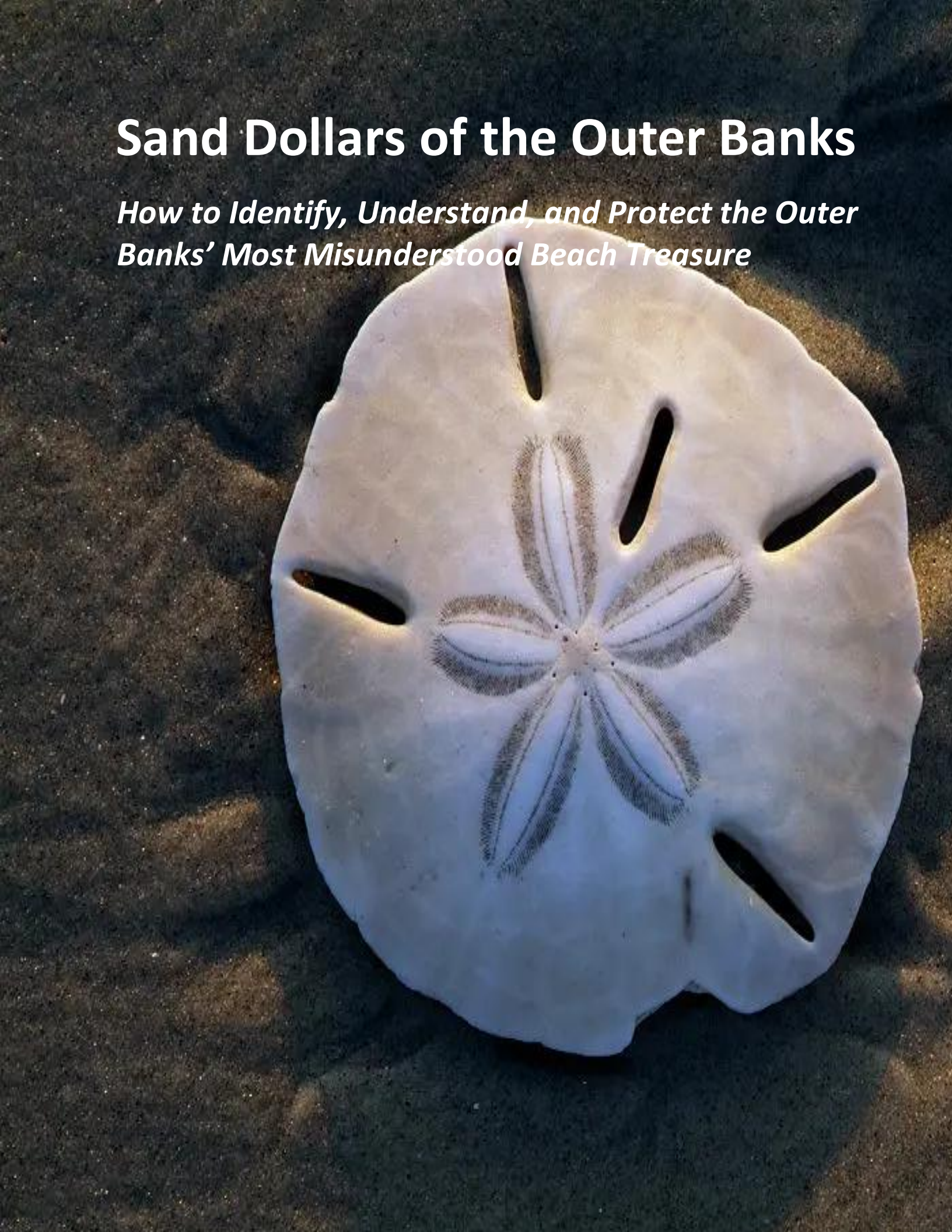
Sand Dollars of the Outer Banks

How to Identify, Understand, and Protect the Outer Banks' Most Misunderstood Beach Treasure



Forward

This pamphlet was created by the Outer Banks Coastal Conservation (OBCC), a nonprofit organization whose mission is to foster environmental stewardship and a deeper connection to the Outer Banks of North Carolina through outreach, education, and conservation efforts.

We believe that small stories can spark big change. That is why we have made this book available as a free resource for parents, teachers, and community members.

All materials in this pamphlet may be freely downloaded, shared, printed and used for educational or nonprofit purposes.

To learn more, access additional resources at: www.theobcc.org.

Introduction: What Exactly Is a Sand Dollar?

Sand dollars are flat, disk-shaped echinoderms, closely related to sea urchins and sea stars. The species most commonly found on the Outer Banks is the Keyhole Sand Dollar (*Mellita quinquiesperforata*).

Although they often wash ashore bleached white, sand dollars are living animals—not shells. Most spend their lives just offshore in sandy bottoms from Corolla to Ocracoke.

The Sand Dollar’s Life on the Outer Banks’ Seafloor

Habitat

Sand dollars thrive in:

- Shallow sandy bottoms just beyond the breakers
- Calm, protected zones within the surf
- Gently sloping beaches where tides bring in organic particles
- Areas with steady water flow, which helps them filter food

They rarely live directly on dry sand; live ones are usually found in the swash zone or shallow water.

How They Move

Sand dollars have:

- Tiny tube feet for oxygen exchange and subtle movement
- Hair-like spines that help them bury themselves

A unique ability to tilt upright during strong currents to avoid being rolled.

Recognizing a Live vs. Dead Sand Dollar

Live Sand Dollars

A living sand dollar will appear:

- **Brown, gray, or purplish**
- **Velvety to the touch**
- **Covered in tiny moving spines**
- **Sometimes "fuzzy" with a shifting texture**

A live sand dollar should never be removed from the beach—it is illegal in many states, and harmful everywhere.

Dead Sand Dollars

A dead sand dollar looks:

- **White, ivory, or pale beige**
- **Smooth and hard, with no moving spines**
- **Often patterned with the "dove shapes" inside**

These skeletons are safe and legal to collect on the Outer Banks.

What Sand Dollars Eat in the Outer Banks

Sand dollars are detritivores and micro-predators that help clean coastal ecosystems.

Main Diet Items

- **Microalgae**
- **Tiny crustaceans**
- **Diatoms**
- **Decaying organic material**
- **Small larvae floating in the water**
- **Plankton caught using their spines**

They use tube feet to pass food into a central mouth called Aristotle's Lantern, a set of five tiny jaws.

The Sand Dollar Life Cycle

Spawning

Sand dollars spawn offshore in warm months (May–September). They release:

- Eggs and sperm into the water
- Fertilization happens externally

Larval Stage

Larvae are:

- Microscopic
- Free-swimming
- Vulnerable to salinity drops, storms, and turbidity
- Carried by Outer Banks currents through Pamlico Sound and nearshore waters

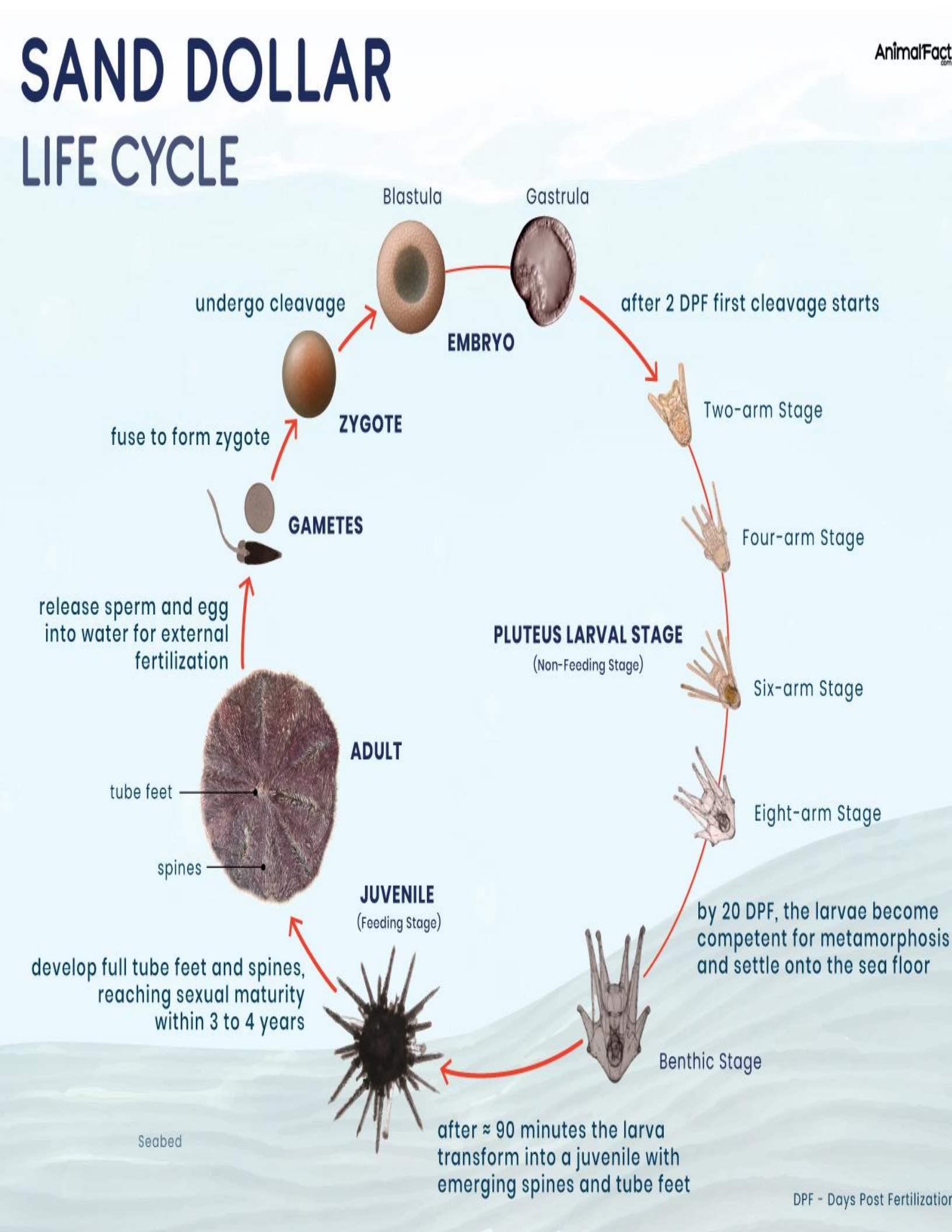
Juvenile & Adult Stages

Juveniles settle on sandy bottoms and begin feeding immediately. Adults can reach:

- 2.5–4 inches in diameter (Outer Banks average)
- Up to 10 years of age in ideal conditions

SAND DOLLAR
LIFE CYCLE

AnimalFact.com



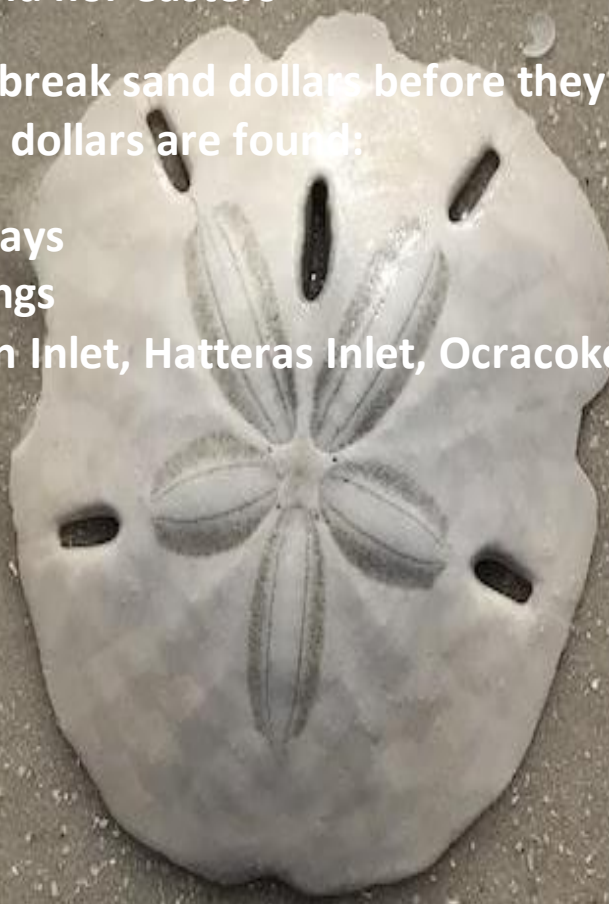
Why So Many Broken Sand Dollars on Outer Banks Beaches?

Outer Banks beaches have:

- **Strong surf energy**
- **Powerful longshore currents**
- **Frequent storms and nor'easters**

These conditions often break sand dollars before they wash up.
Most whole white sand dollars are found:

- **After quiet, calm days**
- **On low tide mornings**
- **Near inlets (Oregon Inlet, Hatteras Inlet, Ocracoke)**



Ecological Role in the Outer Banks

Sand dollars:

- **Filter large amounts of organic particles**
- **Improve water clarity**
- **Provide prey for:**
  - **Pufferfish**
  - **Sheepshead**
  - **Drum**
  - **Rays**
- **Help stabilize sandy sediments**
- **Serve as indicators of water quality and salinity balance**

A decline in sand dollar populations often signals:

- **Hypoxia (low oxygen)**
- **Turbidity from storms**
- **Freshwater intrusion**
- **Pollution**
- **Temperature stress**

Sand Dollar Hotspots in the Outer Banks

You're most likely to find them:

- **Ocracoke beaches (especially south of lifeguard stand)**
- **Cape Lookout National Seashore**
- **Hatteras Village beaches**
- **Pea Island National Wildlife Refuge**
- **Carova and Corolla after calm weather**

Caring for Sand Dollars at the Beach

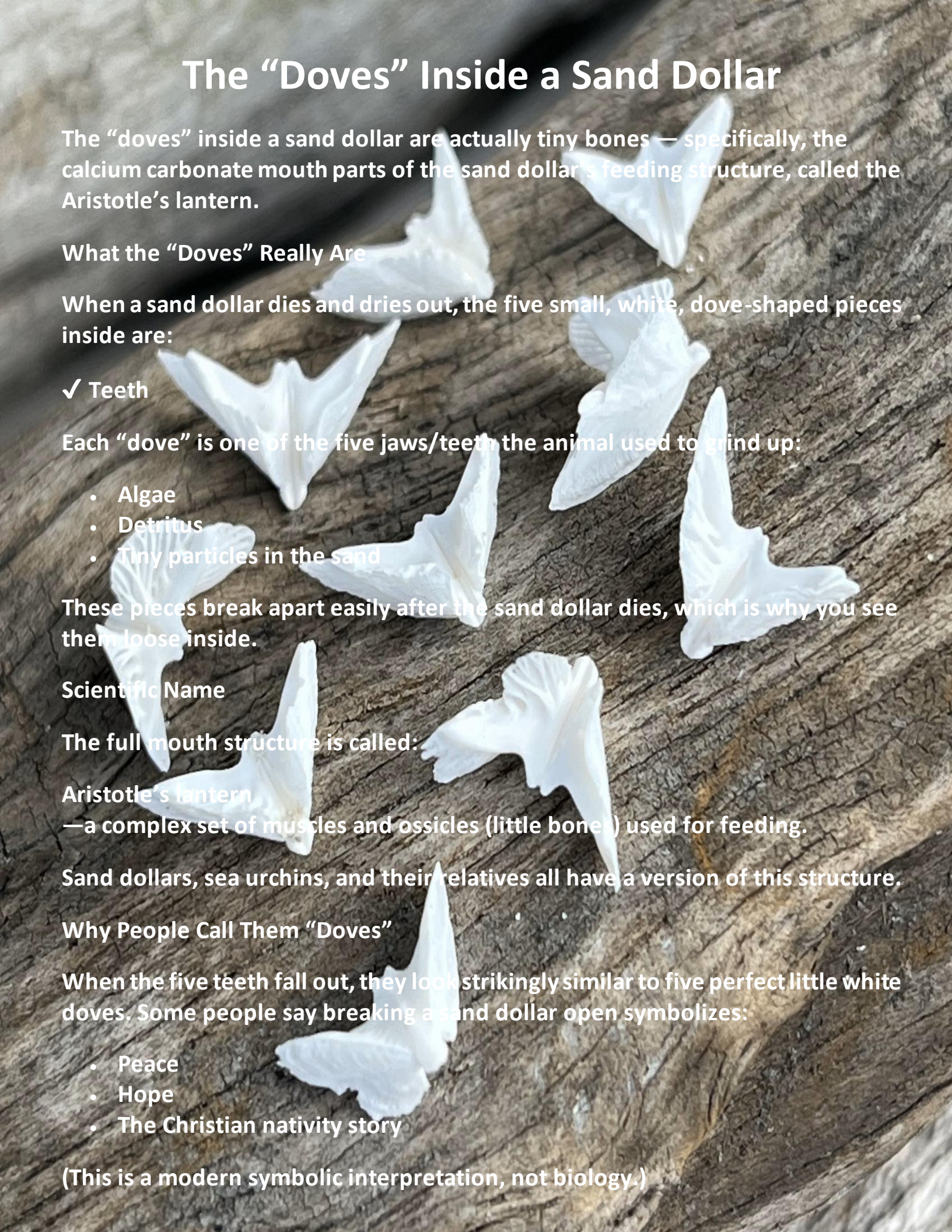
Do:

- Return live sand dollars gently to the water
- Teach children the “wiggle test” (if it moves, it lives)
- Photograph instead of collect
- Watch for groups—sand dollars often cluster together!

Do Not:

- Take live sand dollars
- Leave them exposed to sun
- Scrape spines off to “see the flower pattern” (this kills them)
- Disturb clusters—this stresses feeding adults

The “Doves” Inside a Sand Dollar



The “doves” inside a sand dollar are actually tiny bones — specifically, the calcium carbonate mouth parts of the sand dollar’s feeding structure, called the Aristotle’s lantern.

What the “Doves” Really Are

When a sand dollar dies and dries out, the five small, white, dove-shaped pieces inside are:

✓ Teeth

Each “dove” is one of the five jaws/teeth the animal used to grind up:

- Algae
- Detritus
- Tiny particles in the sand

These pieces break apart easily after the sand dollar dies, which is why you see them loose inside.

Scientific Name

The full mouth structure is called:

Aristotle’s lantern
—a complex set of muscles and ossicles (little bones) used for feeding.

Sand dollars, sea urchins, and their relatives all have a version of this structure.

Why People Call Them “Doves”

When the five teeth fall out, they look strikingly similar to five perfect little white doves. Some people say breaking a sand dollar open symbolizes:

- Peace
- Hope
- The Christian nativity story

(This is a modern symbolic interpretation, not biology.)

What is the Star/Flower Pattern on the Sand Dollar?

The *"diagram"* on a sand dollar is the petaloid pattern — a natural design made by the animal's internal structure and tiny breathing tubes. Each part has a biological meaning, and some parts have inspired myths and folklore. Here's what it actually represents:

The Star / Flower Pattern (Petaloids)

The five "petals" are petaloids, and they are *not decorative*.
They are specialized areas where the sand dollar has:

- Tube feet used for breathing
- Gas exchange channels
- Internal ambulacral system beneath the surface

These petals show where the animal's respiratory system is concentrated.

The Shape: A Five-Part Body Plan

Sand dollars are echinoderms (relatives of sea stars).
Their whole body is based on fivefold (pentamerous) symmetry.

The petal pattern reflects this evolutionary design.

The Keyholes / Slits

Some species have oval slits or "keyholes." These are lunules, which help:

- Reduce lift from waves
- Prevent the sand dollar from being flipped
- Allow water to pass through during strong currents

This inspired folklore about peace, doves, and coins — but they're really part of the feeding mechanism.

The diagram on a sand dollar is:

- A breathing system (petaloids)
- An expression of the animal's fivefold symmetry
- Sometimes wave-adaptation structures (lunules)
- And *not* for decoration — it's functional anatomy

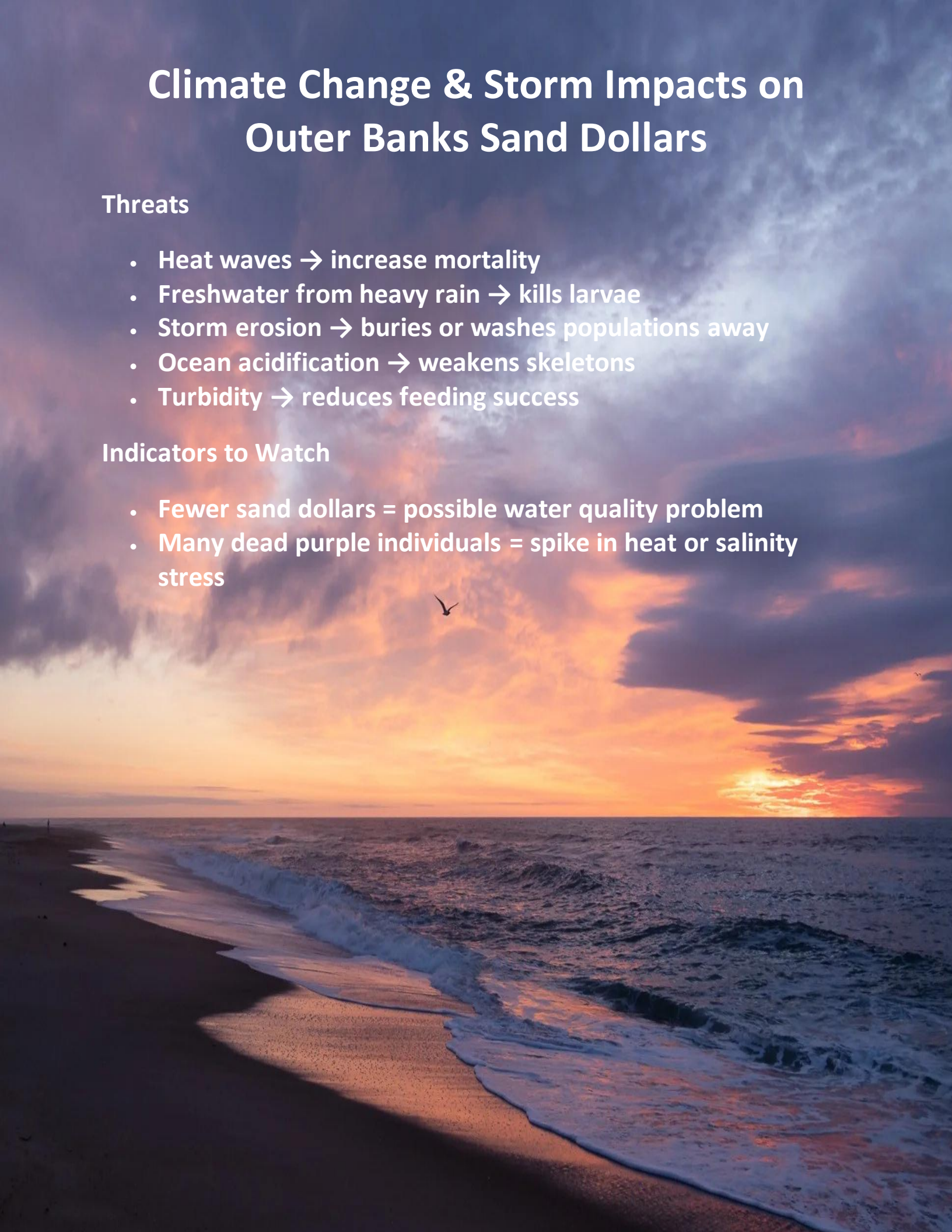
Climate Change & Storm Impacts on Outer Banks Sand Dollars

Threats

- Heat waves → increase mortality
- Freshwater from heavy rain → kills larvae
- Storm erosion → buries or washes populations away
- Ocean acidification → weakens skeletons
- Turbidity → reduces feeding success

Indicators to Watch

- Fewer sand dollars = possible water quality problem
- Many dead purple individuals = spike in heat or salinity stress

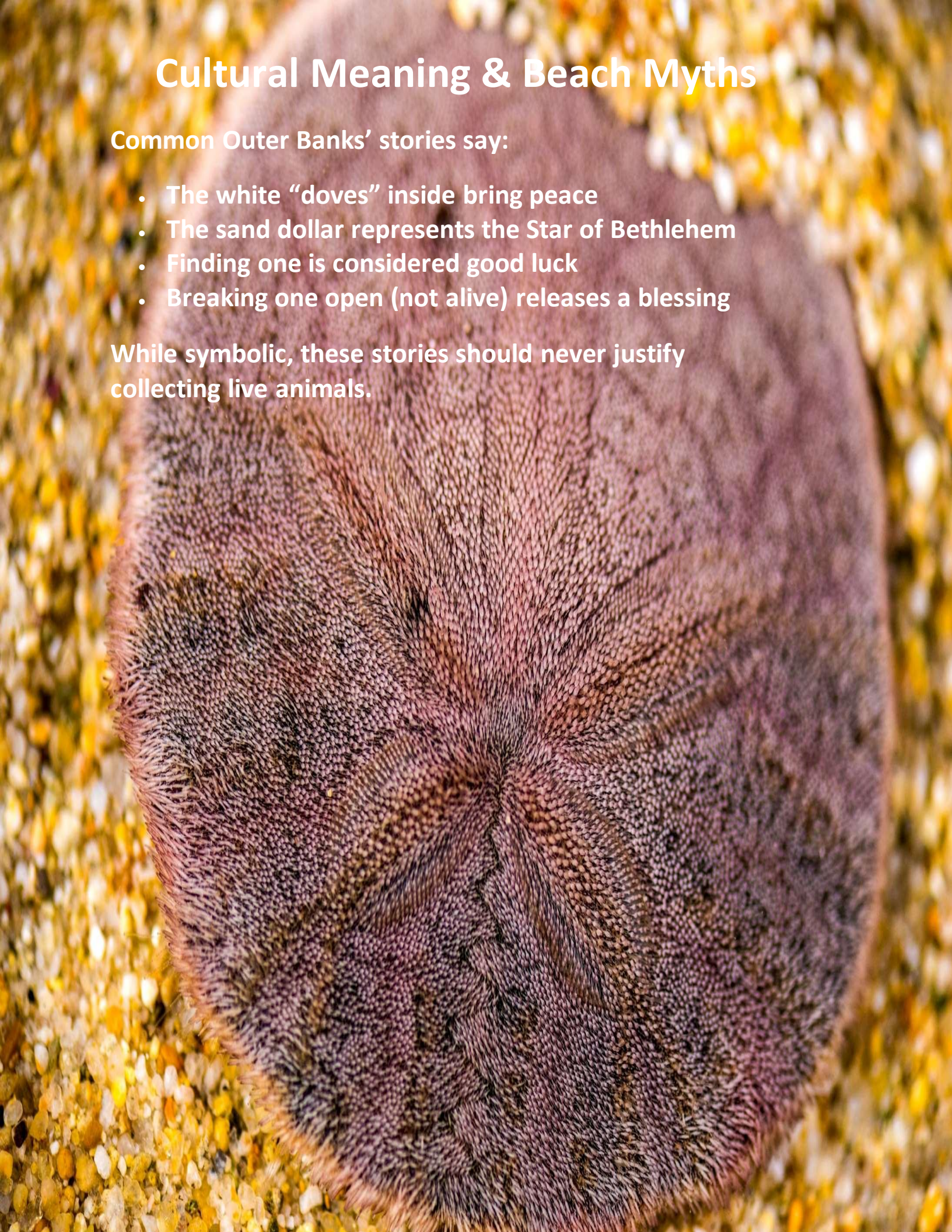


Cultural Meaning & Beach Myths

Common Outer Banks' stories say:

- The white "doves" inside bring peace
- The sand dollar represents the Star of Bethlehem
- Finding one is considered good luck
- Breaking one open (not alive) releases a blessing

While symbolic, these stories should never justify collecting live animals.



Did You Know?

- A live sand dollar can move 15 feet per hour using tiny spines.
- The “flower” on the top is made of breathing pores, not decoration.
- Sand dollars “talk” in a way—they release chemical signals to warn others of predators.
- Outer Banks sand dollars can clone themselves as larvae when predators are near.
- If buried too deep during storms, sand dollars can slow their metabolism to survive low oxygen.

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