**Episode: Changing Sands**

**Chapter 2 (0:00–3:21)**

1. Barrier islands have been moving in response to sea level changes for at least ____________ years.
   \(18,000\text{–}20,000\).

2. Barrier islands move in response to high-energy ____________.
   Storms.

3. Where are barrier islands most affected by storms?
   The front side, where storms have the most energy.

**Chapter 3 (3:21–9:41)**

4. How much lower was sea level 18,000 years ago? Why do you think sea level was lower then?
   \(425\) feet; water was held in ice caps.

5. How old are the Outer Banks?
   The oldest dated layers are about 3,500 years old.

6. What have scientists been able to learn about the Outer Banks by using the technique “optically stimulated bioluminescence”?
   They have learned when grains of sand were last exposed to sunlight; from that, they can estimate the age of the islands.

7. Age vs. Sea Level. Fill in the chart below:

<table>
<thead>
<tr>
<th>Age (years ago)</th>
<th>Sea Level (feet below present)</th>
<th>Major Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,000</td>
<td>-450</td>
<td>Last ice age occurs; North Carolina shoreline is many miles to the east of present location.</td>
</tr>
<tr>
<td>7,000</td>
<td>-40 to 50</td>
<td>No barrier islands; rising sea level floods Pamlico Creek and creates narrow estuaries.</td>
</tr>
<tr>
<td>4,000</td>
<td>-15</td>
<td>Estuaries continue to flood and become wider. Pamlico Creek becomes Pamlico Bay, separated from land by a long, sandy peninsula.</td>
</tr>
<tr>
<td>2,500</td>
<td>0</td>
<td>Barrier islands (Outer Banks) form (a little farther out from where they are now). Islands are very similar to how they appear today.</td>
</tr>
<tr>
<td>500</td>
<td>0</td>
<td>Barrier islands are similar to today’s, but there are many more inlets.</td>
</tr>
</tbody>
</table>
8. Within each parenthetical phrase, circle the boldfaced word that correctly describes the changes you would notice when comparing North Carolina’s modern maps to maps created 7,000 years ago.
   Rising; development; wide

9. Ocracoke Inlet has remained in the same location for the past ____________ years.
   2,500 years.

**CHAPTER 4 (9:41–15:59)**

10. List some traits of simple and complex barrier islands.
   Some possible answers:
   Simple islands: Narrow, little sand supply, dominated by inlets and overwash, migrate readily.
   Complex islands: Wider, higher-profile, large sand supply, more stable.

11. Did early settlers live on simple islands or complex islands?
    Complex.

12. When did people begin to build on simple barrier islands?
    In the 1930s, when tourism grew and artificial structures (e.g., bridges and highways) became common.


13. Why does Dr. Stephen Culver say that the maps drawn by the first European settlers support the idea that barrier islands are dynamic?
    The old maps show many inlets that don’t exist today.

14. What does it mean to “harden” the shoreline?
    To build solid structures such as bulkheads or jetties to “hold back” the ocean.

15. What tends to happen to the beach when hard structures are built?
    The physical dynamics of the shoreline change, so sand and beaches are lost.

16. Beach nourishment is the process of supplementing sand on the front side of barrier islands with sand from other sources. What are the problems with this?
    Some possible answers: Sand is usually taken from the continental shelf, where it is both difficult and expensive to find; beach nourishment is very expensive, and the federal government is no longer subsidizing it.

17. What changes do Dr. Culver and Dr. Riggs think would help minimize the effect of development on barrier islands?
    Improving the ferry system, which would allow tourism to continue and grow as the islands change and move; leaving cars on the mainland and using alternative forms of transportation (e.g., golf carts) on the islands.

18. Which North Carolina island is mentioned as a model for using barrier islands sustainably?
    Bald Head Island.