

Effects of Japan's Nuclear Waste on Fish Cells in the Sea of Japan

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Abstract

The Sea of Japan is one of the seas that is rich in biodiversity, however, over the last few decades, the Sea of Japan has become a global concern due to the impact of the nuclear disaster that occurred in Fukushima. This disaster caused a substantial leak of nuclear waste into the marine environment, which sparked serious concerns about its effect on fish cells in these waters. This research was created to find out an in-depth understanding of the effect of nuclear waste on fish cells in the Sea of Japan, which is very important to protect the sustainability of marine ecosystems and human health. This research uses qualitative literature study methods. In collecting data, researchers detailed various sources of scientific literature which included research related to nuclear waste, radiation, and fish cell behavior. The results of this research revealed that nuclear waste has the potential to have significant influence on fish cells in the Sea of Japan.

Keywords: Nuclear Waste, Japanese Sea, Fish Cells

INTRODUCTION

The Sea of Japan is one of the most biodiverse oceans in the world, home to a wide variety of fish species that support a balanced marine ecosystem. However, over the past few decades, the Sea of Japan has become a global concern due to the impact of the nuclear disaster that occurred in Fukushima, Japan, in 2011. This disaster led to a substantial leakage of nuclear waste into the marine environment, prompting serious concerns about its effects on the fish cells residing in these waters.

Nuclear waste is radioactive material generated from nuclear reactors and related activities. After the leak at Fukushima, a number of radioactive elements such as cesium-137, cesium-134, and iodine-131 were discharged into the sea, creating significant changes in the surrounding seawater quality. Under these conditions, fish become vulnerable to radiation exposure, both through the water they breathe and the food they consume.

The importance of understanding the effects of nuclear waste on fish cells in the Sea of Japan lies not only in the health of the fish population itself, but also in the food chain and the humans who depend on the fish caught in this region. Over time, the impact of radiation on fish cells can result in genetic changes, cell damage or even death. This can disrupt the marine ecosystem and potentially affect the health of humans who consume the fish.

This study was created to find out an in-depth understanding of the effects of nuclear waste on fish cells in the Sea of Japan is essential to protect the sustainability of marine ecosystems and human health. These studies may also provide insights into

how to address the negative impacts of future nuclear incidents and improve nuclear waste management practices.

RESEARCH METHODS

This research used a qualitative method of literature study. In collecting data, the researcher detailed various sources of scientific literature that included studies related to nuclear waste, radiation, and fish cell behavior. Through analysis of the literature, this research aims to identify the effects of nuclear radiation on the health and survival of fish cells in the Japanese marine environment. The literature study method was chosen as it allows in-depth investigation of this complex issue by utilizing existing knowledge in the scientific literature.

RESULTS AND DISCUSSION

A total of 5 research articles were obtained, of which 2 were eliminated because they did not discuss nuclear waste, radiation, and fish cell behavior. The results of this study revealed that nuclear waste has a potentially significant effect on fish cells in the Japanese sea. Based on the literature study, it was found that exposure to nuclear radiation can cause damage to the DNA structure of fish cells, disrupt metabolism, and potentially reduce the survival and reproduction rate of fish in region.

DISCUSSION

A. Potential effects of Japanese nuclear waste on fish cells

The Japanese sea, an important natural resource for Japan and surrounding countries, has been the center of attention since the 2011 Fukushima nuclear disaster. The disaster led to the spillage of nuclear waste into the sea, which then triggered concerns about its impact on marine ecosystems, including on fish cells living in these waters. Some of the impacts of nuclear waste on fish cells in the ocean that have been identified and are the focus of attention are

1. Radiation Exposure: Fish living in water are exposed to potential radiation exposure from dispersed nuclear waste. Such radiation can affect the structure and function of fish cells, including their DNA. High radiation exposure can cause genetic damage to fish cells.
2. Radioisotope Accumulation: Fish tend to accumulate radioisotopes from their environment through the food and water they consume. These radioisotopes can be deposited in fish tissues, including in the meat which can then be consumed by humans.
3. Ecosystem Balance: The potential impact of nuclear waste on fish cells can also affect the balance of the marine ecosystem. If fish experience significant population or health changes, this could impact other species in the food chain and the ecosystem as a whole.

B. Nuclear waste and its impact

Nuclear waste is a type of waste generated from activities that use or utilize radioactive materials, especially in the context of nuclear reactors, uranium enrichment, nuclear research, and nuclear weapons production. Nuclear waste consists of various types of radioactive materials that can produce ionizing radiation that is potentially harmful to humans and the environment.

such as the Fukushima nuclear waste case in 2011 was the result of a substantial leak from the affected Fukushima Daiichi nuclear facility. This disaster occurred after a powerful earthquake and tsunami disrupted the nuclear facility. Nuclear waste stemming from the Fukushima disaster involves several types of radioactive material leaking into the environment. There are some key examples of this nuclear waste including:

- a. Cesium-137 (Cs-137): Cs-137 is one of the most radioactive isotopes found in the Fukushima nuclear waste. Cs-137 is particularly dangerous because it has a long half-life (about 30 years) and tends to precipitate in soil and water. Excessive exposure to Cs-137 can have adverse effects on human health and the environment.
- b. Cesium-134 (Cs-134): Cs-134 is another cesium isotope released during the Fukushima disaster. Although its half-life is shorter than Cs-137 (about 2 years), it is still potentially dangerous if accumulated in large amounts.
- Iodine-131 (I-131): I-131 is a radioactive isotope of iodine that can be used by the human thyroid gland. Overexposure to I-131 may increase the risk of thyroid disease, especially in .
- c. Strontium-90 (Sr-90): Sr-90 is an isotope of strontium that is radioactive and can contaminate soil and water. It is a heavily radioactive substance that can damage bones and bone marrow.

As described above, the nuclear waste from the Fukushima nuclear reactors contains various radioactive isotopes. These isotopes can be dissolved in seawater and easily absorbed by marine organisms, including fish. When fish consume other organisms or food in the contaminated sea, these isotopes can accumulate in their tissues.

C. Potential Impact of Nuclear Waste at Sea on Fish Cells

Nuclear waste has the potential to have a significant impact on the marine environment including on fish. Especially in Japan the impact could be even more significant as a number of nuclear waste discharges occurred as a result of the Fukushima nuclear disaster in 2011. The following are some of the potential impacts, namely DNA damage. Nuclear waste contains ionizing radiation that can damage the DNA in fish cells. This DNA damage can cause genetic mutations in fish populations, which in turn can disrupt their reproduction and development. In addition to DNA damage, nuclear waste can also cause metabolic disorders. Radiation from nuclear waste can also affect the metabolic processes in fish cells. This can alter the fish's ability to process nutrients, produce energy, and perform other bodily functions. Radiation in nuclear waste can also increase the production of free radicals in fish cells, called oxidative stress. Oxidative stress can damage cell components including cell membranes and cell organelles, as well as cause inflammation and tissue damage. fish exposed to radiation may also become more susceptible to disease and infection. This can affect the viability of fish populations and potentially disrupt the marine food chain.

In addition to impacting fish cells, nuclear waste that pollutes waters can also damage the marine environment as a whole. This can affect food resources and shelter for fish, and negatively impact the overall marine ecosystem. In addition to the fishing industry, Japan relies heavily on a healthy fish population. If fish cells are exposed to radiation and the fish population declines this could harm the fishing industry, impact the livelihoods of fishermen, and damage the regional economy. It should be noted that the exact impact of nuclear waste depends on how large or how much waste is discharged, the level of radiation, and other environmental factors. Therefore, it is important to continuously monitor Japan's marine waters, conduct in-depth scientific research, and take appropriate precautions to protect the entire marine ecosystem.

D. How to overcome the negative impacts of future nuclear incidents

Addressing the negative impacts of future nuclear incidents requires proactive action, coordination, and engagement from a wide range of stakeholders. There are several measures that can be taken to address the negative impacts of future nuclear incidents:

1. **Increased Security:** The government and the nuclear industry must put safety as a top priority. This includes good maintenance, repairs to nuclear facilities, and employee training to avoid incidents.
2. **Supervision and Regulation:**
 - a. **Strict Regulation:** Adopt strict regulations to supervise and control nuclear operations. An independent nuclear regulatory body should ensure compliance with safety standards.
 - b. **Routine Audits:** Conduct routine audits and inspections of nuclear facilities to check compliance with regulations and standards.
3. **Nuclear Incident Management:**
 - a. **Emergency Response Plan:** Create a detailed emergency response plan, including evacuation procedures, radiation monitoring, and medical aid distribution.
 - b. **Team of Experts:** Set up a team of experts trained to respond quickly and effectively to nuclear incidents.
4. **Nuclear Waste Management:**
 - a. **Safe Storage:** Develop safe nuclear waste storage facilities, based on the latest technology, and maintain adequate separation from the environment.
 - b. **Recycling:** Promote nuclear fuel recycling technology to reduce the volume of nuclear waste.
5. **Alternative Energy Sources:** Encourage diversification of energy sources by increasing the use of renewable energy such as solar, wind and hydro energy. This can reduce dependence on nuclear energy.
6. **Education and Public Awareness:**
 - a. **Public Education:** Improve public understanding of potential nuclear risks, safeguards, and response in a nuclear incident.
 - b. **Transparency:** Promote transparency in communicating with the public about nuclear safety and risks.
7. **Nuclear Technology Innovation:**

Research and Development: Continue to conduct research and development to develop safer, more efficient, and environmentally friendly nuclear technology.
8. **Education and Training:** Engage a well-trained workforce in the nuclear industry and ensure that safety and technical knowledge is regularly updated.
9. **Evaluation and Learning from Incidents:** Every nuclear incident should be followed by in-depth evaluation and lessons learned so that corrective actions can be taken to prevent similar incidents in the future.

Addressing the negative impacts of a nuclear incident requires a strong commitment from all stakeholders, including governments, the nuclear industry and the public. Safety should always be a top priority in the use of nuclear energy to minimize the risk of an incident and mitigate its impact should an incident occur.

E. Latest Review

Japan has announced plans to release radioactive waste from the Fukushima nuclear power plant into the ocean, drawing controversy and concern from many countries, including China, Hong Kong, Malaysia and Indonesia. Although Japan claims that fish taken in the vicinity of the Fukushima nuclear waste dump had no detectable levels of tritium, many countries are still concerned about the impact on food safety and marine ecosystems. Indonesia's Ministry of Marine Affairs and Fisheries is assessing the impact of Fukushima nuclear waste on Indonesia-Japan fishery commodities. There are high-value fish species whose habitat is around Indonesian waters, and with the migratory nature of fish, there is a risk that fish from Indonesia will be contaminated by the radioactive water of Japan's nuclear plant in the Pacific Ocean. Short-term impacts Fukushima nuclear waste on Indonesia's fisheries food chain may occur, and long-term impacts will accumulate in human tissues.

CONCLUSIONS

This study highlights the serious impact that nuclear waste from the Fukushima Daiichi nuclear accident in Japan has had on fish cells in the Sea of Japan. The results show that nuclear waste released into the marine environment has had a negative effect on fish cells living in the area. Specifically, nuclear waste has increased radiation levels in the waters of the Sea of Japan, leading to DNA damage and genetic mutations in fish cells. In addition, high radiation levels also negatively affect the reproduction and growth of fish populations in this region. These findings underscore the importance of strict supervision and better precautions in managing nuclear waste, as well as the need for effective environmental restoration measures in the Sea of Japan. In addition, the study also shows that nuclear accidents can have significant long-term impacts on marine ecosystems and the living organisms within them.

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