

# PREDICTING SALMON HATCH

*Students calculate accumulated thermal units using temperature data and math to predict when eggs will hatch in their tanks.*

**STANDARDS**  
Environment & Sustainability  
Life Science

**THEME**  
Salmon

**GRADES**  
4 - 12

## LEARNING OBJECTIVES

- To understand what accumulated thermal units are and how fish hatcheries use them to gauge egg development.
- To apply math to real-world problem-solving.
- To understand temperature as one environmental factor contributing to biological function.
- To appreciate that inexact methodology can be a useful tool in the study of biology.
- To gain experience in gathering specific data in a specific way.

## PREPARATION

1. Begin this lesson as soon as eyed salmon eggs are in your tank.
2. Ask hatchery staff (or whoever delivered your eggs) to give you **fertilization date** and **total ATUs** on the day your eggs left the hatchery.
3. Decide if this study will involve everyone in your class or just a team of monitors.
4. Make a copy of "About Accumulated Thermal Units" for each participating student.
5. Make a copy of the ATU calendar page to post by the tank.
6. Go over the handout with participating students.
7. Make estimates for weekends.

## CONDUCTING THE STUDY

1. Engage students in deciding what time of day to take temperature readings and how to schedule monitors.
2. Fill in the information at the top of the ATU calendar page.
3. Walk your students through recording one day's worth of data.
4. Spot check student math in calculating ATUs.
5. Engage students in predicting when the first eggs will hatch and when all viable eggs will finish hatching.
6. Walk students through their data and what conclusions they can make based on it.
7. Engage students in evaluating what worked well and what could be improved.

## OPTIONS

- Continue this study to predict when the first alevin will "button up" and become fry.
- After one week, ask all students to use the chart on the handout to predict on a slip of paper when eggs will have accumulated enough thermal units to start hatching. Deposit the slips in a box and examine afterwards to see who came the closest.



## ABOUT ACCUMULATED THERMAL UNITS

Temperature affects everything from the rate at which salmon eggs develop to the amount of feed that fry require and the amount of dissolved oxygen that water will hold. Accumulated thermal units (ATUs) are one way to measure temperature.

### What is an ATU

As measured in Fahrenheit, the daily ATU is water temperature minus 32. For example, if the first day of incubation occurred when the water was 45°F, the calculation would be  $45 - 32 = 13$ .

Hatcheries use ATU measurements to predict date of hatch and date when alevins will "button up" to become fry. In a creek or river, other environmental factors such as oxygen level and water flow also influence the speed of development. In a controlled environment, however, temperature is usually the only variable.

### How to measure ATUs in Fahrenheit

Charting water temperature and adding each day's reading to the sum of readings from preceding days is a simple way to document ATUs:

1. Take the temperature at approximately the same time each day and from the same part of the tank. This discipline will guard against readings not representative of the whole tank and differences that can occur over a 24-hour period.
2. If using a thermometer not mounted in the tank, leave the thermometer submerged until the column of mercury (if using this type) has stabilized. If possible, kept the bulb submerged as you read the temperature OR read the temperature the instant you remove the bulb from the water so that it's not affected by air temperature.
3. Enter the temperature reading on the ATU chart and subtract 32.
4. Add the new daily ATU to the ATU total from the day before.

### What does the reading indicate?

During incubation, documenting temperature may seem to be boring work. The information becomes more interesting, however, as the days pass and ATUs begin to near the total at which hatching and then "buttoning up" might occur. The following chart shows ATU readings at which salmon species can be expected to reach these stages. Unusually warm or cold water (say from a brief equipment problem) might cause your experience to vary, but under normal conditions, this chart is reliable.

ATUs REQUIRED FOR SALMONIDS TO REACH DEVELOPMENTAL STAGES			
SPECIES	STAGE	ATUs in °C	ATUs in °F
CHINOOK SALMON	To hatch	480-540	860-970
	To button up	900-1000	1620-1800
CHUM SALMON	To hatch	475-525	860-950
	To button up	900-1000	1620-1800
COHO SALMON	To hatch	400-500	720-900
	To button up	700-800	1260-1440
PINK SALMON	To hatch	550-650	990-1170
	To button up	900-950	1620-1710
SOCKEYE SALMON	To hatch	500-550	900-990
	To button up	900-1000	1620-1800