

Exploring Tokyo Bay

Present problems and future prospects of Tokyo Bay

2. Improvement of the aqueous environment in Tokyo Bay

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Tokyo Bay—Our activities on land have a lasting effect on the bay.

As can be seen from Fig. 1, Japan imports a considerable amount of nitrogen in the form of animal feed and people food. Some of this nitrogen—about 1×10^5 tons a year, 60% of which comes from human life system—ends up in Tokyo Bay. This excess nitrogen has made the bay eutrophic: rich in nutrients, which cause excessive plant growth, such as red and blue tides. Industry and cities have degraded the bay's aqueous environment, but new regulations on total emissions are reducing the impact.

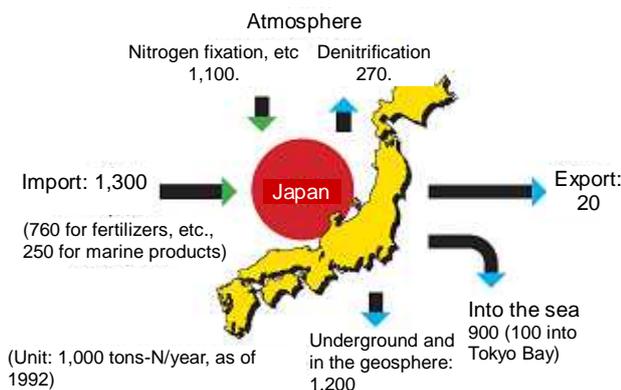


Fig. 1 Japan's nitrogen balance (prepared by Mizutani¹⁾)

The intertidal zone – the critical zone where land and sea meet

The tidal flats at the head of the bay are a unique ecosystem that provides food and shelter to a variety of organisms and serves as a safe environment for young fish. Because the tidal flats are rich fishing grounds, they enhance the land-sea cycle for materials. In the Taisho period, the tidal flats were about 16 km²

in size, but have since decreased sharply to only one-tenth their former size. Still, the Tokyo Bay tidal flats are the fourth largest in Japan after those in the Ariake Sea, on the western coast of the Suo Sea, and in the Yatsushiro Sea, and retain a high potential for wildlife recovery.

Natural systems such as tidal flats can quickly adapt to environmental fluctuations and often require nothing more than a technological boost to get the recovery process going. To examine this phenomena, the Port and Airport Research Institute (hereinafter referred to as the PARI)²⁾ created an artificial tidal flat by placing fine mud in a pool at their laboratory and then pumping seawater into the pool. (Photo 1) A high/low tide cycle is simulated twice a day. This study has been ongoing since 1995. While no organisms have been deliberately placed in the pool, cells, larvae, seeds, and other microorganisms were observed a half year after the start. They arrived in the pumped seawater and settled in the tidal flat. Within about one year, a tidal flat ecosystem had formed consisting of spiral shells, sandworms, fine algae and bacteria. The system has gradually grown over the past ten years, but no particular species dominates the ecosystem. Neither has the system collapsed even once in those ten years.

This study shows that civil engineering can help restore a tidal flat ecosystem. Subjects for future study include how to recruit organisms for a restoration project.



Photo 1 Tidal flat experimental facility at the Port and Airport Research Institute

Linking community activities

Short-necked clams are often seen in tidal flats. In the larval stage, they float on the surface, drifting with currents in the bay. After about ten days of floating and drifting, the young clams settle in a suitable spot and form shells. Using radar equipment capable of two-dimensionally observing surface currents in the bay, the National Institute for Land and Infrastructure Management (NILIM)³ observed wide areas and measured the density of the floating larvae. (Fig. 2) The results show that the floating larvae disperse widely, which means it may be possible to recruit tidal flat organisms to a particular location even if there is no tidal flat in the vicinity. Detailed examinations of the currents and the distribution of larvae show that tidal flats have strong connections to one another in the western part of the bay (Kanagawa Prefecture side) and that scattered flat lands can be regarded as a unit.⁴ This connectivity can be used to link distant efforts, which was reflected in the action plans of the Tokyo Bay Restoration Conference. (Fig. 3)

Tidal flats in Tokyo Port Wild Bird Park, Kanazawa Sea Park and Funabashi Seaside Park were reclaimed more than 20 years ago and today are frequently visited by people from nearby areas. Recently, another reclamation project, Omori Furusatono (Hometown) Beach, was opened. These civil engineering projects are examples of "learning

while creating."

Other ongoing projects include continuous monitoring at Chiba light beacon (3rd Regional Coast Guard Headquarters), observing currents using a high frequency ocean radar (Kanto Regional Development Bureau), observing currents from ferries traveling across the mouth of Tokyo Bay (PARI)⁵; and flash reports on occurrences of oxygen-deficient water. Finally, the Kanto Regional Development Bureau has created a new Tokyo Bay Environmental Information Center web site.

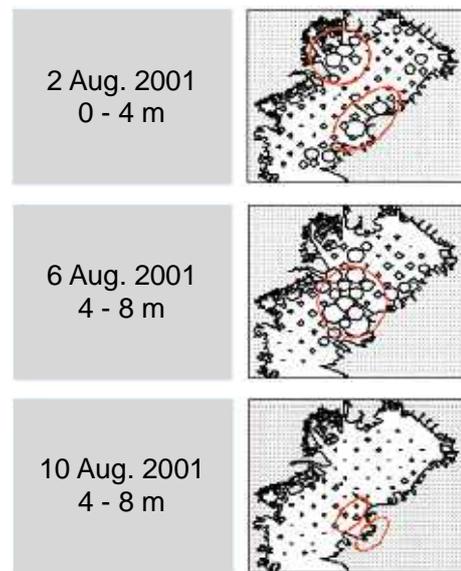


Fig. 2 Distribution of floating short-necked clam larvae in Tokyo Bay

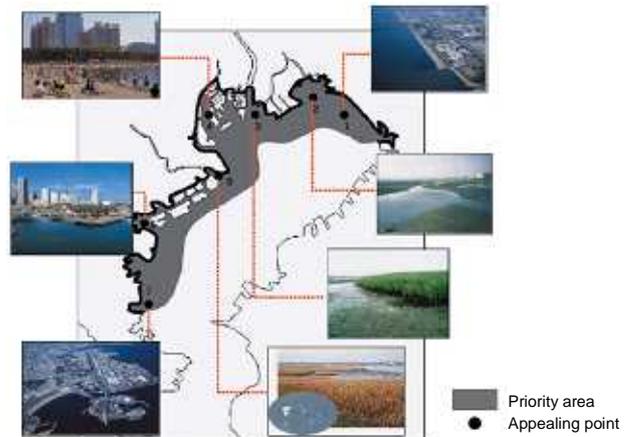


Fig. 3 Priority areas and appealing points in the action plan for restoring Tokyo Bay (2003)

Improving Tokyo Bay's aqueous environment

The aqueous environment of Tokyo Bay has suffered greatly from the effects of human activities. To reduce the effects of our activities on the environment, we must reconsider those activities and rethink our relationship with the sea and its organisms, particularly those in the intertidal zone where land and sea meet. We must develop a comprehensive plan that reflects the opinions of the people, provides for adaptive management, incorporates technologies for monitoring and assessing ecosystems that have been restored by community activities, and encourages communication and cooperation with outside organizations.⁶⁾

References

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- 2) Kuwae, Journal of Japan Society of Civil Engineers, No. 790/VII-35, 2005
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- 4) Hosokawa, Collection of Lectures at The 32nd Meeting for Reading Research Papers on Environmental Systems, 2004
- 5) Suzuki et al., Port and Airport Research Institute Report, (44) 2, 2005
- 6) Port and Harbor Environmental Information: <http://www.nilim.go.jp> (National Institute for Land and Infrastructure; database), 2005