

PORT OF NAGOYA
PUBLIC AQUARIUM

Breeding and Rearing Loggerhead Turtles at Port of Nagoya Public Aquarium.

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Sea Turtles and PNPA

■ PNPA opened in October 1992.

Dr. Itaru Uchida, the founding director, was a sea turtle researcher.

Opened with a focus on **the breeding, protection, and study of sea turtles** as part of its mission.

Equipped with a **turtle breeding and research facility** (Chelonian Institute) for studying sea turtles.



Sea Turtles and PNPA

■ PNPA opened in October 1992.

First in the World (1995) : Achieved breeding of loggerhead turtles in an indoor facility.



A turning point in sea turtle conservation — **successful breeding under artificially controlled conditions** such as water temperature and diet.



Sea Turtles Husbandry Facility

■ Sea Turtle Migration Tank

Total volum : 560m^3 Dimensions : $\phi 13\text{m} \times 2.5\text{m}$ (depth)

Donut-shaped design allows sea turtles to keep swimming continuously.

Equipped with an artificial sandy beach designed as a sea turtle nesting site.



Sea Turtles Husbandry Facility

■ Artificial Sandy Beach for Nesting

Dimensions : **20 m** (length) × **5 m** (width)

Designed based on field survey data from wild sea turtle nesting sites, taking into account length, width, and slope.



Sea Turtles Husbandry Facility

■ Behavioral Observation Through Surveillance Cameras

Four high-sensitivity infrared cameras capable of recording in complete darkness are installed to monitor sea turtle behavior, **enabling comprehensive documentation and observation of their reproductive activities**, including mating and nesting.



A loggerhead sea turtle landed on an artificial sandy beach to nest.



A loggerhead sea turtle laying eggs.

Sea Turtles Husbandry Environment

■ Individuals in Captivity (Peak Number)



Loggerhead **8** (M : 2 F : 6)



Hawksbill **6** (M : 2 F : 4
)



Green **7** (M : 3 F : 4)

■ Water Temperature

Max : about **28° C** (Jun–Aug)

Min : about **21° C** (Jan–Feb)



Sea Turtles Husbandry Environment

■ Feed

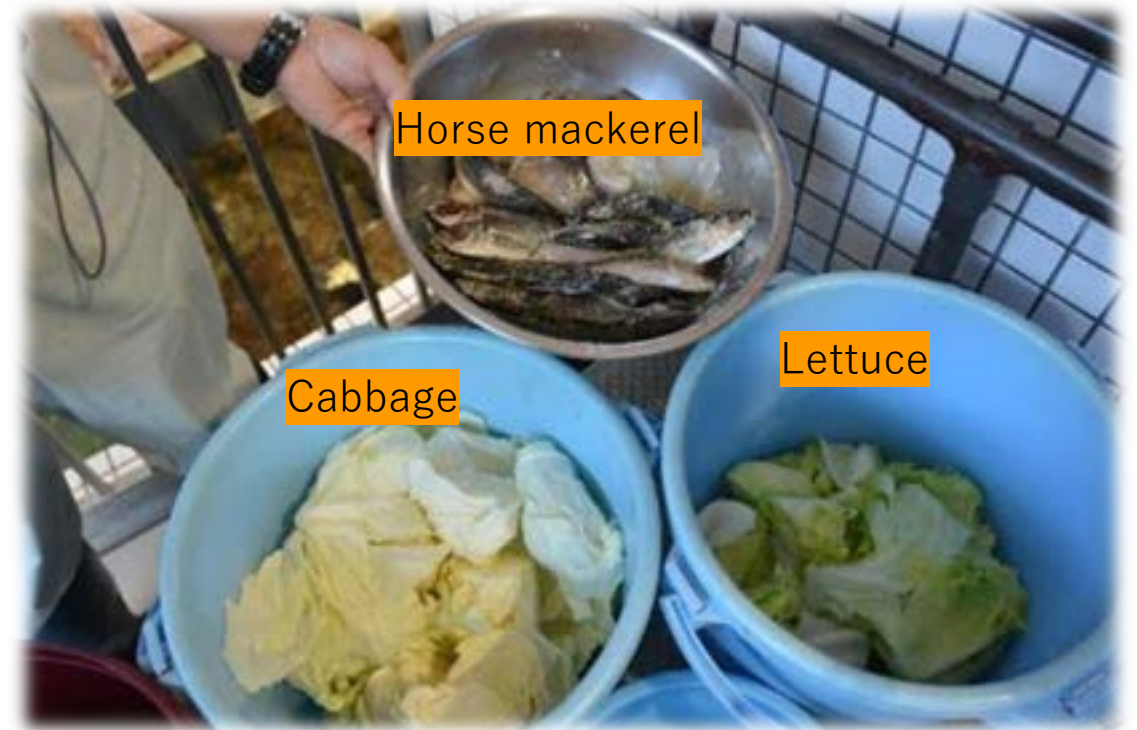
Animal-based feed : Horse mackerel

⇒ Mainly for Loggerhead & Hawksbill turtles

Plant-based feed : Cabbage / Lettuce

⇒ Mainly for Green turtles

(Supplemented with **multivitamins** and **calcium**)



■ Daily Feeding Amount

Amount set based on individual body weight.
(0.2–1.0% BW/day)

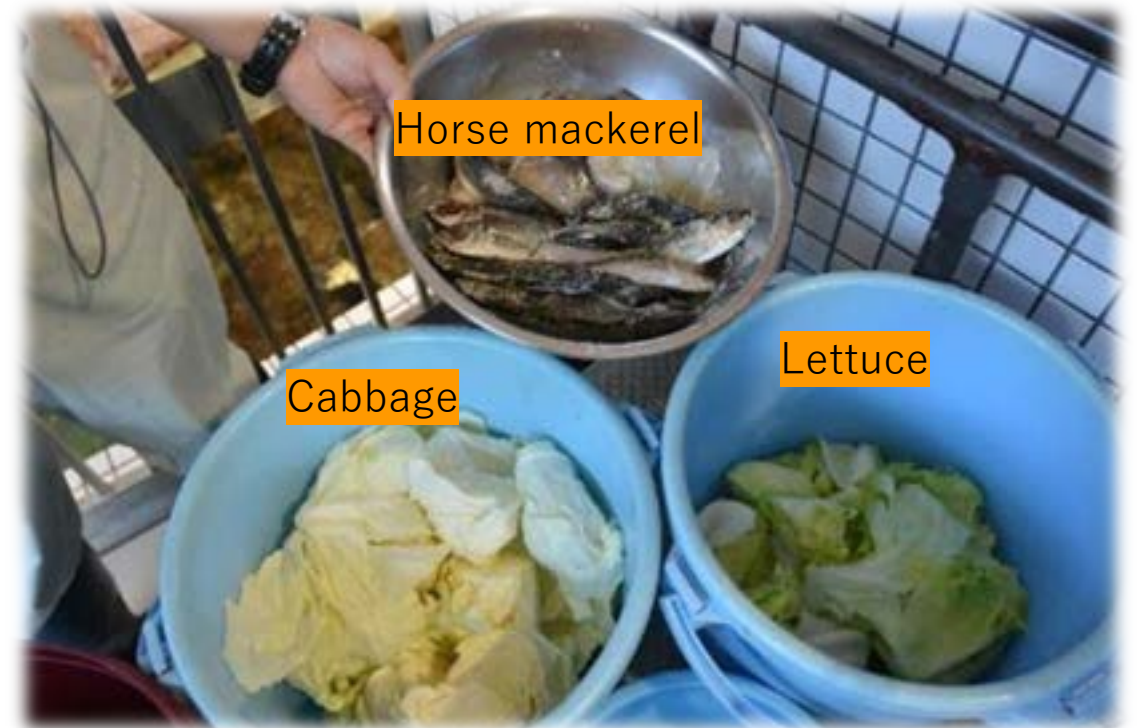
(e.g.)

Female Loggerhead

→ Feeding increased to **1.0% BW/day** before breeding season (autumn–winter)

Male Loggerhead

→ Maintained at **0.4% BW/day** throughout the year



Breeding of Loggerhead Turtles

■ Mating of Loggerhead Turtles

Mating of loggerhead turtles is observed every year between **February and May** in the tank.

Ultrasound examination enables visualization of **shelled eggs formed several weeks after mating.**



Breeding of Loggerhead Turtles

■ Nesting of Loggerhead Turtles

From April to June each year, loggerhead turtles nest on the artificial sandy beach.

Total Nests : 207 (Mar : 1, Apr–Jun : 201, Jul : 5)

Average clutch size : 85 eggs.



Breeding of Loggerhead Turtles

■ Egg Excavation

On the day following oviposition, eggs are excavated and moved to the artificial incubation facility.



Using a red pencil, the top of the egg is marked, and careful handling ensures the apex does not move.

Breeding of Loggerhead Turtles

■ Egg Size Measurement

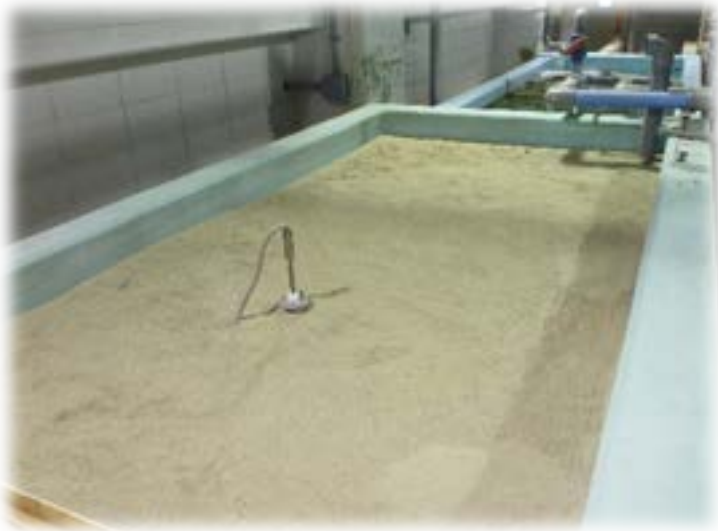
Measurements of egg diameter and weight were conducted on **10 randomly selected eggs** from the extracted group and recorded.

Egg size : about $\phi 40$ mm , $W = 38$ g



Breeding of Loggerhead Turtles

■ Egg Reburial



Relocating eggs to a **temperature-controlled** sand incubation site.

Incubation sand is from **Akabane Beach**, a **natural nesting site** in Aichi, Japan.

A hole approximately 50 cm deep and ϕ 25 cm in , **similar to the one dug by the female parent.**

Place the eggs gently, **using the red mark at the apex as a reference point.**



Breeding of Loggerhead Turtles

■ Hatchling Emergence

When incubated at 29° C, hatchlings emerge in about two months. **A surface depression** in the sand signals the start of emergence.



Hatchlings emerge at night, several days after the surface subsidence occurs.

Breeding of Loggerhead Turtles

■ Rearing Hatchling Turtles

Hatchling turtles are kept in **shallow circular tanks resembling tubs. (ϕ 62 cm)**

Central overflow enables quick removal of surface films from feed and waste.



Breeding of Loggerhead Turtles

■ Rearing Hatchling Turtles

Feeding begins approximately one week after emergence.

⇒ Feeding while **the yolk is still present in the body** can cause indigestion.



Yolk sac closure site

Breeding of Loggerhead Turtles

Rearing Hatchling Turtles

Hatchlings are first fed a **paste made from blended krill and horse mackerel**.

Fed twice daily, totaling 10% of body weight per day.



Krill and minced horse mackerel



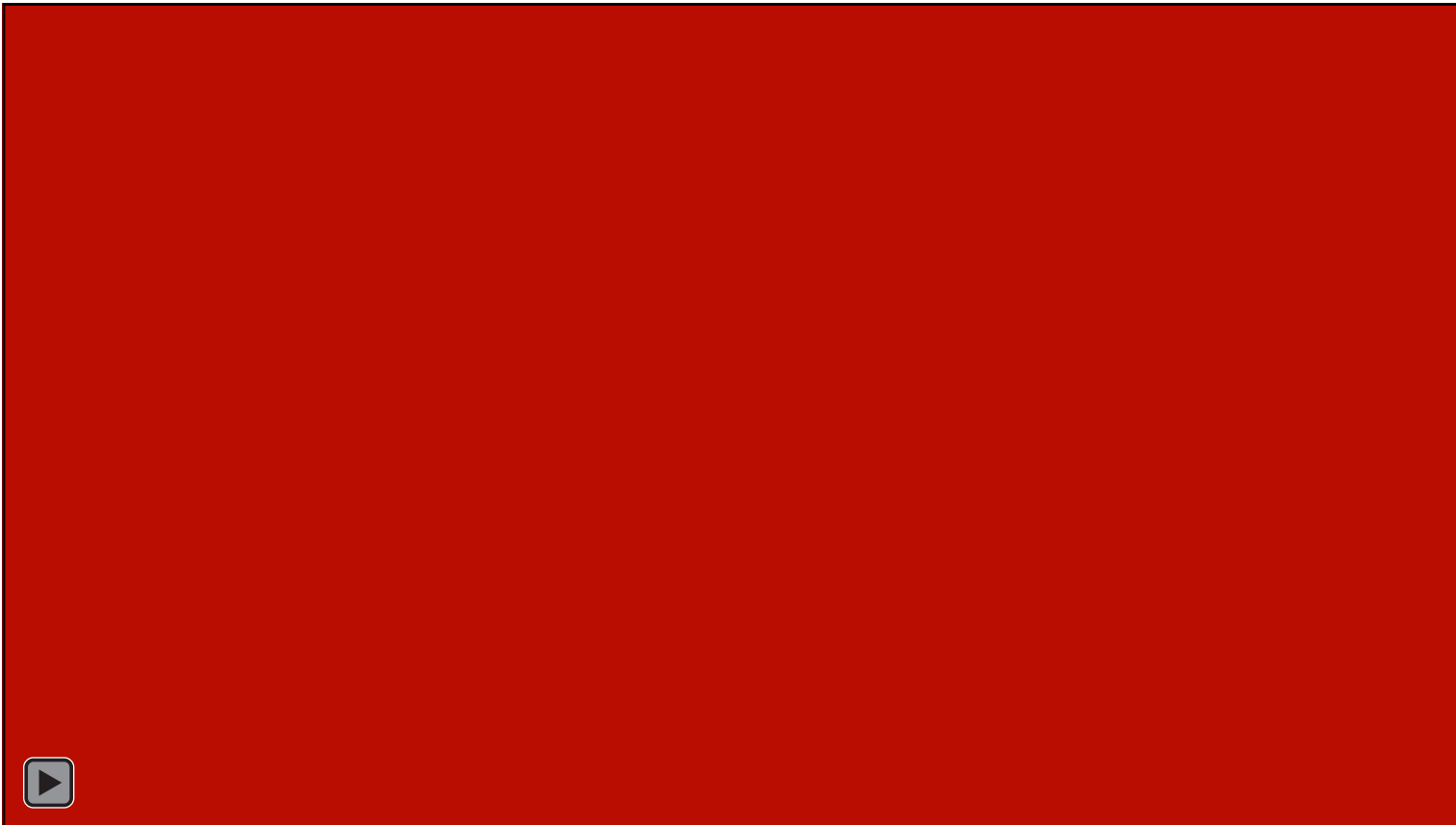
Add a multivitamin supplement and calcium.



Well-mixed state

Breeding of Loggerhead Turtles

■ Rearing Hatchling Turtles



Hatchlings feeding

A Brief Aside

■ Rearing **STRETCH** Turtles

Must grow to **35–45 cm SCL in 2 years** to support satellite tag attachment

Raised under **high temperature (27°C)** and **high-nutrition diet** to accelerate growth

Maximum monthly growth : **+3 cm SCL, +1.7 kg BW**



Breeding of Sea Turtles

■ Breeding Record of Sea Turtles (1995–2025)

species	Nesting ♀ (No.)	Nesting Events	Total Eggs	Hatchlings	Hatch Rate (%)
Loggerhead	6	207	17576	10350	58.9
Hawksbill	3	28	2840	326	11.5
Green Turtle	2	11	1049	11	1.0

At PNPA, water temperature is mainly controlled to suit loggerhead turtle breeding.



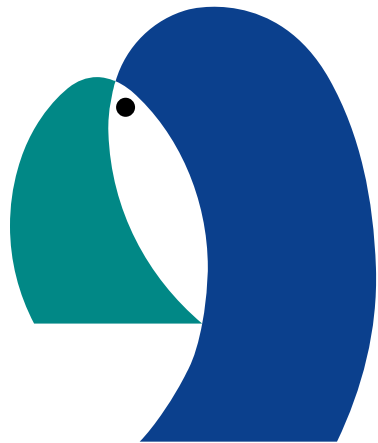
Breeding of Sea Turtles

Age of Sexual Maturity in Sea Turtles

species	Individual ID	Year of Birth	First Nesting	Remarks
Loggerhead	CcW-19	1992	2004	Underwater egg release
Loggerhead	Cc97-11	1997	2020	Second-generation breeding (completing the life cycle)
Hawksbill	Ei03-28	2003	2021	Not all eggs hatched

Rare documented cases of **known-age sea turtles reproducing** — valuable for understanding maturity and reproductive timing.

Lifelong care may reveal “ **How many eggs a sea turtle can lay in its lifetime ?** ” — a long-term challenge and one of our key missions.



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Thank you for your attention.