Drifting with the R/V Yaquina

INTRODUCTION:

Ocean currents are important to us in many ways. Currents influence climate, marine shipping, and the distribution of fish and other marine life. How are currents studied?

Scientists use drift bottles and buoys to measure ocean currents. The original drift bottles were simply glass bottles with a message placed inside and sealed with a cork or stopper. These glass bottles have been largely replaced by plastic disks or other devices with the message engraved on the surface. In this activity you will use actual drift-bottle data gathered on a cruise aboard the research vessel, **R/V Yaquina**, off the Oregon coast in November, 1970. You will use this data to determine the speed and direction of surface currents.

Since you can't paint an "X" on the surface of the ocean, how can you locate the starting points for the drift bottles? We use the stars and sun to tell us our position in terms of **latitude** and **longitude**.

What are **latitude** and **longitude**? To measure the location of points on the Earth's surface, imaginary lines have been drawn over the Earth. The evenly spaced latitude lines tell us the distance North or South of the **equator** (the imaginary line around Earth located halfway between the North and South poles). The longitude lines tell us the East and West distances. The East-West distances are referenced to the **prime meridian** (the imaginary line around Earth that runs from pole to pole through Greenwich, England). These longitude lines converge (come together) at the poles.

MATERIALS:

-Ruler
-Pencil
-Drift Bottle Data Sheet (attached)
-Drift Map (attached)

PROCEDURE:

1. Using the data provided on the "Drift Bottle Data Sheet" plot the course of each of the 12 drift bottles released by the R/V Yaquina by:
    a. Locating the release and return positions and marking them on your map.
    b. Connecting the release point to the return point using a ruler. (*NOTE: Since no visual observation is made of a drift bottle after it is released, it is impossible to draw the actual course the bottle follows. For this activity, we will assume that the bottle travels in a straight line from the point of release to the point of return.)* Mark this line with the number of the drift bottle.

2. From the information you have plotted on your map, determine the total distance each of the 12 bottles traveled in degrees by:
    a. Measuring the length of the line from the point of release to the point of return in centimeters using a ruler.
    b. Next, lay your ruler along the vertical axis (latitude) of your map and note how many degrees of latitude (in minutes)correspond to your measured distance in centimeters. *(For example: if bottle number 13 traveled 3.5 centimeters you would lay the ruler against the latitude lines and see that 3.5 centimeters equals the distance from 43 degrees to 44 degrees one degree of latitude or 60 minutes of latitude.)* Record this data in minutes on your data table.

Latitude is measured in degrees → each degree is subdivided into 60 minutes → each minute can be divided into 60 seconds

3. Calculate the number of nautical miles traveled by each bottle. You can do this by knowing that a minute of latitude equals one nautical mile. Add this data to your data table.

4. Calculate the number of kilometers traveled by each bottle. One minute of latitude equals 1.852 kilometers. Add this data to your data table.

5. Compute the speed of each drift bottle in nautical miles per hour (knots). Remember that there are 24 hours in a day! Add this data to your data table.

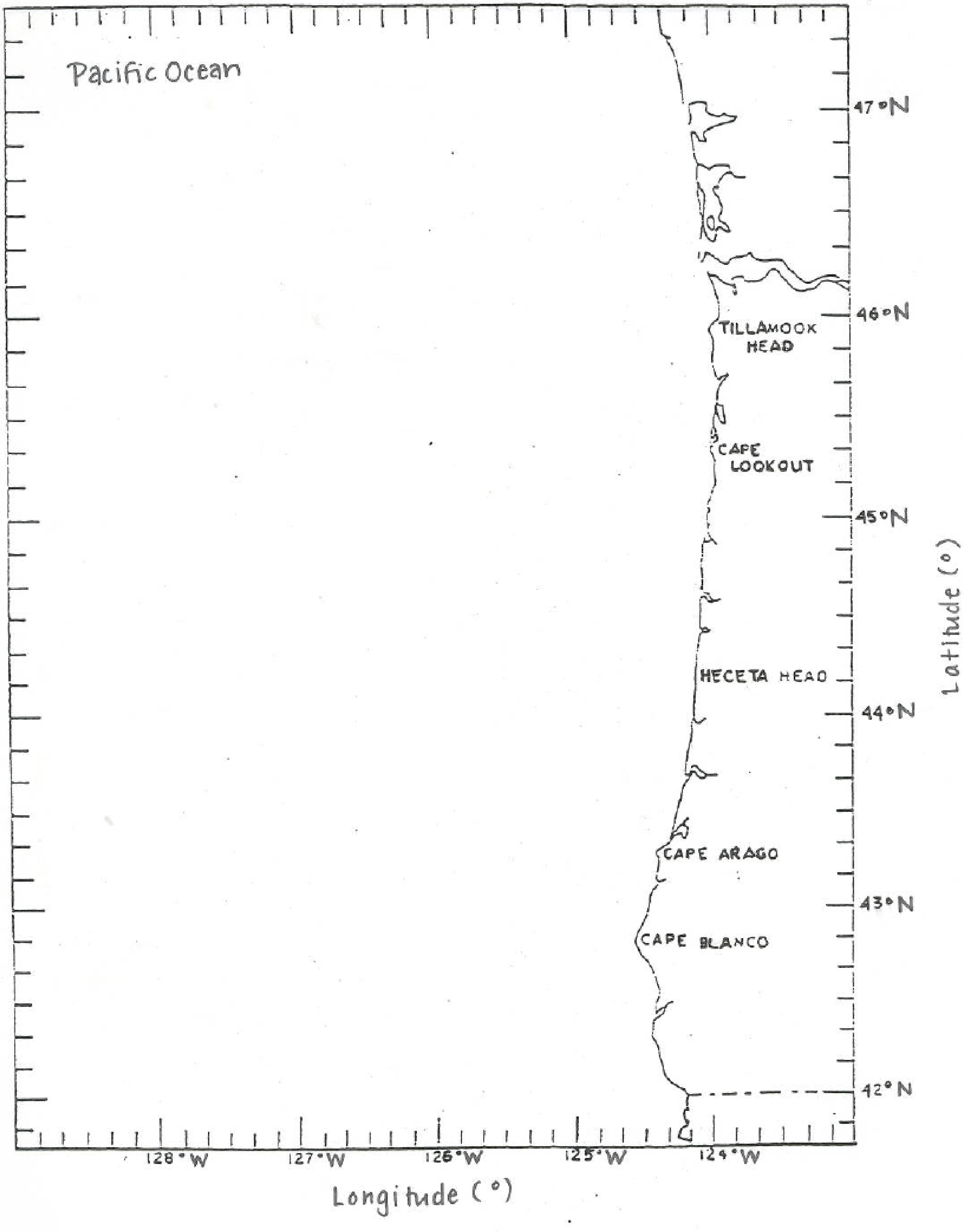
RESULTS AND ANALYSIS:

1. Which bottle traveled the greatest distance?
2. Which bottle had the slowest speed?
3. Which bottle made the greatest change in latitude? What was this change in degrees? In nautical miles?
4. One might expect that the further from the shore one dropped his/her drift bottle, the further North or South it would drift. Does the data from the **R/V Yaquina** support this generalization?
5. We have assumed that the drift bottles moved in a straight line. Is this a reasonable assumption?
6. Electronic technology will now allow us to put a small radio transmitter in our drift bottles. How might this breakthrough help us in plotting the currents?
7. Does the distance from shore at which bottles are released have any effect on where they are found? How do you know?
8. Do all the currents off the Oregon coast run in the same direction? Add arrows to your map showing whether the currents move North or South.
9. The data used was gathered in November. Do you think data gathered at other times of the year would be the same? Explain.

D R I F T B O T T L E D A T A S H E E T

Cruise Y7011B R/V Yaquina, November 19 – 21, 1970

Bottle Number	Release Position		Return Position		Distance traveled (minutes of latitude)	Distance traveled (nautical miles)	Days Out	Total Hours Out	Speed (nautical miles/ hour OR knots)
	Latitude North	Longitude West	Latitude North	Longitude West					
1. 21913	44° 39’	124° 11’	46° 43’	124° 06’			22.0		
2. 21915	44° 39’	124° 11’	45° 32’	123° 58’			8.0		
3. 21722	44° 39’	124° 25’	46° 53’	124° 08’			13.0		
4. 20675	44° 39’	124° 39’	45° 53’	123° 58’			11.0		
5. 20865	44° 39’	126° 03’	46° 03’	123° 56’			51.0		
6. 20869	44° 39’	126° 03’	43° 08’	124° 24’			105.0		
7. 20764	44° 39’	126° 59’	47° 11’	124° 14’			61.0		
8. 20767	44° 39’	126° 59’	43° 58’	124° 08’			54.0		
9. 20770	44° 39’	126° 59’	44° 18’	124° 06’			51.0		
10. 20772	44° 39’	126° 59’	43° 43’	124° 12’			54.0		
11. 20781	44° 39’	127° 27’	46° 28’	124° 04’			70.0		
12. 20783	44° 39’	127° 27’	45° 23’	123° 59’			96.0		


Pacific Ocean
47°N
46°N
TILLAMOOK HEAD
CAPE LOOKOUT
45°N
HECETA HEAD
44°N
CAPE ARAGO
43°N
CAPE BLANCO
42°N
Latitude (°)
128°W
127°W
126°W
125°W
124°W
Longitude (°)

*1° = 60 minutes