**Feature Weight**

**Dissolved Oxygen (mg/L):** +5.0

**pH:** +3.5

**Temperature (°C):** -0.4

**Ammonia Nitrogen (mg/L):** -4.3

**Phosphate (mg/L):** -3.6

**Nitrate (mg/L):** -3.0

**Turbidity (NTU):** -2.6

**Biological Oxygen Demand (BOD) (mg/L):** -3.5

**Threshold Value**

**Dissolved Oxygen (mg/L):** (5.0, 9.0)

**pH:** (6.5, 8.5)

**Temperature (°C):** (22.0, 30.0)

**Ammonia Nitrogen (mg/L):** (0.0, 1.5)

**Phosphate (mg/L):** (0.0, 0.1)

**Nitrate (mg/L):** (0.0, 10.0)

**Turbidity (NTU):** (0.0, 5.0)

**Biological Oxygen Demand (BOD) (mg/L):** (0.0, 3.0)

**Why These Features Were Chosen for Threshold Calculation?**

The features selected for computing the **Quality Index** are directly related to **water quality and coral growth**. Each feature was chosen based on its impact on coral health, considering scientific research and environmental factors.

**Feature Selection and Weight Explanation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **Weight** | **Reason for Selection** | **Impact on Quality Index** |
| **Dissolved Oxygen (mg/L)** | **+5.0** | Corals need high oxygen levels for respiration. More dissolved oxygen improves water quality. | **Higher is better (Positive impact).** |
| **pH** | **+3.5** | Corals thrive in a slightly alkaline pH (7.8-8.4). A stable pH is crucial. | **Balanced is better (Positive impact).** |
| **Temperature (°C)** | **-0.4** | Extreme temperature changes cause coral bleaching. | **Moderate temperatures are best (Negative impact for high temperatures).** |
| **Ammonia Nitrogen (mg/L)** | **-4.3** | Excess ammonia is toxic to marine life. | **Lower is better (Negative impact).** |
| **Phosphate (mg/L)** | **-3.6** | High phosphate levels promote algal blooms, suffocating corals. | **Lower is better (Negative impact).** |
| **Nitrate (mg/L)** | **-3.0** | Excessive nitrate leads to eutrophication, reducing water quality. | **Lower is better (Negative impact).** |
| **Turbidity (NTU)** | **-2.6** | High turbidity reduces sunlight penetration, affecting coral photosynthesis. | **Lower is better (Negative impact).** |
| **Biological Oxygen Demand (BOD) (mg/L)** | **-3.5** | High BOD indicates pollution and oxygen depletion, harmful to marine life. | **Lower is better (Negative impact).** |

**Why These Specific Weight Values?**

* The weight values reflect **how strongly each factor influences coral growth**.
* **Higher positive values** (like **+5.0** for Dissolved Oxygen) indicate a **greater benefit** to coral health.
* **Higher negative values** (like **-4.3** for Ammonia Nitrogen) indicate a **stronger harmful effect**.
* **Temperature has a small negative weight (-0.4)** because corals can tolerate small fluctuations, but extreme changes are harmful.
* The weights were fine-tuned to **balance** the **number of suitable samples** and maintain **realistic ecological impacts**.