Unit 1: History of Oceanography & Marine Research
Unit 1 Learning Goal:

I will understand the history, technology, and scientific processes involved in Marine Science.
Lesson 1.1:

History of Ocean Research

*Refer to Chapter 2 in your Textbook
Lesson 1.1 Learning Targets:

1. Explain the major influences on the history of oceanography and marine research.
2. Determine a location from a given latitude & longitude.
Ancient Exploration:

- Earliest recorded sea voyage took place around **3200 B.C. in Egypt** using hieroglyphics.
Ancient Exploration:

- North Star = **Phoenician Star** used for navigation around the Mediterranean
Ancient Exploration:

- **Polynesians** were the 1st to travel long distances beyond land in canoes = “seafaring” (2000 – 500 B.C.)
Ancient Exploration:

- **Ancient Greeks: (450 – 150 B.C.)**
  - **Pytheas** predicted tides using phases of the moon
  - **Eratosthenes** invented the 1st map with latitude & longitude
Latitude & Longitude

- **Latitude:**
  - Runs parallel to the equator & measures **N – S**
  - 0° is the **equator**
  - 90° is at the N & S poles

- **Longitude:**
  - Runs pole-to-pole & measures **E – W**
  - 0° is called the **prime meridian** in Greenwich, England
The Middle Ages (500 A.D. – 1400’s)

- **Chinese** invented the **magnetic compass** (1125)
- **Europe** didn’t do much seafaring during the middle ages
The Renaissance (1400’s – 1700)

- The Renaissance “to be born again” brought ocean exploration back to Europe in the 1400’s
Major Expeditions

- 1492 Christopher Columbus voyage to the Caribbean
- 1497 Vasco de Gama sailed around Africa to India
- Early 1500’s Vasco Nunez de Balboa crossed the Isthmus of Panama in Central America to discover the Pacific Ocean
- 1522 Ferdinand Magellan sailed across the Pacific to discover the Philippine Islands
- 1577 Francis Drake sailed from England to the tip of South America
The Enlightenment (1700-1800)

- The Enlightenment period changed ocean exploration from primarily trade and military to science and research in the 1700’s
- The chronometer was invented by John Harrison which allowed sailors to determine their exact longitude and travel longer distances
Major Expeditions *READ ONLY

- Captain James Cook (1768):
  - 1\textsuperscript{st} voyage sailed from England to Tahiti, New Zealand, and Australia
  - 2\textsuperscript{nd} voyage to Southern tip of Africa and Antarctic circle, but never found Antarctica
  - 3\textsuperscript{rd} voyage to Hawaii & the Bering strait
Major Expeditions

- Charles Darwin HMS Beagle (1831)
  - Coastline of South America, through the South Pacific, to the Southern tip of Africa
Industrial Revolution (1800’s)

- **US Exploring Expedition** (1836)
  - Charles Wilkes spent 4 years exploring the Southern Ocean; mapping and gathering specimen (plants & animals)
Industrial Revolution

- **Matthew Maury** “Father of Physical Oceanography” published *The Physical Geography of the Sea* in (1855) after collecting data from the Navy on winds, temps, and currents.
Industrial Revolution

- **HMS Challenger I**
  - 1st expedition dedicated entirely to marine science in **1872**
  - 2 Major Scientists = [Charles Wyville Thompson & Sir John Murray](#)
  - Documented temperature, currents, weather, water quality, depth, marine organisms, and sediment samples
Industrial Revolution

- HMS Challenger I
Lesson 1.2:
Modern Ocean Research—Submersibles
Learning Goals:

1. I can describe the major advancements of research in oceanography over time.
2. I can compare & contrast the 3 different types of marine submersibles.
Ocean Explosion

• Inventions during the 1900’s:
  • Steal/iron ships with engines
  • Echo sounding mapping
  • Submersibles
  • Self-contained diving
  • ROV’s/AUV’s
  • Electronic navigation & Satellites
Ocean Explosion

- **The German *Meteor* (1925)**
  - Primary accomplishment was mapping the Atlantic ocean floor using echo sounding technology
  - (Crossed the Atlantic ocean 14 times in 2 years)
Ocean Explosion

- **U.S. Atlantis** (1931)
  - Confirmed the existence of a mid-ocean ridge = underwater mountain chain
  (NASA named a shuttle after its accomplishments!)
Ocean Explosion

- **HMS Challenger II** (1951)
  - Used echo sounding to map the depth of the Pacific & Indian Oceans
  - Discovered the deepest part of the ocean in the **Mariana’s Trench**
    - 10,914 meters / ~7 miles
Submersibles

- **Bathysphere** (1932)
  - William Beebe & Otis Barton
  - Steel ball with a window
  - Oxygen circulating system
  - Attached to a cable from a ship
  - Only went up & down
Submersibles

- **Bathyscaphes**
  - Similar to bathysphere, but not attached to a ship
  - Instead has a float that contains a liquid that is buoyant in water (ex. gasoline), & heavy ballast water to move up and down
  - Small motor to move side to side (though very limited)
• **Bathyscaphes**
  • *Trieste 1960*
    • The one and only time the Challenger Deep (deepest part of the ocean in the Mariana’s Trench) was ever visited by man****
    • Claim to have seen a fish, jellyfish, and shrimp
Submersibles

BATHYSCAPHE

access to the bridge
propeller
towing fair lead
rudder
metal hull
observation light

navigation porthole
Cabin (sphere)
observation porthole
Submersibles

- **Deep Diving Submarine**
  - Large variety of shapes & sizes
  - Move both vertically & horizontally
  - Some have robotic arms to grasp samples or perform experiments outside the submersible
  - Most current & technologically advanced
Submersibles

- **Deep Diving Submarine**
  - ***UNTIL NOW!***
  - James Cameron 2012
  - Updates since the *Trieste*:
    - Color pictures & videos
    - Collected samples
Lesson 1.3:
Modern Ocean Research Continued- SCUBA

*Refer to Chapter 2 in your Textbook
Learning Goals:

1. Describe the advantages and disadvantages of submersibles & SCUBA.
2. Explain the medical aspects involved with SCUBA.
3. Describe the major technological advances in ocean navigation.
Self-Contained Diving

- **Hard-Hat Helmet Diving:**
  - **Augustus Siebe** (1840)
  - Used for underwater labor & **walking** on the ocean floor
  - **Heavy** and limited in movement (cannot tip)
Self-Contained Diving

  - Henry Fleuss 1878
    - 1st working SCUBA
    - Used **pure oxygen**, cannot go beyond 10 meters because the oxygen becomes **toxic**, so quickly stopped using
Self-Contained Diving

- **SCUBA**
  - **Jacques Cousteau 1943**
    - 1st SCUBA with compressed air
      (Air = 78% N, 20% O)
    - Safer & allowed for longer, deeper dives with greater range of movement
  - Still used **today**!
Diving Equipment:

- **Mask** (covers eyes & nose)
- **Fins** (kick more efficient, go further)
- **Snorkel** (used for surface breathing)
- **Wetsuit** (controls your body temp)
- **Tank** (contains compressed air)
- **Weights/belt** (helps you sink)
- **Buoyancy control device (BCD):** inflates & deflates to allow you to ascend and descend
- **Regulator:** delivers the air from your tank to your mouth
- **SPG gage:** tells you depth, pressure, how much air is left in your tank, & other info
Medical Aspects to Scuba

• **Temperature:**
  • **Hypothermia**: body drops below normal temperature
  • Dive suits keep you warmer

• **Endurance:**
  • Requires a lot of effort to move in the water resulting in **fatigue**
  • **Pace** yourself!
Medical Aspects to Scuba

**Breathing:**
- **Hypoxia**: lack of proper oxygen to the body
- **Salt Water Aspiration Syndrome**: salt water in lungs
- Check gages to ensure they work properly and check gas levels frequently

**Pressure:**
- **Decompression Sickness** “The Bends”
  - Caused by your body absorbing excess gas bubbles in your tissues
  - Results vertigo (dizziness), joint and breathing problems
  - Must come to the surface slowly in stages called “decompression stops” where you must **equalize the pressure**
## Submersibles VS Scuba

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<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Submersibles</td>
<td>• Greater depth</td>
<td>• High Cost</td>
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<tr>
<td></td>
<td>• Long duration</td>
<td>• Large size</td>
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<tr>
<td>Scuba</td>
<td>• Accessibility</td>
<td>• Limited depth</td>
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<tr>
<td></td>
<td>• Portable</td>
<td>• Short duration</td>
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<tr>
<td></td>
<td>• Lower cost</td>
<td>• Medical aspects</td>
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ROV’s

- **Remote Operated Vehicle** (1970’s)
  - Small, *unmanned* submarine with propellers and a video camera
  - Some have robotic arms, claws, or other tools
  - Attached to a cord, controlled from ship
AUV’s

- **Autonomous Underwater Vehicle** (1980’s)
  - Similar to a ROV, but is not attached to a cord on a ship, swims freely by controls
  - Must be **pre-programmed** with location/path
Electronic Navigation

- 1st system was called **LORAN** (Long Range Navigation)
  - Transmitters in **different countries** to provide a more accurate location
- **GPS** (Global Positioning System)
  - Similar to LORAN, but with **satellites orbiting the earth**