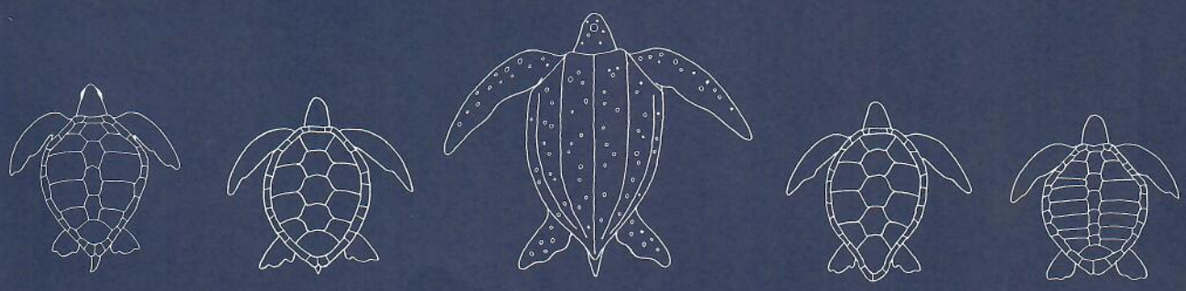
Sanriku Sea Turtle Research Fieldbook

Chihiro Kinoshita



2005 - 2017


Most of what we know about sea turtles comes from watching newly hatched babies on the beach or observing mother turtles when they come ashore to lay their eggs. Much else about the sea turtles' lifecycle is shrouded in mystery.
Why do young sea turtles travel far from the nest where they were born to the Sanriku coastal region? How many years does it take them to become an adult?

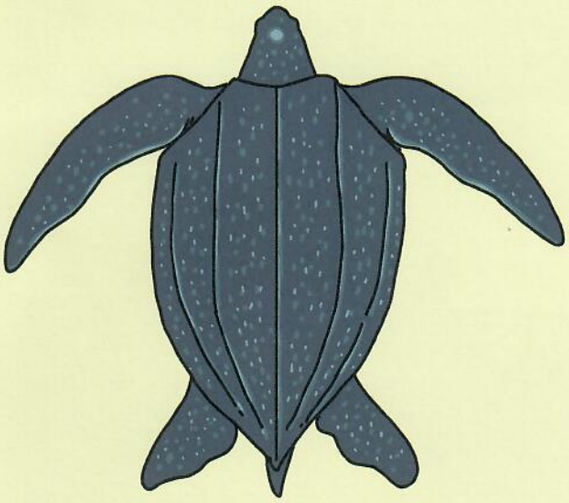
Sanriku Sea Turtle Research

Fieldbook

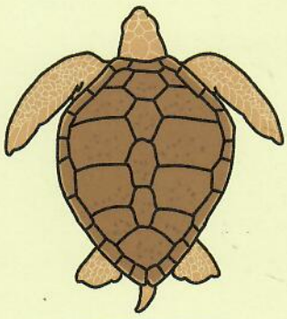
2005 - 2017

Migratory sea turtles spotted around the Sanriku coast

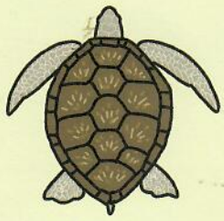
Sea turtles are commonly thought as inhabiting warm ocean areas, but during the summer, they migrate far away from their nesting grounds to the temperate Sanriku coastal area.



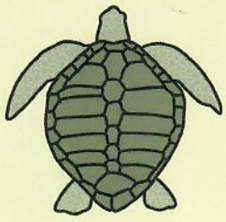
Leatherback turtle
(August - October)



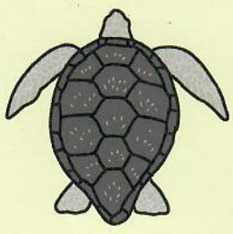
Loggerhead turtle
(July - September)



Green turtle
(August - September)



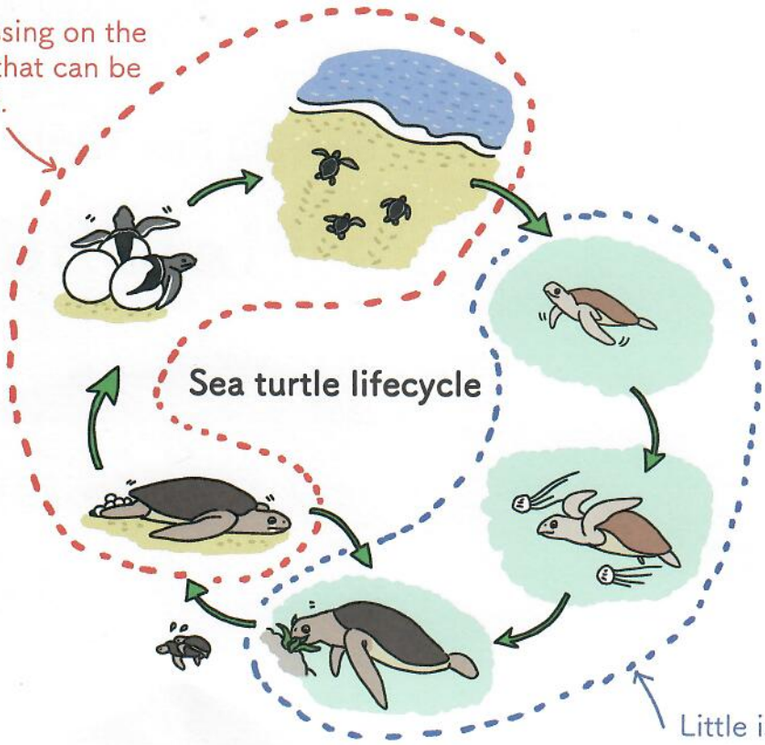
Olive ridley turtle
(July)



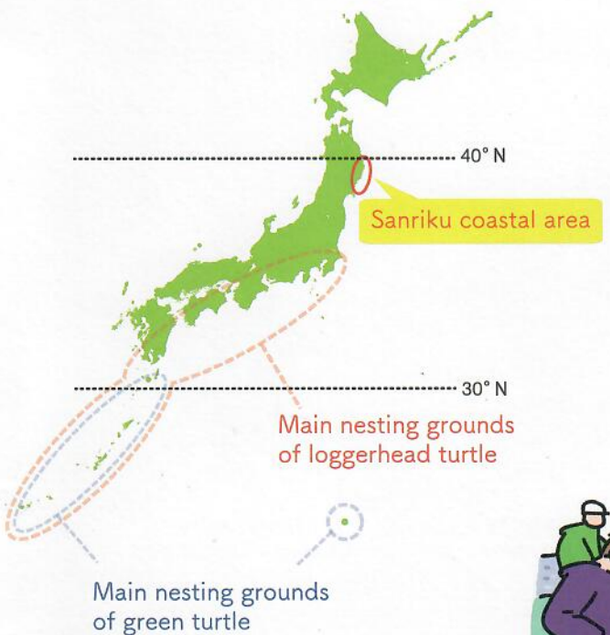
Black turtle
(August - September)

Much about the sea turtles' lifecycle is unknown

Research is progressing on the sea turtle lifecycle that can be observed from land.



Little is known about the sea turtle lifecycle that can't be observed from land.



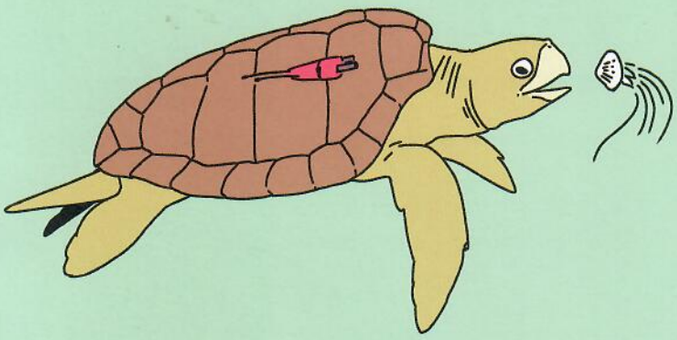
Scientists recently discovered that a significant number of sea turtles migrate to the Sanriku coastal area in northeastern Japan.

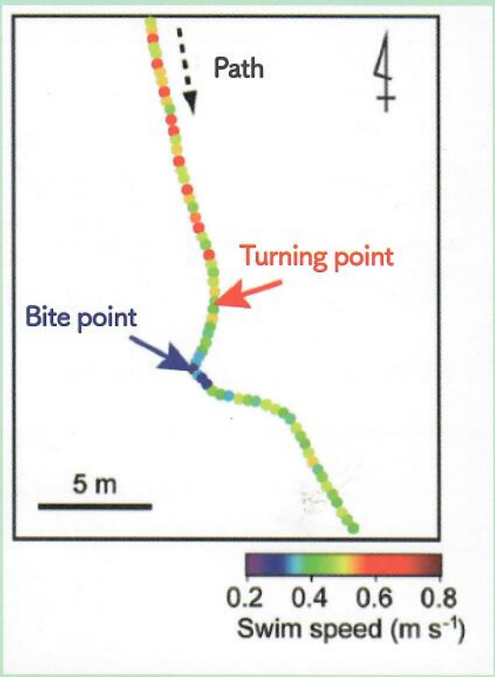
But what prompts these sea turtles to travel so far away from their main nesting grounds? We sought to find out by monitoring their movement.

A sea turtle is captured in a set net used for fishing in the Sanriku coastal area →

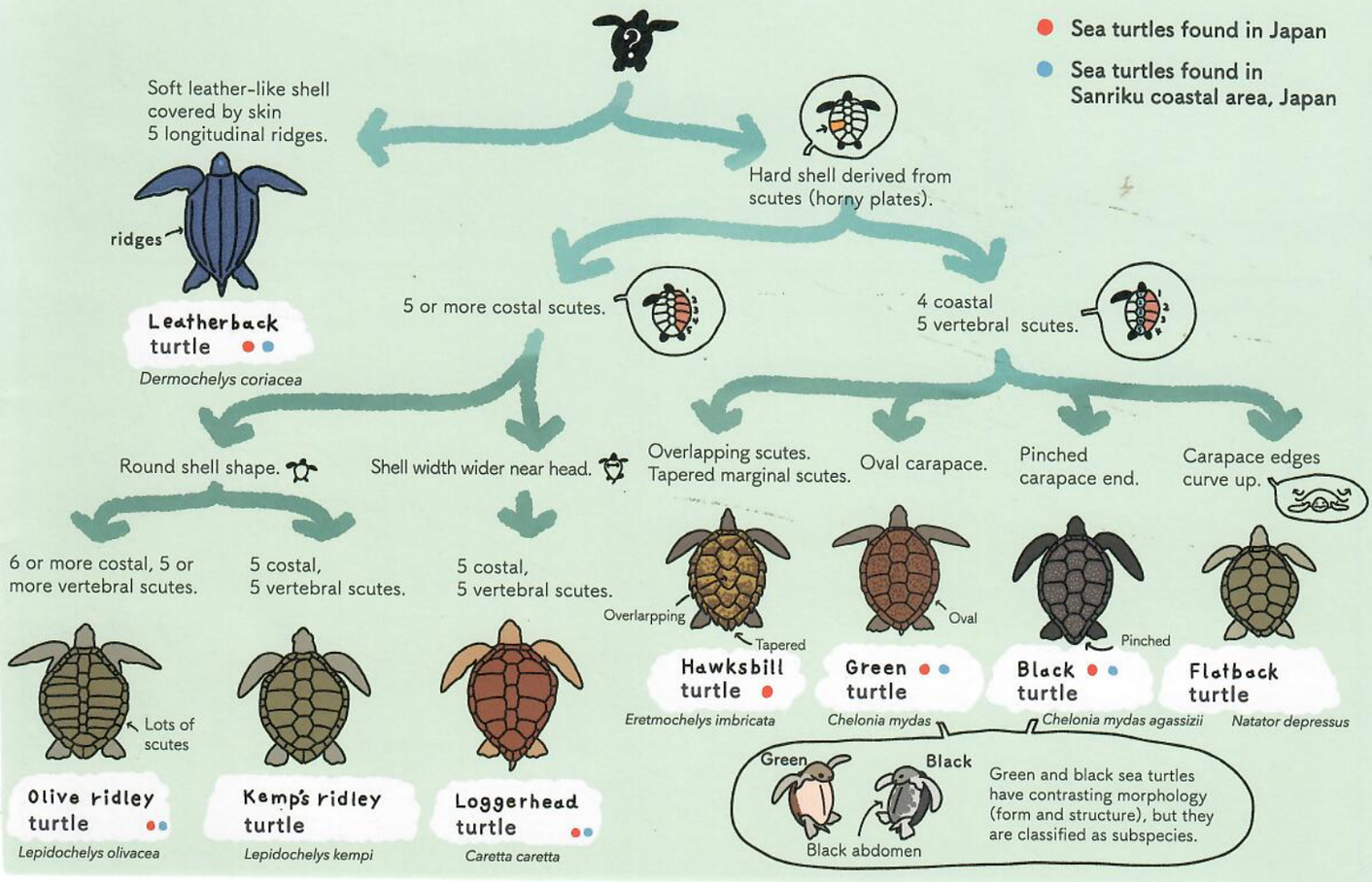
Loggerhead sea turtles rely on vision to capture jellyfish

A study found that loggerhead sea turtles divert their course just before homing in on their food. This behavior was not observed so much at nighttime, suggesting that the turtles rely on vision when hunting and foraging for food (Narazaki et al., 2013).

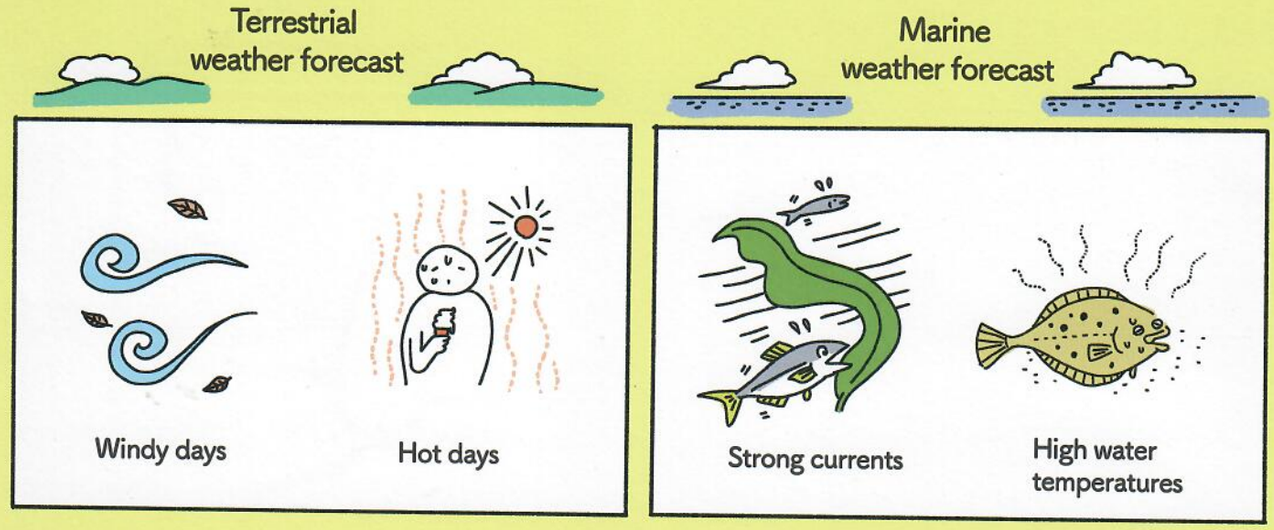




How to identify sea turtles



There are lots of terrestrial weather forecasts but few marine forecasts



Important information for those living and working on land.

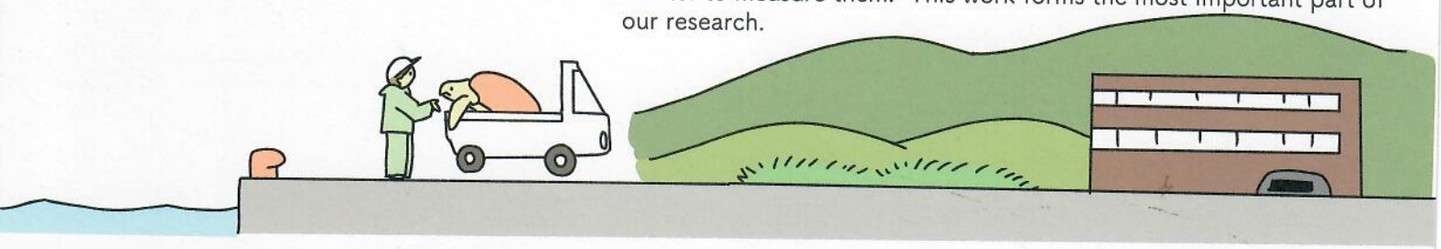
Information is readily available on mobile devices and TV.

Important information for people making their livelihood out at sea.

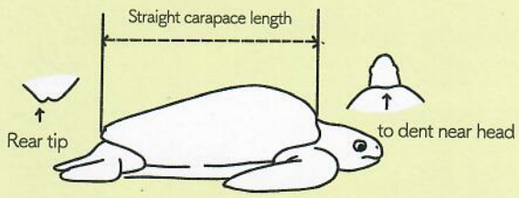
There is a lack of information because of an insufficient observation network.

Measuring sea turtles

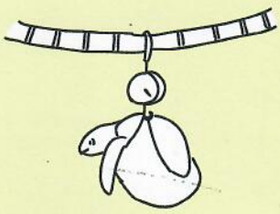
After receiving sea turtles inadvertently captured in fishing nets by local fishermen, we bring the turtles to the International Coastal Research Center to measure them. This work forms the most important part of our research.



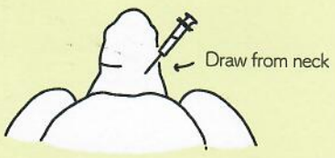
① Measure carapace length



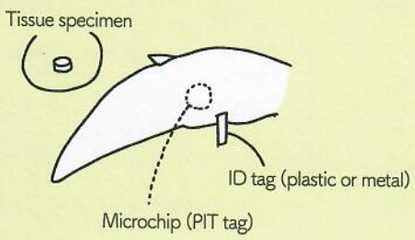
② Weigh body mass



③ Draw blood sample

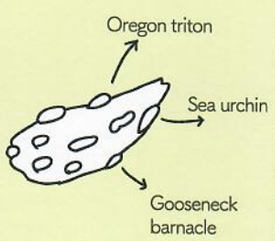


④ Attach tags, collect tissue specimen



⑤ Collect parasite specimens

⑥ Gather feces



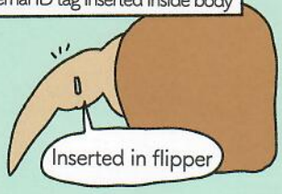
Microchip PIT tag serves as permanent ID

There are two methods for tagging individual sea turtles.

1. External ID tag attached onto body

Visible externally, but highly prone to fall off.

2. Internal ID tag inserted inside body

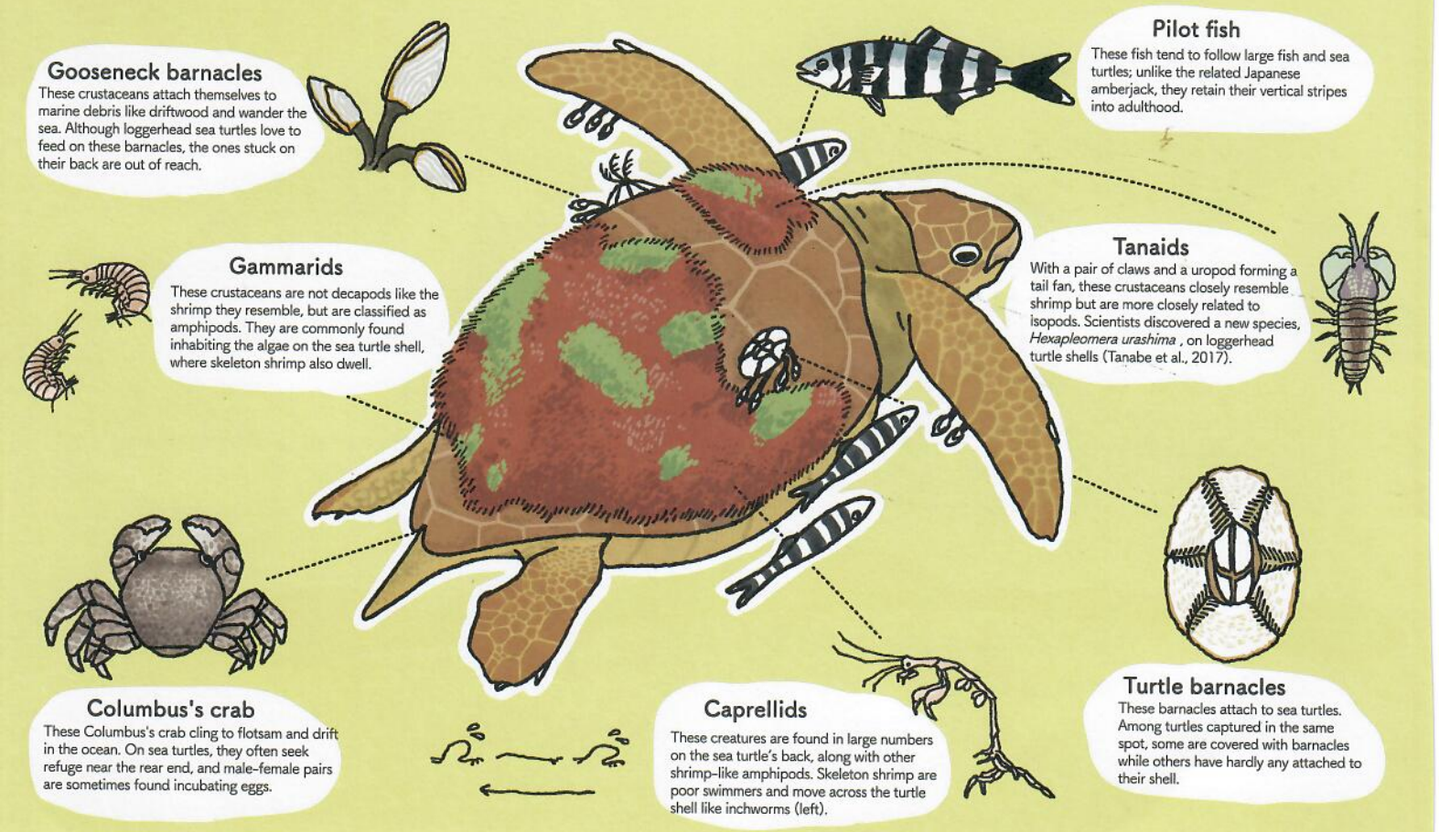


Requires reading device, but can be installed permanently.

We do not yet know how long it takes sea turtles to mature into adults.
→ PIT tag may help scientists track growth.

Loggerhead sea turtle's back is home to many organisms

Many organisms settle on the back of the loggerhead turtle as it roams the sea.



Gooseneck barnacles
These crustaceans attach themselves to marine debris like driftwood and wander the sea. Although loggerhead sea turtles love to feed on these barnacles, the ones stuck on their back are out of reach.

Pilot fish
These fish tend to follow large fish and sea turtles; unlike the related Japanese amberjack, they retain their vertical stripes into adulthood.

Gammarids
These crustaceans are not decapods like the shrimp they resemble, but are classified as amphipods. They are commonly found inhabiting the algae on the sea turtle shell, where skeleton shrimp also dwell.

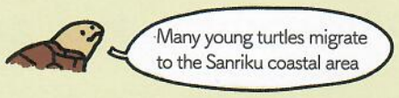
Tanaids
With a pair of claws and a uropod forming a tail fan, these crustaceans closely resemble shrimp but are more closely related to isopods. Scientists discovered a new species, *Hexapleomera urashima* , on loggerhead turtle shells (Tanabe et al., 2017).

Columbus's crab
These Columbus's crab cling to flotsam and drift in the ocean. On sea turtles, they often seek refuge near the rear end, and male-female pairs are sometimes found incubating eggs.

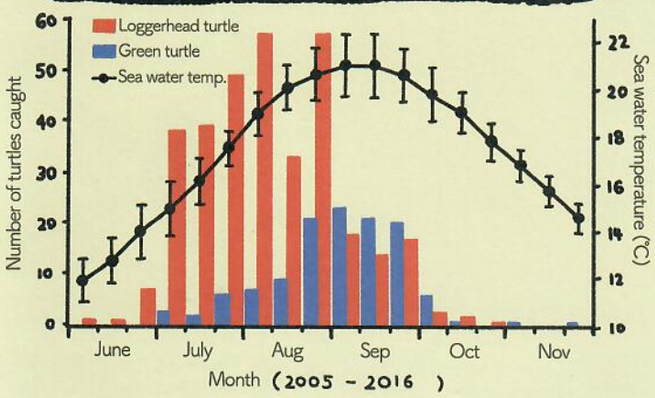
Caprellids
These creatures are found in large numbers on the sea turtle's back, along with other shrimp-like amphipods. Skeleton shrimp are poor swimmers and move across the turtle shell like inchworms (left).

Turtle barnacles
These barnacles attach to sea turtles. Among turtles captured in the same spot, some are covered with barnacles while others have hardly any attached to their shell.

When does each species of sea turtle visit Sanriku coastal area?



Migration period, corresponding water temperature

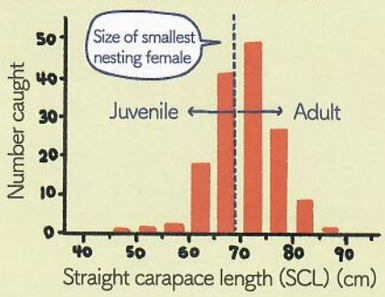


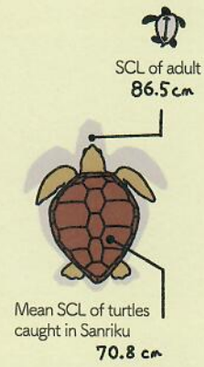
Loggerhead turtles migrate to the Sanriku coast around July when the water temperature rises to 15° C and above. They are captured in fishing nets until the latter half of September. Roughly 40 loggerhead turtles are captured in a season.

Green turtles migrate to Sanriku from August to September when the water temperature is highest. In one season, around 10 green turtles are captured unintentionally in fishing nets.

(Narazaki et al. 2015, Fukuoka et al. 2015)

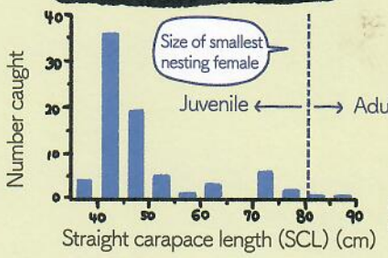
Size of loggerhead turtles

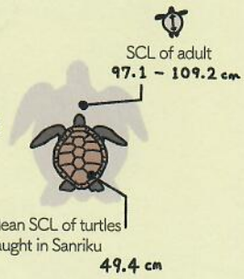




▶ **Migratory loggerhead turtles are juvenile- to adult-size.**

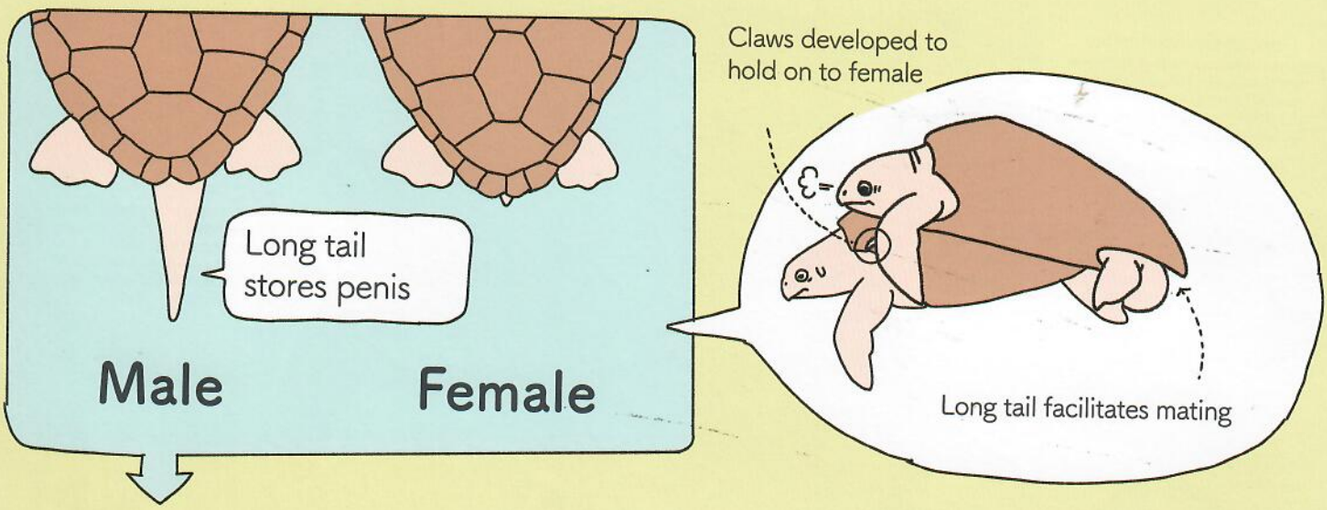
Size of green turtles





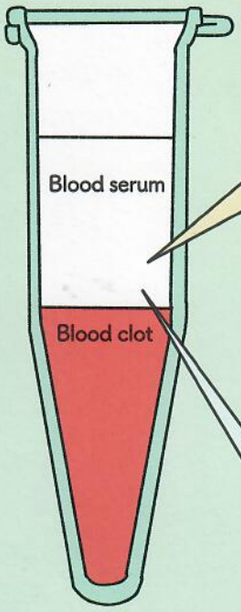
▶ **Migratory green turtles are size of small subadults.**

What's the male turtle's big tail for?



The Sanriku coastal area is unusual in that a large number of male loggerhead sea turtles migrate there.

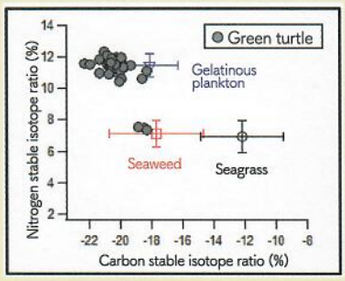
What the sea turtle's blood can tell us



Blood sample separated by centrifuge into blood serum and blood clot.

Stable isotope analysis

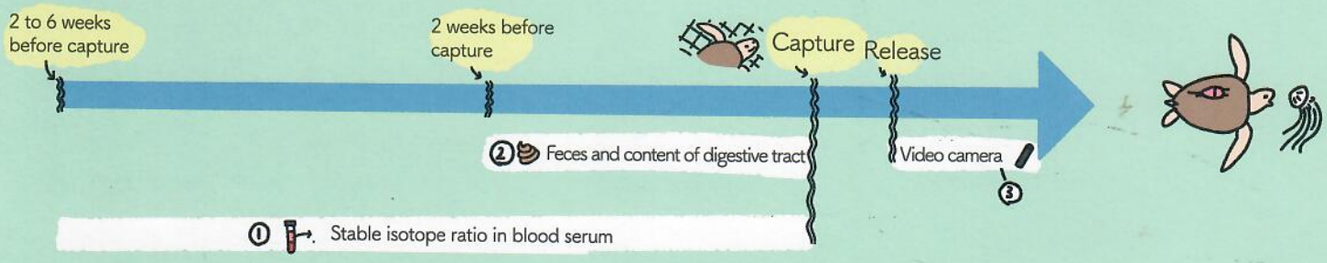
We can investigate what the sea turtles have eaten and absorbed into their bodies. As it takes some time for this ratio to change, we are able to find out what they ate several months ago.



Hormone (testosterone)

Oftentimes, differences in male and female morphology do not manifest themselves in subadult sea turtles, making it difficult to tell the sexes apart. As reported in recent studies, we now can determine the turtle's sex by analyzing the amount of the male hormone testosterone in the blood.

What does a sea turtle eat?



Using a combination of 3 methods we can precisely determine turtles' diets.

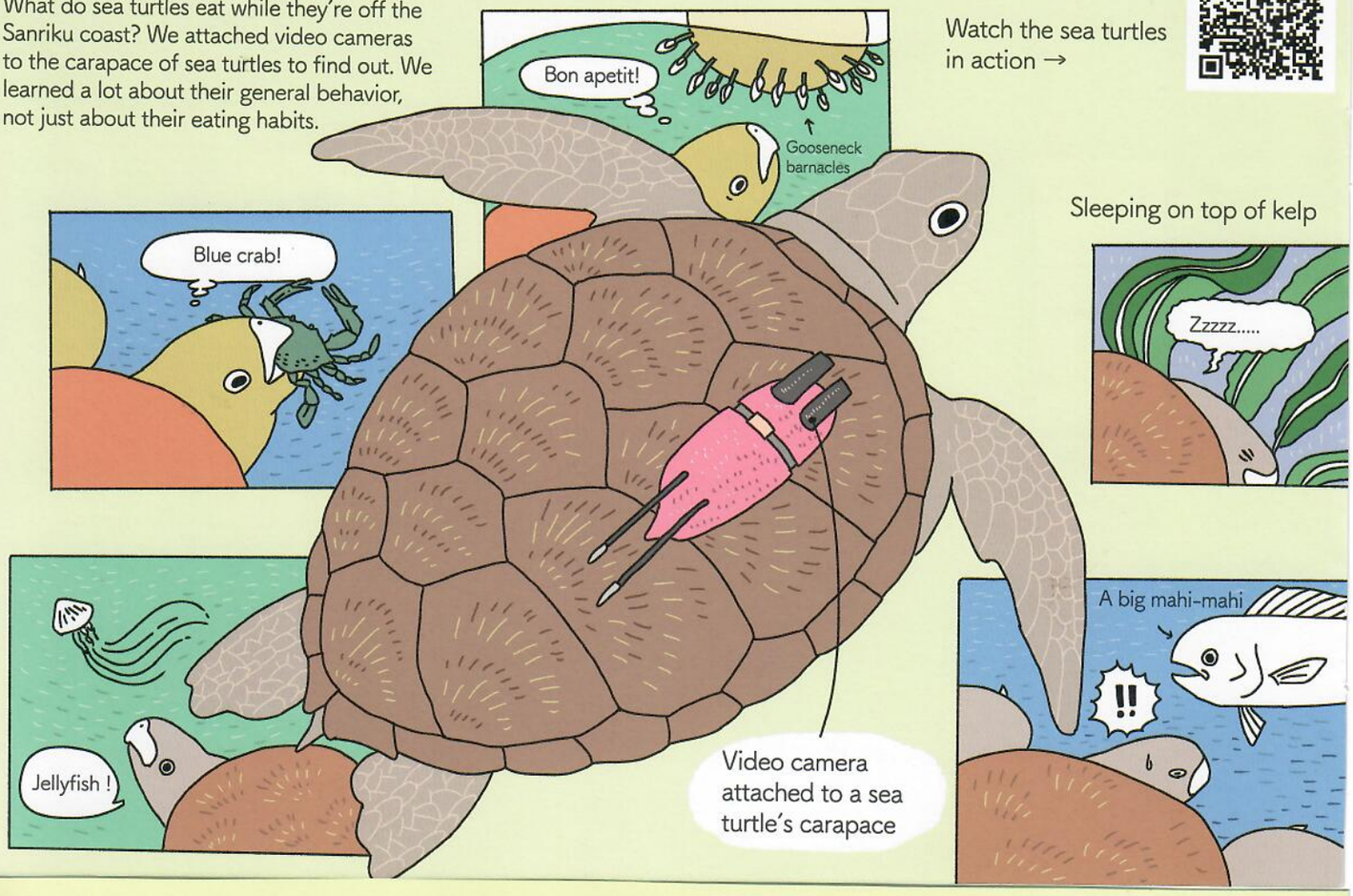
	Stable isotopes	Feces and digestive tract	Video camera
Loggerhead turtle	Jellyfish	Benthos	Jellyfish
Green turtle	Jellyfish	Seaweed	Seaweed and jellyfish

You can't tell by examining their feces, but sea turtles love eating jellyfish!

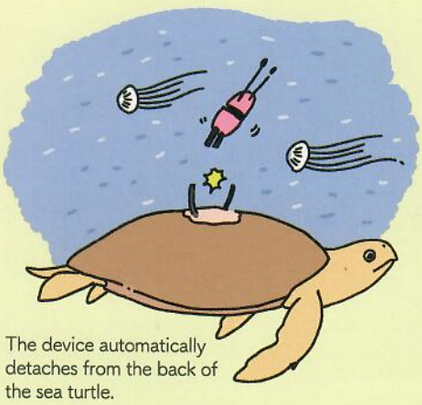
What shows up on the sea turtle's camera?

What do sea turtles eat while they're off the Sanriku coast? We attached video cameras to the carapace of sea turtles to find out. We learned a lot about their general behavior, not just about their eating habits.

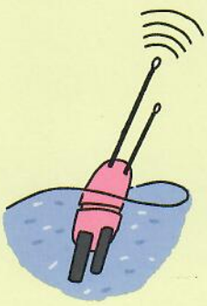
Watch the sea turtles in action →



Getting the data logger back isn't easy!



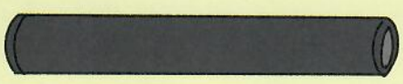
1. The device automatically detaches from the back of the sea turtle.



2. At the surface, the device transmits a radio signal.

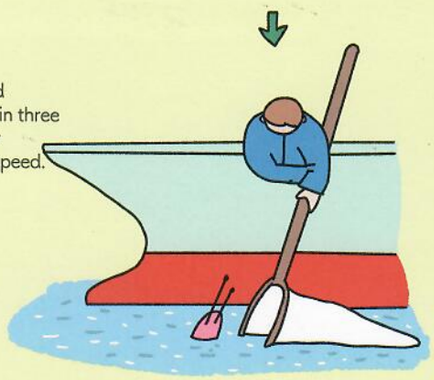
3. The researcher homes in on the signal, looking for the device.

A data logger that can record acceleration and magnetism in three dimensions and depth, water temperature and swimming speed.



This data logger can record 12 hours of video.

The recovered device yields highly precise data that can't be gathered by visual observation or satellite monitoring.



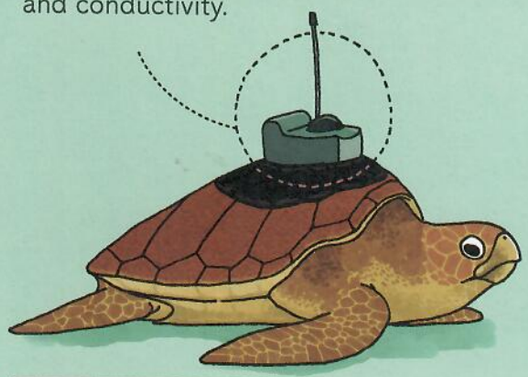
4. Got it!

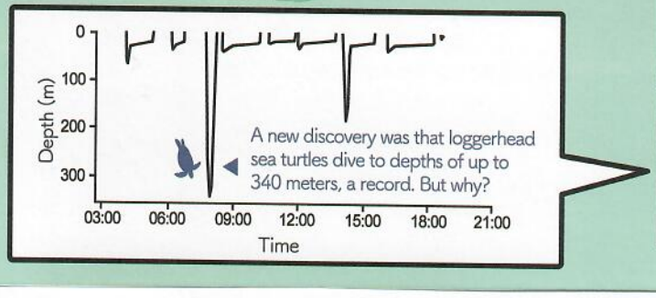
Where do the sea turtles go ?

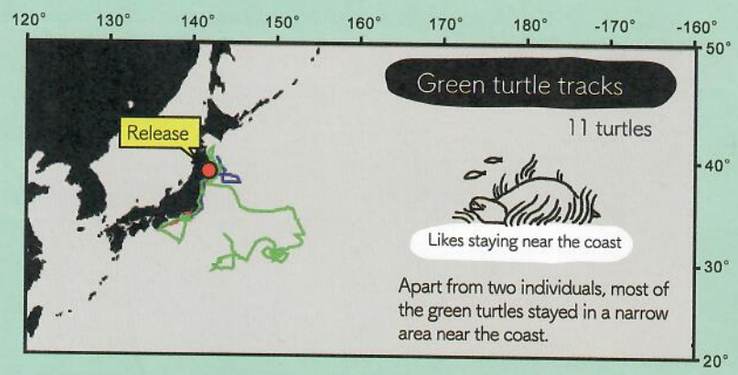
Where do the sea turtles go after Sanriku? We followed them using the tracking device.

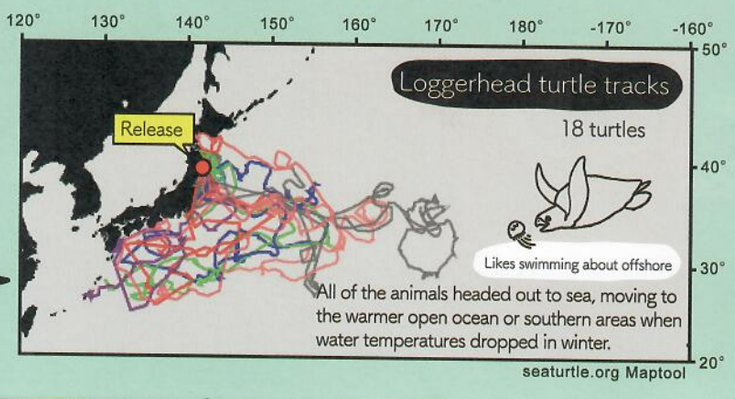
Satellite Relay Data Logger

A satellite data logger that can record location, water temperature, dive depth and conductivity.

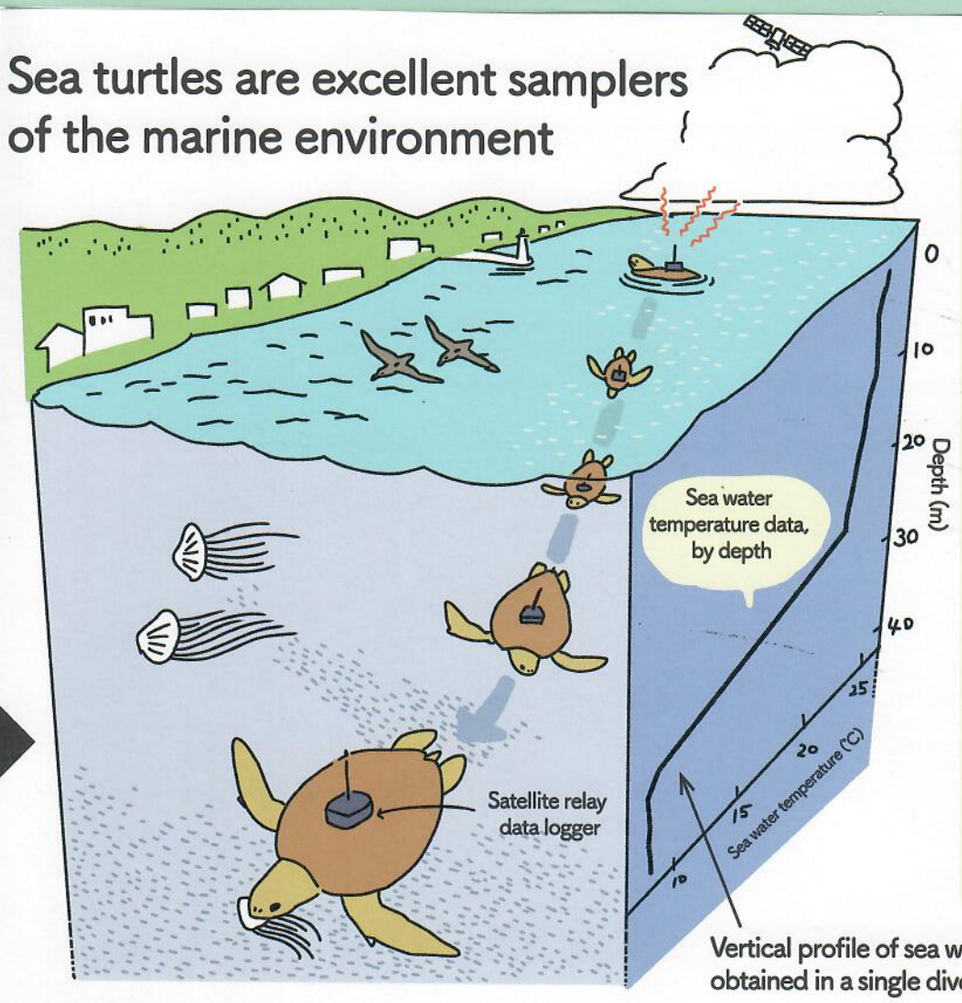








Sea turtles are excellent samplers of the marine environment



Vertical profile of sea water temperature obtained in a single dive

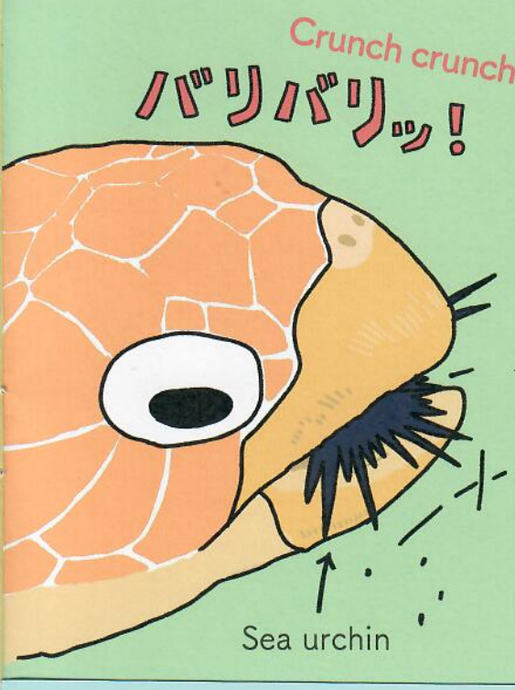
Ocean water temperatures directly affect the growth of typhoons and other meteorological events. Attempts at getting sea turtles to collect such data are currently underway.

We now understand the marine environment on a finer scale, thanks to the sea turtles' ability to gather data on water temperatures at various depths at more frequent intervals than conventional observational buoys.

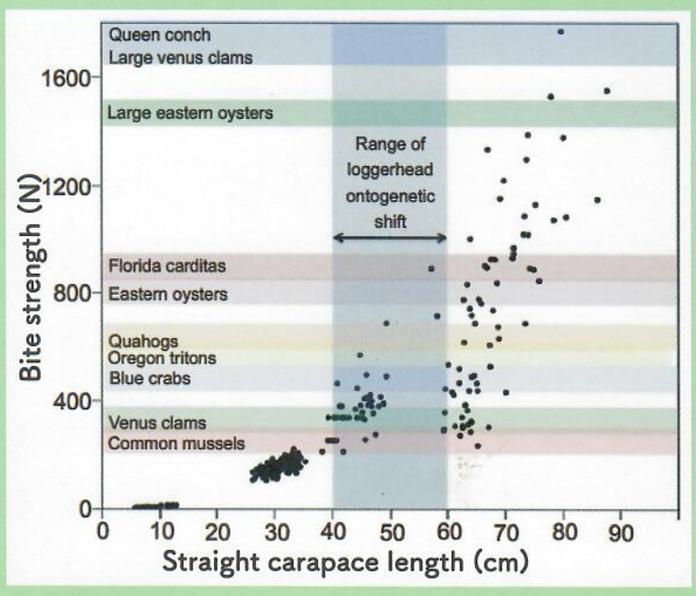
Weather forecasts using data collected by sea turtles may not be so far-fetched.

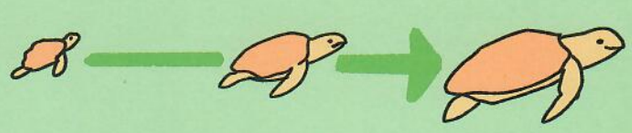
The loggerhead sea turtle packs quite a bite!

It's been found that the loggerhead sea turtle's bite suddenly increases in strength as it grows (Marshall et al. 2012).

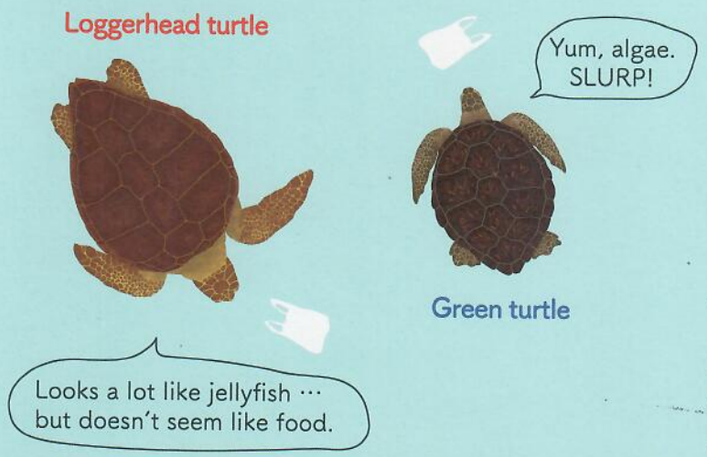


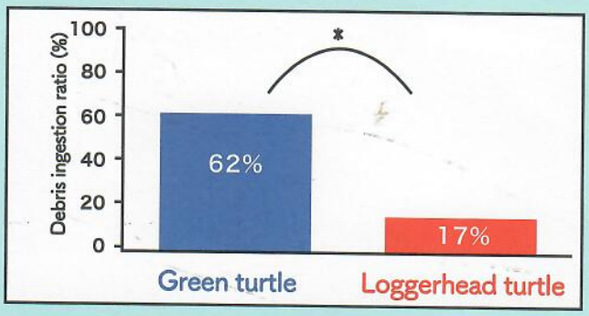
The loggerhead sea turtle likes animals likes sea urchins and mollusks which have hard shells and has a hard beak to eat them with. But when does it get its strong bite?





Green sea turtles are more likely than loggerheads to ingest marine debris





Video footage shows that green sea turtles swallow marine debris at a higher rate than loggerhead sea turtles. Green turtles may have difficulty telling apart the debris from drifting algae, its prey, because of their similar shape and movement (Fukuoka et al., 2016).

Does swallowing debris kill sea turtles?

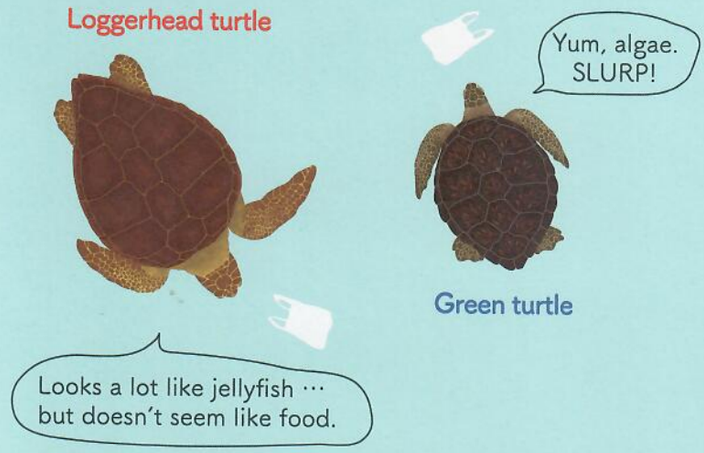
→ **No, not directly.**

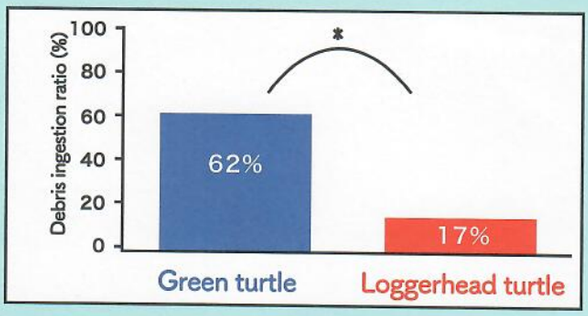
Sea turtles excrete human litter in the same way as small pieces of wood and other natural debris they consume.

But scientists point out indirect adverse effects—e.g., reduced food intake and accumulation of harmful substances.


Animals that live in the same area as sea turtles
スルメイカ
Japanese flying squid
ミンククジラ
Minke whale
クロマグロ
Pacific bluefin tuna
ヒラマサ
Yellowtail amberjack
サケ
Chum salmon
アオウミガメ
Green turtle
メカジキ
Swordfish
Opah
アカマンボウ
Ocean sunfish
マンボウ
ヤリイカ
Spear squid
ブリ
Japanese amberjack
ゴマサバ
Blue mackerel
マルソウダ
Bullet tuna
アカウミガメ
Loggerhead turtle
マアジ
Japanese jack mackerel
オサガメ
Leatherback turtle
Chub mackerel
マサバ

Green sea turtles are more likely than loggerheads to ingest marine debris





Video footage shows that green sea turtles swallow marine debris at a higher rate than loggerhead sea turtles. Green turtles may have difficulty telling apart the debris from drifting algae, its prey, because of their similar shape and movement (Fukuoka et al., 2016).

Does swallowing debris kill sea turtles?

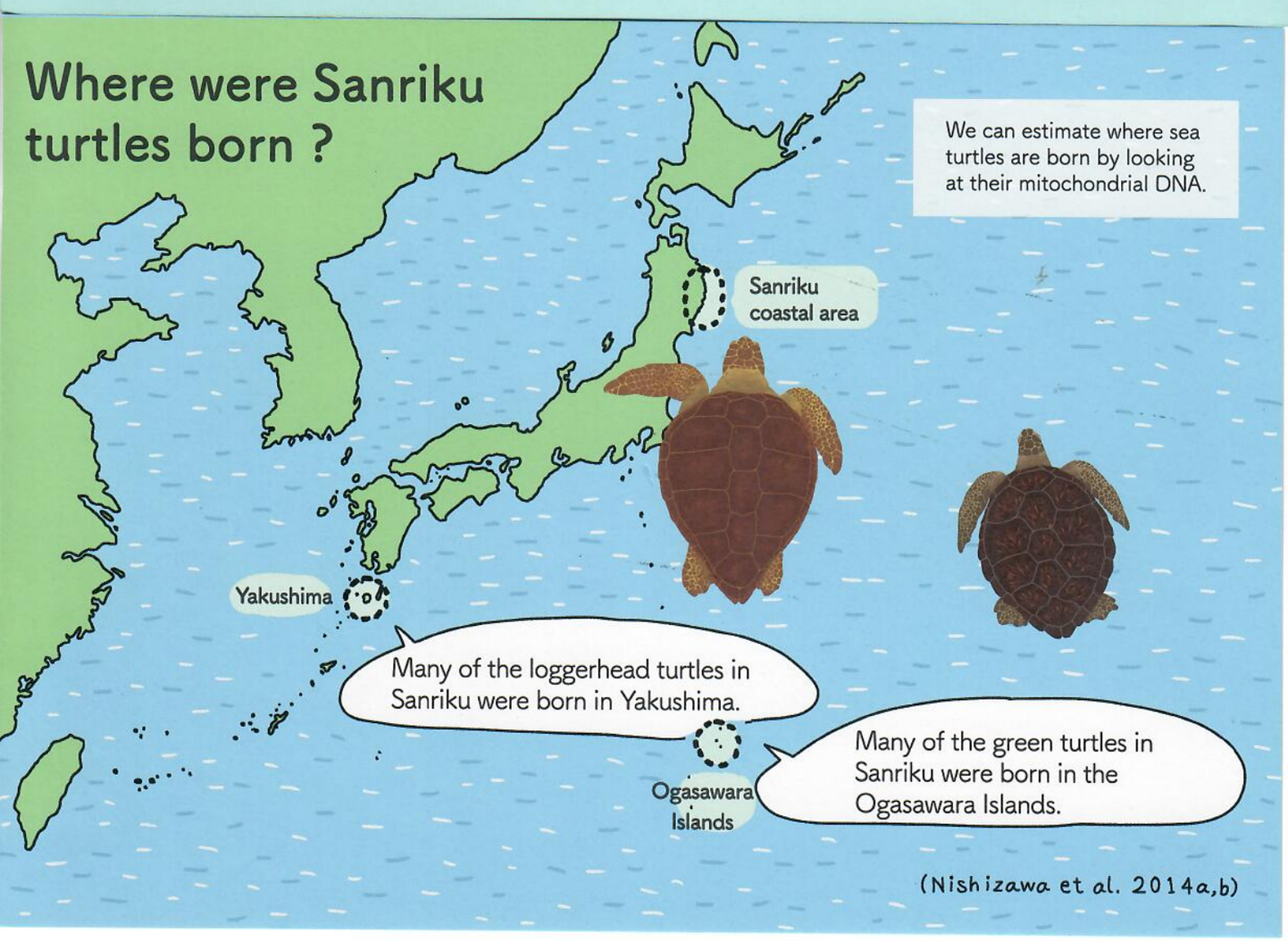
→ **No, not directly.**

Sea turtles excrete human litter in the same way as small pieces of wood and other natural debris they consume.

But scientists point out indirect adverse effects—e.g., reduced food intake and accumulation of harmful substances.

Where were Sanriku turtles born ?

We can estimate where sea turtles are born by looking at their mitochondrial DNA.



(Nishizawa et al. 2014a,b)

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