recedes, rocks become clearer, with accumulation of brown algae and Sargassum on rocky surfaces and along the beach.

There was a clear difference between the two sites: the rocky area is more suitable for algae growth due to surface stability and moisture retention, while in the sandy area with surface rocks, algae accumulate temporarily due to wave and current movement.

Chronologically, algae density was highest in November and December, beginning to decline gradually toward the end of January, indicating this period as the local peak for algae spread in the area.



## Interviews

Within the framework of our GLOBE competition project on the impact of temperatures on the growth and quantity of brown algae and Sargassum on the coasts of Wilayat Al Jazer, we conducted direct and semi-structured interviews with a sample of local fishermen and community members. The aim was to document their realistic observations and experiences regarding changes in algae patterns and quantities, linking them to observed changes in sea water warmth over the years.

We also conducted a field visit to the Department of Agricultural, Fisheries, and Water Resources in the Ministry of Agriculture, Fisheries, and Water Resources, discussing access to coastal temperature data, previous related studies, and official monitoring efforts. This visit strengthened our scientific and administrative understanding and enriched the research with an official perspective complementing our field observations.

## Discussion

The study results indicate that coastal surface type plays a major role in determining the quantity and stability of brown algae. Rocky surfaces in the rocky area provide a suitable environment for attachment and longer stability, while stability is lower in sandy coastal areas with unclear rocks.

The results confirm that Tidal movement directly affects algae distribution: low tide exposes algae and causes temporary accumulation on the beach, while high tide remobilizes and transports them with marine currents.

The recorded peak timing in November and December aligns with a relative decrease in temperatures compared to summer, supporting the hypothesis that seasonal temperature changes, along with marine currents, contribute to increased Sargassum spread on coasts.

Field interviews with local fishermen supported these results, noting that increased accumulation is linked to changes in current direction, water cooling during this period, and wave movement. Documentary photographs confirm that high algae density coincides with temperature stability and water movement, reinforcing the research hypothesis.

The results also highlight the environmental and economic impact of algae accumulation, as decomposition causes undesirable odors, distorts beach appearance, and may affect fishing and local tourism.

The findings indicate that tidal movement plays a fundamental role in controlling the distribution of marine algae on beaches: low tide exposes rocky surfaces, allowing algae exposure to light and air, supporting growth and fixation on rocks, while high tide submerges algae and redistributes them via water currents.

These results align with NOAA studies (2022), which explained that rising water temperature within the natural range enhances algae biological activity, while sudden drops slow growth. Lobban and Harrison (2019) noted that brown algae have an optimal thermal range allowing increased photosynthetic efficiency and cell division. Reports from the Ministry of Agriculture, Fisheries, and Water Resources (2023) support this by confirming the impact of seasonal changes on Omani coastal biodiversity.

Data were collected according to GLOBE Program guidelines (2023), enhancing measurement reliability and result accuracy.

## **Conclusion**

The study concluded that sea water temperature is a major influencing factor on the growth and density of brown algae (Sargassum) on the coasts of Wilayat Al Jazer, with growth increasing at moderate and warm temperatures and decreasing with cooling. The results revealed a clear seasonal pattern reflecting the direct relationship between thermal change and biological distribution of algae. The study highlights the importance of monitoring coastal climatic variables and their role in maintaining marine ecological balance, contributing to local environmental databases under the GLOBE Program.

## **Recommendations**

1. Utilize accumulated brown algae on beaches for producing natural organic fertilizer after treatment and drying, due to its nutrient content (e.g., potassium and trace elements), reducing reliance on chemical fertilizers.
2. Encourage experimental school or community projects to convert algae into organic fertilizer for local agriculture and school gardens.
3. Continue seasonal monitoring of brown algae, linking density to temperature and marine currents to improve prediction of peak periods.
4. Organize periodic coastal cleanup campaigns in cooperation with the local community to benefit from collected algae instead of random disposal.
5. Enhance environmental awareness regarding the importance of managing natural resources and converting natural waste into beneficial products.

## **Thanks and Appreciation**

To everyone who contributed to the research, with special thanks to the school principal, Miss. Samta

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