



ALLIANCE™

[.https://www.globalseafood.org](https://www.globalseafood.org)Health &  
Welfare

# Benzopyrene, a polycyclic aromatic hydrocarbon, found to harm bay scallops

31 May 2022

By Responsible Seafood Advocate

## Study reveals the toxic effects of a common aquatic pollutant, the PAH Benzo[ $\alpha$ ]pyrene (BaP), on bay scallops

A new study from South Korea has found that higher levels of benzo[ $\alpha$ ]pyrene (BaP), a carcinogenic polycyclic aromatic hydrocarbon, can significantly dampen the immune and oxidative stress response of bay scallops.

Rapid industrialization of coastal areas and a rise in sea transport continue to cause pollutants to be released into marine ecosystems. Polycyclic aromatic hydrocarbons (PAHs) are one of the most common pollutants released into the sea. They negatively affect aquatic ecosystems, but their impact on marine animals has not been sufficiently explored.

For example, PAHs disrupt a variety of biological systems in marine creatures, including energy metabolism, growth, genetics and reproduction. Exposure to these compounds causes toxicity not only in marine organisms but also in humans who consume these organisms. Although the immunotoxicity of PAHs has been extensively studied in mammals and fish, its influence on shellfish has not been

**Effects of Polycyclic Aromatic Hydrocarbons on Shellfish**

Polycyclic aromatic hydrocarbons (PAHs):

- Commonly pollute marine ecosystems
- Can significantly impact aquatic organisms
- Can reach humans through the food chain, causing toxicity

Despite their potential dangers, research on PAHs' direct toxic effect on shellfish is scarce

**What are the toxicological effects of benzo[a]pyrene (BaP, a carcinogenic PAH) on bay scallops?**

**Examining bay scallops' response upon exposure to different BaP concentrations**

72 Hours

BaP concentrations: 0.5 µg/L, 1.0 µg/L, 10 µg/L, 50 µg/L

**Responses analyzed**

**Immune**

- Nitric oxide (NO)
- mRNA expression of:
  - Peptidoglycan recognition proteins (PGRP)
  - Fibrinogen-domain-containing protein (FReDC1)
  - Heat shock protein (HSP70)

**Oxidative stress**

- mRNA expression and localization of metallothionein (MT)

BaP concentration: 1 µg/L → 50 µg/L

At BaP 50 µg/L:

- 6-24 h: mRNA expression of NO, FReDC1, MT (increased)
- 24+ hours: mRNA expression of PGRP, HSP70 (decreased)
- 72 hours: mRNA expression of MT (decreased)

**Exposure to increased amounts of BaP slowed immune responses in bay scallops and lowered their capacity to deal with oxidative stress and DNA damage**

Toxicity response to benzo[a]pyrene exposure: Modulation of immune parameters of the bay scallop, *Argopecten irradians*  
 Song et al. (2022) | DOI: 10.1016/j.fsi.2022.04.044

NATIONAL KOREA MARITIME & OCEAN UNIVERSITY

To fill a knowledge gap, researchers from South Korea evaluated the toxicological effects of a particular polycyclic aromatic hydrocarbon (BaP) 72 on bay scallops. Photo courtesy of Korea Maritime and Ocean University.

adequately investigated.

To fill this knowledge gap, a group of researchers from South Korea evaluated the toxicological effects of PAHs on bay scallops. They selected a particular polycyclic aromatic hydrocarbon (BaP), which is a known carcinogen.

**Pass the torch not the complications**

Succession planning made easy

**Grant Thornton**  
Audit | Tax | Advisory

(<https://www.grantthornton.ca/insights/how-do-i-develop-an-exit-strategy-for-my-business/>).

“The effect of BaP on scallops was investigated by observing various immune- and oxidative stress-related parameters,” said Dr. Cheol Young Choi, professor at Korea Maritime and Ocean University’s Division of Marine Bioscience.

The researchers exposed the scallops to seawater containing four different concentrations of BaP (0.5, 1.0, 10, and 50 µg/L) for 72 hours, and then measured five different parameters in these scallops: the nitric oxide (NO) levels in their hemolymph, and the mRNA expression of peptidoglycan recognition proteins (PGRP), fibrinogen-domain-containing protein (FReDC1), metallothionein (MT) and heat shock protein (HSP) 70.

“While NO levels and the expression of PGRP, FReDC1 and HSP70 indicate the scallops’ immune response to BaP toxicity, the expression of MT is seen as a stress response in these organisms,” wrote the research team in a press release.

The study, which was recently published in ***Fish and Shellfish Immunology*** (<https://www.sciencedirect.com/science/article/abs/pii/S1050464822002273?via%3Dihub>), found that except for the BaP 0.5 µg/L group, NO and FReDC1 and MT mRNA expression rose considerably with time in each BaP group. The expression of PGRP and HSP70 mRNA in the BaP 50 µg/L group rose for 6–24 hours before declining. Moreover, at 72 hours, the BaP 50 µg/L group had greater MT mRNA expression than the control group.

“All the parameters increased significantly over time at higher BaP concentrations,” said Choi.

The researchers also used a special *in situ* hybridization technique to confirm the location of MT expression in the cytoplasm of certain cells in these scallops – confirming that these organisms do, indeed, overexpress MT in the presence of PAHs.

From these observations, the researchers concluded that the BaP dampens the immune response of scallops and decreases their capacity to respond to oxidative stress, infection, inflammation and tissue damage.

“This study paves the way to develop new techniques to control the release of BaP into water bodies and its transfer to humans through the food chain,” said Choi.

**[Read the full study \(https://www.sciencedirect.com/science/article/abs/pii/S1050464822002273?via%3Dihub\)](https://www.sciencedirect.com/science/article/abs/pii/S1050464822002273?via%3Dihub)**.

**[@GSA\\_Advocate \(https://twitter.com/GSA\\_Advocate\)](https://twitter.com/GSA_Advocate)**.

## Author

---



**RESPONSIBLE SEAFOOD ADVOCATE**

[editor@globalseafood.org](mailto:editor@globalseafood.org) (<mailto:editor@globalseafood.org>)

Copyright © 2023 Global Seafood Alliance

All rights reserved.