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"Two Shades of Marine Life"

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ABSTRACT:

Background: Macroalgae, commonly referred to as seaweed, are a diverse group of multicellular photosynthetic organisms that are distributed throughout marine environments across the globe. They are typically classified into three taxonomic groups based on their chemical structure and pigmentation, which include brown algae (Ochrophyta), green algae (Chlorophyta), and red algae (Rhodophyta).

However, marine microalgae produce harmful toxins that can cause various syndromes such as shellfish and fish poisonings. These Harmful Algal Blooms (HABs) have increased in frequency, severity, and range, posing significant health risks to those who consume contaminated seafood. HABs are a result of anthropogenic activities and climate change that affect marine planktonic systems.

Human health is seriously threatened by marine biotoxins. However, the toxicity mechanism of a few of them is still unknown, primarily because there is little pure material available for toxicity testing. Legal restrictions for numerous toxin groups have been established and put into effect, reducing consumer exposure to acutely hazardous amounts. Other than oral intoxication pathways should be taken into account, and new toxins may need regulatory limitations. However, in order to reevaluate risk assessment and strengthen protection plans, more epidemiological data must be collected soon utilizing strict, methodical techniques.

It is important to look into the amounts and combinations of biotoxins to which consumers may be exposed, as well as the toxicological effects of these toxin combinations

Conclusion*:*

It's crucial to be aware of the potential health risks associated with consuming seaweed, including toxic contaminants and excessive iodine content.

Keywords: marine toxins, Harmful algal blooms, poisoning, toxic marine creatures.

Introduction:

The ocean ecosystem is an incredibly diverse collection of organisms that have enormous potential for developing functional foods for the health market. These organisms, including marine microorganisms, sponges, algae, crustaceans, mollusks, and fish species, can be directly used or processed to obtain different health benefits for humans. (1)

Lipids and proteins are bio-molecular components that can be extracted on a large scale using modern biotechnological approaches. These components are ideal drug candidates for the pharmaceutical industry or as functional food ingredients for the food industry. High throughput molecular biological technology has significantly improved the identification, mining, and extraction of molecular components from marine bio-resources. (1)

It is crucial to note that marine algal toxins pose a significant threat to human health and can cause a wide range of illnesses when consumed through seafood or inhaled as aerosolized toxins. Shockingly, in the US, one in five foodborne disease outbreaks is linked to seafood consumption, with half of them attributed to naturally occurring algal toxins. Therefore, the proper identification and management of these toxins are essential to ensure the safety of seafood consumption and public health. (2)

Globally, over 60,000 intoxication incidents per year are caused by these toxins, resulting in a mortality rate of 1.5%. Moreover, marine mammals, birds, and other animals that rely on fish and shellfish as their primary food source are at high risk due to the widespread die-offs caused by these toxins. While the acute health effects of algal toxins are well-established, the chronic effects of prolonged exposure to low levels of these toxins are not fully understood and are a growing concern for the environment it is crucial to discuss global issues as they have a significant impact on the world. Through constructive discussions, we can develop solutions that benefit not only one country but the entire planet. We must approach these discussions with confidence and a willingness to take action to ensure a brighter future for all issues. (3)

Ciguatera Fish Poisoning

Eating reef fish tainted with maitotoxin or ciguatoxin can result in poisoning. The organism (dinoflagellate)

Gambierdiscus toxins, which develop near coral reefs, is the source of these toxins. Fish that consume plants swallow such dinoflagellates. As the toxins ascend the marine food chain reaches carnivorous fish and eventually people. Fish heads, intestines, and liver contain the majority of ciguatoxins. It accounts for approximately 20% of all fish poisoning. [4]

Due to climate change, coral reefs are degrading, and this increases the risk of ciguatera poisoning. This poisoning is commonly found in tropical and subtropical waters, particularly in the Pacific, Indian, and Caribbean seas, often between 35°N and 35°S in latitude. Some of the types of fish that can cause ciguatera poisoning include amberjack, barracuda, grouper, moray eel, sea bass, and sturgeon. Even red snapper, surgeonfish, and parrotfish have the potential to be dangerous. [5]

Symptoms of ciguatera poisoning can take up to 30 hours to appear and can cause gastrointestinal, neurological, neuropsychiatric, and cardiovascular problems.

The initial symptoms usually show up between 3–6 hours after consuming contaminated seafood and can include lethargy, general malaise, insomnia, along with bradycardia, heart block, or hypotension. Gastrointestinal symptoms such as abdominal discomfort, nausea, vomiting, and diarrhea can also occur. Neurological symptoms can include paresthesia, itching, sweating, impaired vision, and cold allodynia.t can cause ciguatera poisoning include amberjack, barracuda, grouper, moray eel, sea bass, and sturgeon. Red snapper, surgeonfish, and parrotfish can potentially be dangerous. [5]

Signs and symptoms of ciguatera poisoning can be delayed up to 30 hours and result in gastrointestinal, neurological, neuropsychiatric, and cardiovascular problems. The initial symptoms, which include lethargy, general malaise, and insomnia along with bradycardia, heart block, or hypotension, appear 3–6 hours after consuming contaminated seafood. Abdominal discomfort, nausea, vomiting, and diarrhea are examples of gastrointestinal symptoms. Some of the neurological symptoms of poisoning include paresthesia, itching, sweating, impaired vision, and cold allodynia. [6]

Travelers should avoid eating reef fish, especially those that weigh more than five pounds and should never eat high-risk fish like barracuda or moray eels. They should also avoid eating the fish's head, intestines, liver, or roe, as these organs contain concentrated

ciguatera toxins, which are not affected by cooking, canning, freezing, pickling, salting, smoking, or gastric acid. [7]

There isn't a known remedy for ciguatoxin poisoning. Treatments for symptoms include amitriptyline for persistent itching and paresthesia, fluoxetine for persistent fatigue, gabapentin or pregabalin for neuropathic pain, and acetaminophen or nifedipine for headaches. Uncontrolled trials have shown that intravenous mannitol can lessen the intensity of neurologic symptoms, especially if it is administered to hemodynamically stable, well-hydrated patients within 48 hours after the onset of symptoms. [8]

Scombroid (Histamine) fish poisoning

Histamine poisoning from eating fish that has high histamine content is caused by bacteria converting histidine to histamine; this process can be slowed down by freezing or refrigerating the fish. ish was the only food associated with the illness with an attack rate of **73.8**% ($p < 0.001$). [8]

Fish that are commonly linked to scombroids include amberjack, anchovies, bluefish, herring, mackerel, mahi mahi (dolphin fish), marlin, sardines, and tuna because their meat has a high histidine content. Certain scombrotoxins, like histamine, are not affected by freezing, smoking, canning, or boiling. [9]

An acute allergic reaction typically manifests itself 10–60 minutes after consuming infected seafood. Abdominal cramps and diarrhea, dizziness, facial and upper body flushing, intense headaches, itching, and palpitations are among the symptoms that typically go away in 12 hours but can sometimes linger up to 48 hours. Seldom can malignant arrhythmias, hypotension necessitating hospitalization.[9]

Once caught, it is important to quickly chill fish using ice, cold brine or seawater, or mechanical refrigeration. Within four hours, the temperature of the fish should be decreased to below 15°C, preferably below 10°C. Contaminated fish usually has a distinct appearance, smell, and flavor and may taste peppery, harsh, or salty. If a person experiences scombroid toxicity, it can be treated with antihistamines, typically H1-receptor

antagonists, although H2-receptor antagonists may also be helpful.receptor antagonists may also be helpful. [10]

Shellfish Poisoning

A variety of poisoning symptoms can be caused by the toxins carried by crustaceans (such as Dungeness crab, lobster, and shrimp), filter-feeding bivalve mollusks (such as clams, cockles, mussels, oysters, and scallops), and gastropod mollusks (such as abalone, moon snails, and whelks). Shellfish consume and concentrate tiny creatures called dinoflagellates, which are the source of toxins. [11]

When a person consumes poisonous shellfish, symptoms of gastrointestinal and neurological illnesses of variable severity usually start to show up 30 to 60 minutes later, though they can take several hours to manifest. Usually made by exclusion, the diagnosis is based on a patient's history of consuming contaminated fish. [12]

Amnesic Shellfish Poisoning

Amnesic shellfish poisoning (ASP) is an uncommon type of shellfish poisoning caused by diatoms of the Pseudonitzchia spp. that are contaminated with domoic acid. There have been documented outbreaks in the Pacific, Europe, and the Americas. Scallops, mussels, razor clams, and other crustaceans are among the shellfish that could be involved. [13]

Within 24 hours of consuming poisonous shellfish, symptoms of the gastrointestinal tract (such as nausea, vomiting, and diarrhea) appear. These are frequently followed by headaches, memory loss, and cognitive decline, which go away in a few hours to days. Severe cases have also been recorded to include other symptoms such as hypotension, arrhythmias, ophthalmoplegia, coma, and death. Severe anterograde short-term memory loss may be present in survivors. Three deceased patients had hippocampal necrosis found

during autopsy. overall, PSP had **68% incidence** (37% in the SW and 31% in SS) while ASP had 31% (26% in the SW and 5% in SS). [14]

Diarrheic Shellfish Poisoning

The consumption of bivalve mollusks (such as mussels and scallops) infected with toxins (such as okadaic acid) can lead to diarrheal shellfish poisoning (DSP). There have been documented outbreaks in Europe, Asia, and the Americas. Within two hours of ingestion, symptoms such as diarrhea, nausea, vomiting, chills, and abdominal discomfort normally go away in two to three days. [15]

Paralytic Shellfish Poisoning

The most prevalent and dangerous type of shellfish poisoning brought on by consuming saxitoxins-contaminated seafood. Different dinoflagellates create these powerful neurotoxins. When people eat bivalve mollusks, such as mussels, clams, oysters, and scallops, and they ingest toxic dinoflagellates, it can cause paralytic shellfish poisoning (PSP). However, no cases of paralytic shellfish poisoning have been reported in Ontario since the disease became reportable in 2013. [16]

PSP is found all over the planet, although it is most prevalent in the temperate waters off the shores of Alaska and the Atlantic and Pacific in North America. Other nations in Asia, Europe, and the Pacific, in addition to nations in the Americas. Numbness and tingling in the face, lips, tongue, arms, and legs are among the symptoms that develop 30 to 60 minutes after consuming deadly shellfish. Patients may also experience nausea, headaches, and diarrhea. Large toxin dosages that result in ataxia, dysphagia, flaccid paralysis, altered mental status, and respiratory failure are linked to severe instances. [17]

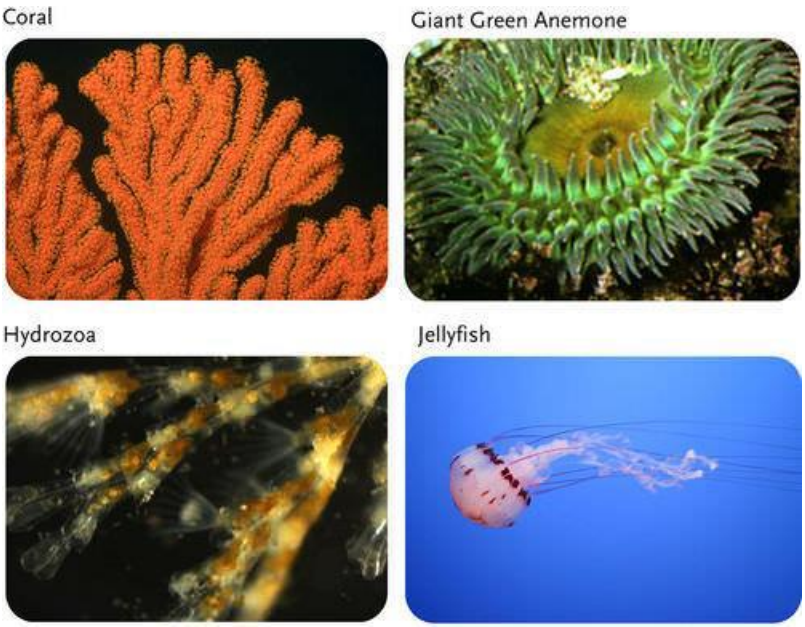
Although there isn't a known cure for PSP, breathing support is given when paralysis develops. Avoiding potentially contaminated shellfish is the best way to prevent poisoning, especially in areas during or soon after algal blooms, which are locally known as "red tides" or "brown tides." Shellfish also carries a very high risk for bacterial and viral infections, including Salmonella, Shigella, Vibrio parahaemolyticus, and V. vulnificus. In severe situations, mechanical breathing may be necessary in addition to symptomatic and supportive treatment. [18]

Neurotoxic Shellfish Poisoning (NSP)

Often referred to as breve toxic shellfish poisoning, or BSP, is a condition brought on by consuming shellfish tainted with Gymnatorium breve, a red tide bacterium. Red tides produce wind and waves that can cause respiratory irritation due to the irritating aerosols they emit. Muscle aches, gastrointestinal problems, dizziness, and tingling and numbness in the lips, tongue, throat, and surrounding area of the mouth are all examples of the symptoms. Usually, the intoxication wears off in a few hours or days and is not fatal. Regretfully, there isn't a remedy for this yet. [19]

Puffer Fish Poisoning (PFP)

The substance that is causing this poisoning is called tetrodotoxin. Poisonous puffer fish have varying degrees of toxicity. The first tingling and numbness of the lips, tongue, and fingers, which can proceed to the paralysis of the limbs, the symptoms like those of paralytic shellfish poisoning. Additional signs and symptoms could be ataxia, trouble speaking, and finally respiratory paralysis-related death. [20]



Nausea and vomiting are the initial symptoms of poisoning. For tetrodotoxin, supportive care is the primary form of treatment as there is no recognized counteragent. The fatality rate for food poisoning due to pufferfish

for the last 10 years (from 2006 to 2015) is 2.8%

The risk of intoxication has not been eradicated by the distribution, preparation, and sale of puffer fish as food, even with strict public health rules and qualified, trained puffer cooks. It can be found in Egypt's Red Sea. [18].

Bristle worms

Marine worms with segments that slide over sponges, cling to coral, and creep beneath rocks are called bristle worms. Every worm segment has parapodia for propulsion, from which numerous setae, which resemble silk or bristles and stand upright when in contact, protrude. [18]

These are like tiny cactus spines in that they can be readily separated and pierce human skin. Bristle worm stings, like those from Hermodice Carunculate, are mostly found in Floridian and Caribbean waters. Necrosis is uncommon after contact with bristle worms; instead, severe skin irritation is typically followed by a reddish urticarial rash. Severe localized soft-tissue edema and excruciating itching may occur after several stings. [21]

mollusk

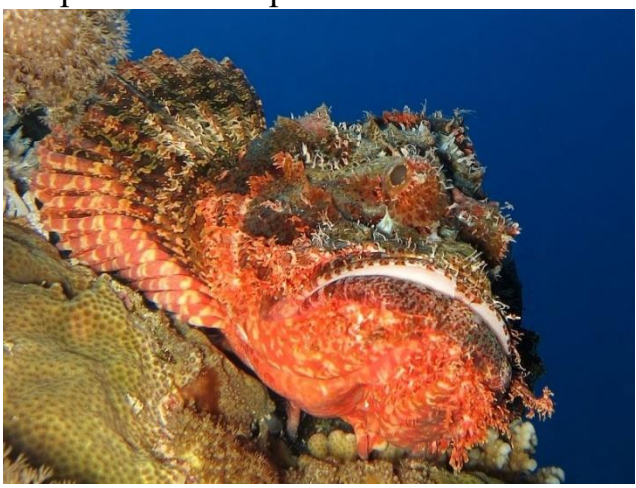
Unsegmented invertebrates, mollusks secrete calcareous shells in large numbers. Some cone-shaped seashells found in Indo-Pacific waters are equipped with an advanced venom system that may inject powerful toxins into those who encounter them. [22]

The venom affects neuromuscular transmission like curare. When their tentacles are extended, the Australian blue-ringed octopus (Octopus maculosus) and spotted octopus (O. lunulate) seldom grow longer than 20 cm. They are carrying a toxin that is at least partially like tetrodotoxin, which inhibits the conduction of impulses through peripheral nerves. The salivary glands produce venom, which is then expelled by a strong beak. [23]

Cone-shell stings are similar to those of the Hymenoptera and are frequently linked to peripheral and perioral paresthesia, which can occasionally be followed by hypotension and respiratory failure. One or two mild punctures are caused by a paralytic octopus bite, which is quickly followed by paralysis. A summary of the hazardous animals you can come into while diving or snorkeling in the Red Sea's Egyptian portion. [24]

Scorpionfish

Both temperate and tropical oceans are home to scorpionfish. Scorpionfish can mix in with coral, rocks, and seaweed because to their exceptional camouflage abilities provided by their form and color. The two pelvic, three anal, and twelve to thirteen dorsal spines—all of which include venom glands protected by an integumentary sheath. [25]



They are frequently indistinguishable from stones and lurk undetected in the surrounding reef, making them difficult to identify at first look from their food. Inimikus filamentous, often known as the Red Sea Walkman, is a species of scorpionfish. It uses three claw-like front fin rays to walk along the sandy floor. This fish, which has vivid pectoral and tail fins that extend like butterfly wings, is also extremely venomous. [26]

It is advised to submerge the injured area in hot water (between 60° and 70° for many hours) as a first aid to denature the protein component of the toxin. Take analgesics; this injury hurts a lot. There have been documented fatal cases.

Lionfish

Belong to the scorpionfish group as well. With venomous spines on its dorsal fin. To denature the protein component of the toxin, it is advised to submerge the affected area in hot water as first aid. And because it’s painful, use painkillers. [8]

Muray Eels

Moray eels are serpentine-shaped animals with mucous-covered, naked skin devoid of scales and no pectoral fins. Their anal and dorsal fins are joined and form a boundary that runs the length of their body. The massive moray can reach a length of three meters and is common in the Red Sea. In addition to not attacking people, moray eels do not have toxic teeth or spines. But their teeth are sharply bent backward, making their bite uncomfortable. (1)

Blue Spotted Stingray

Because their bodies are made of cartilage rather than bones, they are flexible. widely distributed in the Red Sea, where it defends itself with two deadly spines on its tail. Its enormous tail is covered in venomous spines as well. It is possible to come across a leopard stingray on occasion. Additionally, there is the so-called torpedo panthera, which stuns its target with an electric shock. (21)

Red Sea Sharks

In the open ocean, sharks can be observed near reefs that boat divers can access. Hammerhead, tiger, and white tip oceanic sharks are frequently sighted. Certain species may be deadly because they target sick dolphins and turtles near the surface. Whitetip sharks and other smaller sharks are typically shy. Shark attacks are rare in the Red Sea region near Egypt. (20)

Red Sea Sea Urchins

The most frequent wound suffered by sea urchins is from their spines pricking a bare foot. Sea urchins reside amid stones. It is quite impossible to remove the sea urchin from the wound with your own strength due to the extreme agony of the damage and the fragility of their spines. (26)

The body absorbs the remaining pieces of the spine throughout the three days when the discomfort lasts. As initial aid, submersion in hot water is advised. Next, use tweezers to remove the visible spines; however, proceed with caution as they are delicate and often leave portion of the wound exposed. Use over-the-counter antibiotic ointments or antiseptic solutions because there is a chance of infection afterward. [20]

Red Sea Cone Shells

Cone shells stand for the greatest risk. Living inside a conical shell is a snail. The snail hunts most of the time with its venomous barb, which is attached to its body with a long thread. Some species of cone shells have venom which is a combination of nerve toxins, including conotoxin, along with ingredients that quicken the heartbeat, ensuring a swift and lethal outcome. It is advised against gathering marine animal shells. [27]

Conclusion

Harmful algal blooms (HABs) are a global challenge that requires a broad global vision to be addressed at local levels. Much work has been done to understand HAB dynamics and mitigate their impacts. Studies and monitoring of toxic phytoplankton and biotoxins have been conducted at various levels.

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