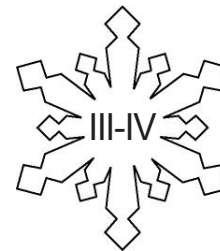


# Sea Ice: Cracking the Egg Code \_\_\_\_\_

Levels



Grades 5-8

## Overview:

In this lesson, students learn about the egg code, an international way of describing sea ice. The egg code describes the size of sea ice floes in an area, as well as the thickness, extent and concentration of the ice. It is called the egg code because of its oval shape.

## Objectives:

The student will:

- determine sea ice thickness, concentration and floe size by reading egg codes;
- create an egg code for an area of sea ice; and
- determine nearby sea ice conditions.

## GLEs Addressed:

### *Math*

- [6] MEA-6 The student uses measurement techniques by converting and using equivalent measurements within the same system.
- [9] MEA-1 The student demonstrates understanding of measurable attributes by estimating or converting measurements between the English and metric systems in real-world applications, given a conversion factor (e.g., miles/kilometers) (M2.4.2).
- [7] E&C-5 The student accurately solves problems (including real-world situations) involving converting between equivalent fractions, terminating decimals, or percents ( $10\% = 1/10 = 0.1$ ) (M3.3.5).
- [8] E&C-4 The student accurately solves problems (including real-world situations) involving converting between equivalent fractions, decimals, or percents (M3.3.5).

## Overview:

Sea ice can be a problem for ships trying to cut a path through cold seas. Large icebreakers can force their way through almost any ice conditions, but even large ships travel easier when captains can find the lightest ice along their route. To make traveling through ice easier, ship captains use ice information produced by government ice experts. This information is in a form known as the “egg code.”

The egg code is a diagram named for its shape. Into different sections of an oval, people who study ice conditions insert numbers that represent local ice conditions. The numbers in the egg code, inserted by people who look at satellite images from above, represent the thickness, type, size, and concentration of the sea ice. Technicians print ice-code ovals on top of ice maps, and captains use the egg code to avoid thick ice and find the best way to get where they’re going. Egg codes are also used for lake ice in large bodies of fresh water.

## Materials:

- Internet access
- Tape
- Scissors
- STUDENT WORKSHEET: “Cracking the Egg Code”
- STUDENT INFORMATION SHEET: “Egg Code Cards” (2 pages)
- STUDENT INFORMATION SHEET: “Egg Code Game” (3 pages)
- OVERHEAD: “Cracking the Egg Code”

*(Download from the Classroom Lessons page of <http://www.ArcticClimateModeling.org>)*

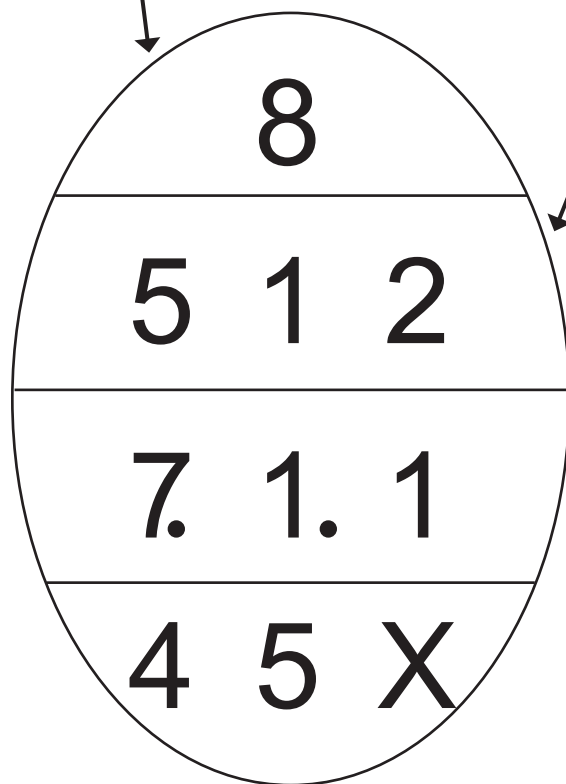
## Activity Preparation:

During this activity, students play a card game to help them understand the egg code, which is an international way of describing sea ice. Students can play the “Egg Code Game” in groups of 2 to 4. Each group will need one set of cards (2 pages), and one STUDENT INFORMATION SHEET: “Egg Code Game.” Copy the STUDENT INFORMATION SHEETS to compile a game packet for each group.

## Activity Procedure:

1. Explain that scientists and sea travelers use an international code known as the “egg code” to describe ice conditions around the world. The egg code describes sea ice concentration (amount of the sea surface that is covered in ice), stage of development (thickness) and form of ice (floe size) for a given area.
2. Place the OVERHEAD: “Cracking the Egg Code” on the overhead projector. Explain that:

- The top section of the egg tells how much of the sea in this area is covered by ice. This number is expressed in tenths. *In the example, eight-tenths of the region is covered by ice.*



- The second row of the egg tells how much of the sea in a region is covered by each of up to three types of ice and is expressed in tenths. The first number in this section tells the concentration of the thickest ice in the area, the second number tells the extent of the medium thickness ice in the area, and the third number tells the extent of the thinnest ice in the area. The sum of the numbers in this row is always equal to or less than the number in the top section of the egg. *In the example, we know that eight-tenths of the surface is covered by ice. Of this, five-tenths is the thickest ice in the area, one-tenth is ice of medium thickness for this area, and two-tenths is the thinnest type of ice found in this area.*

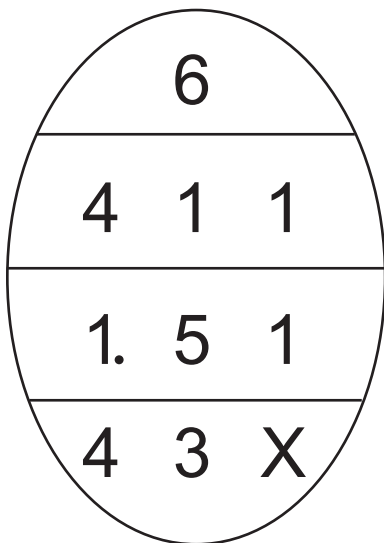
- The third row of the egg describes the stage (age and thickness) of each concentration of ice indicated in the second row. The number and dot code in this row are keyed to the Stages of Sea Ice Development Chart. The first number in the third row describes the stage and thickness of the thickest ice. The second number in the third row describes the stage and thickness of the medium ice and so on. *In the example, 7. indicates that Old Ice more than 200 cm thick covers five-tenths of the sea surface in this region. The 1. indicates that Medium First Year Ice 70-120 cm thick covers one-tenth of the surface, and the 1 indicates that New Ice 0-10 cm thick covers two-tenths of the surface in this region.*

- The bottom section of the egg describes the form of the ice, including the floe size. A floe is a piece of floating sea ice. The numbers in this section are keyed to the Forms of Sea Ice Chart. The first number in the bottom section indicates the form of the thickest ice. The second number indicates the form of the ice of medium thickness and so on. Ask students to pay careful attention to the units in the chart. Remind them that 100 cm = 1 m and that 1000 m = 1 km. *In the example, 4 indicates that the Old Ice in the region is made up of one or more Medium Ice Floes (100 m -500 m across). The 5 indicates that the Medium First Year Ice in the region is made up of one or more Big Ice Floes (500 m – 2 km across). The X indicates that the New Ice in the region is in small pieces 0-10 cm across.*

3. Divide students into groups of 2-4 and distribute the STUDENT INFORMATION SHEETS, scissors and tape to each group. Explain that students will play a game to help them learn about the egg code.
4. Ask students to prepare their game pieces by cutting out the cards and die along the dotted lines, then folding the die along the solid lines and taping the sides to form a cube.
5. Allow students to play the game following the directions on their STUDENT INFORMATION SHEET: "Egg Code Game."
6. After each group has played for at least 15 minutes, distribute the STUDENT WORKSHEET: "Cracking the Egg Code" and ask students to complete the worksheet using what they have learned from the game. Students should use the Stage of Development Chart and the Forms of Sea Ice Chart to help them answer the questions on the worksheet.
7. Visit the Web site: <http://www.natice.noaa.gov/products/arctic/index.htm>. Select the appropriate shaded region of the map to zoom in on sea ice in your area. Use the detailed map and the letter key to find the current egg code describing sea ice conditions near your village. Write this egg code on the chalkboard and ask students what the code tells them about the ice in their area. If your village does not lie on the coast, visit <http://www.gi.alaska.edu/WLSICE> to see a webcam view of sea ice conditions near Wales, Alaska.

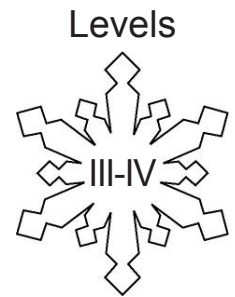
### Answers:

1. 7 tenths
2. more than 120 cm
3. Medium Ice Floes 100 m – 500 m across
4. Medium First Year Ice
- 5.



# Egg Code Card Game (2-4 players)

## Student Information Sheet (page 1 of 3)



### Preparation:

Cut out the Egg Code Cards and die. Fold the die along the dotted lines and tape the edges that meet to form a cube.



### How To Play:



1. Select a dealer to deal all cards, face down, to the players.
2. Do NOT look at your cards. Place them in a “playing pile,” face down, in front of you.
3. The player to the dealer’s left goes first and play continues clockwise. On his or her turn, a player rolls the die, then all players turn over the top card in their pile and place it in the center of the table. The word on the top of the die determines the rule for this hand.
  - If the die says CONCENTRATION, players look at the top section of the egg on their Egg Code Card. This section tells how much of the sea in a region is covered by ice. This number is expressed in tenths. The player with the greatest concentration of ice on their card collects all the cards from the center of the table and places them face up beside their playing pile.
  - If the die says THICKEST, players look at the third section of their egg. This section describes the stage of each type of ice in a region using a number and dot code. Use the Stages of Sea Ice Development Chart on the next page to determine whose card shows the thickest ice. This player collects all cards from the center of the table. *Hint: The thickest ice in a region is always represented by the first number in the third section of the egg.*
  - If the die says LARGEST FLOE, players look at the bottom section of their egg, which describes the form of the ice, including the floe size. A floe is a piece of floating sea ice. Use the Forms of Sea Ice Chart on the next page to determine which player’s card shows the largest floe. This player collects all cards from the center of the table.
4. In the case of a tie, the cards remain in the center of the table and play proceeds to the left. This means the next player to win a hand will get to collect an extra-large pile of cards!
5. When players have used all the cards in their playing pile, the game is over. Players count the cards they have collected. The player with the most cards wins!

# Egg Code Card Game (2-4 players)

## Student Information Sheet (page 2 of 3)

Scientists and sea travelers use an international code known as the “egg code” to describe ice conditions around the world. Use the tables below to determine what the numbers on the egg code represent.

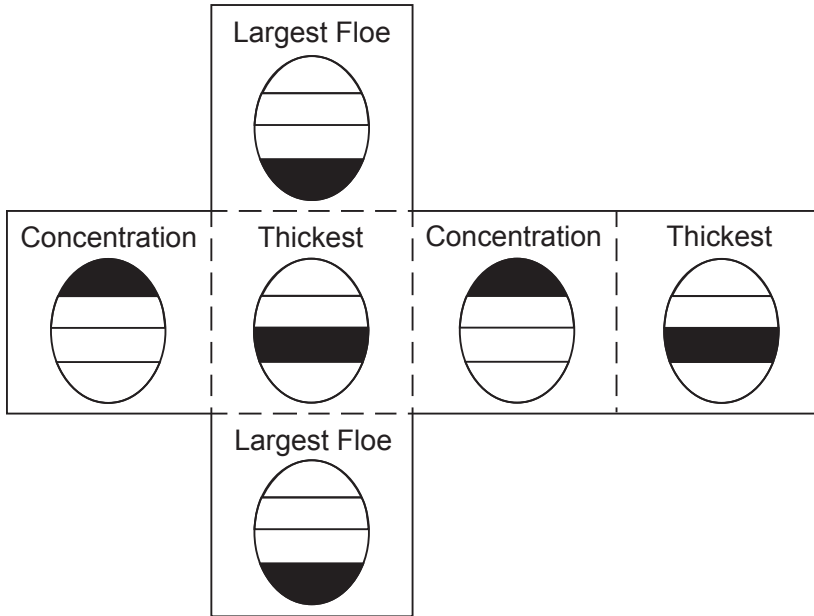
 <b>Stages of Sea Ice Development</b> 		
Stage	Thickness	Code
New Ice - frazil, grease, slush	0-10 cm	1
Nilas, Ice Rind	0-10 cm	2
Young Ice	10-30 cm	3
Gray Ice	10-15 cm	4
Gray-White Ice	15-30 cm	5
First Year Ice	30-120 cm	6
First Year Thin Ice	30-70 cm	7
First Year Thin-First Stage Ice	30-70 cm	8
First Year Thin-Second Stage Ice	30-70 cm	9
Medium First Year Ice	70-120 cm	1.
Thick First Year Ice	More than 120 cm	4.
Old Ice - survived at least 1 melt season	More than 200 cm	7.
Second Year Ice	More than 200 cm	8.
Multi-Year Ice	More than 200 cm	9.
Ice of Land Origin		▲.

 <b>Forms of Sea Ice</b> 		
Form	Size of Floe	Code
New Ice	0 cm - 10 cm	X
Pancake Ice	30 cm - 3 m	0
Brash Ice	Less than 2 m	1
Ice Cake	3 m - 20 m	2
Small Ice Floe	20 m - 100 m	3
Medium Ice Floe	100 m - 500 m	4
Big Ice Floe	500 m - 2 km	5
Vast Ice Floe	2 km - 10 km	6
Giant Ice Floe	More than 10 km	7
Fast (stationary) Ice		8
Ice of Land Origin		9
Undetermined or Unknown (icebergs, growlers, bergy bits)		/

# Egg Code Card Game (2-4 players)

## Student Information Sheet (page 3 of 3)

Cut out the die along the solid lines. Fold the die along the dotted lines and tape the edges that meet to form a cube.



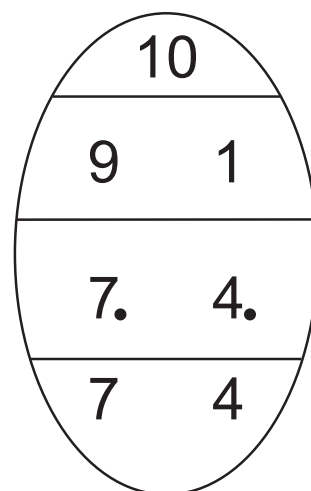
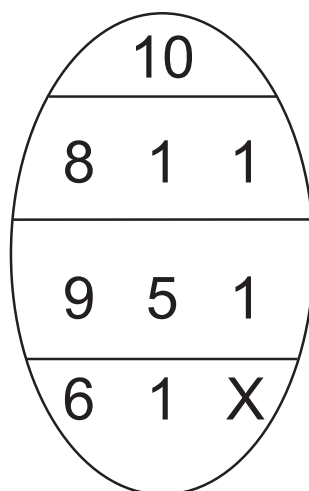
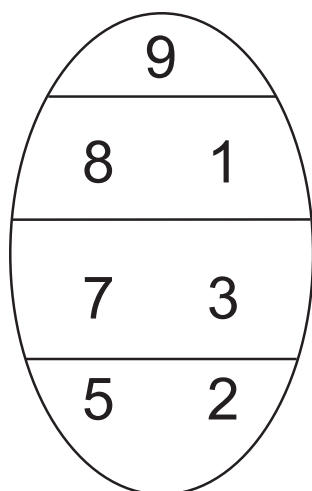
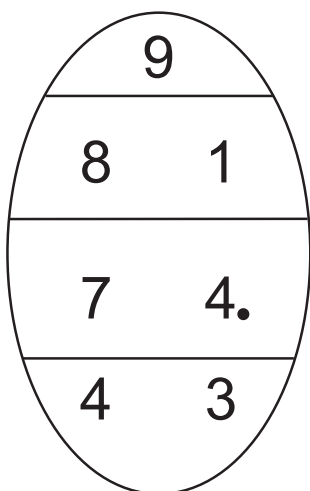
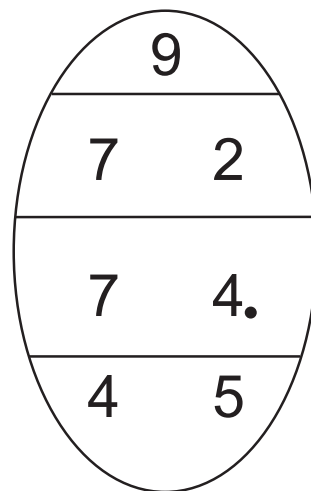
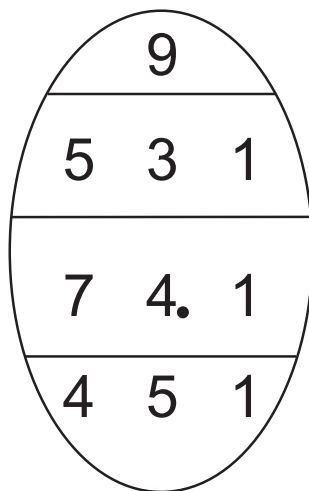
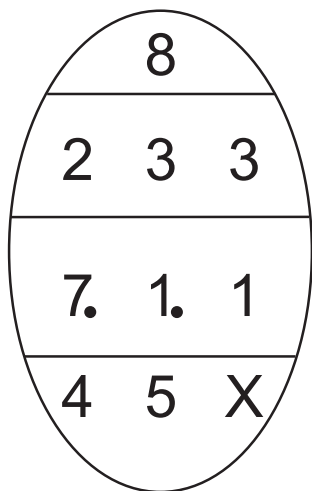
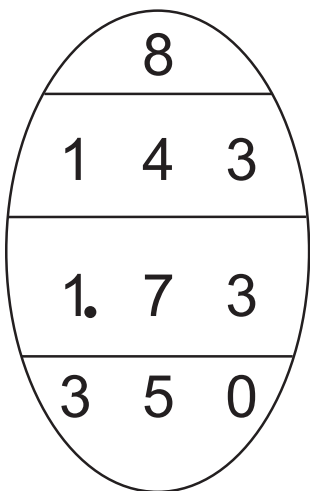
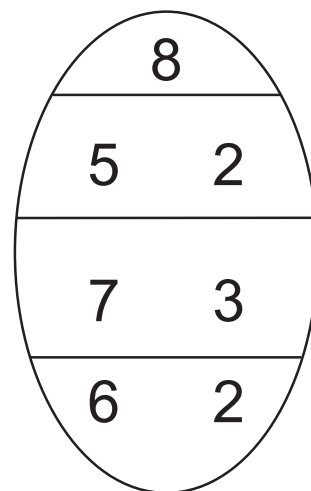
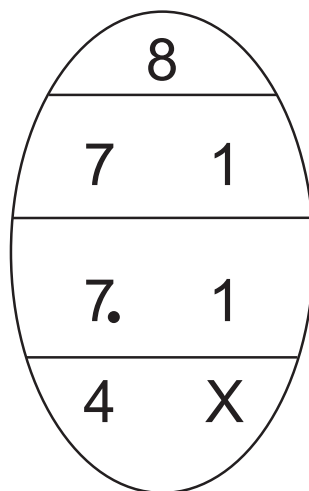
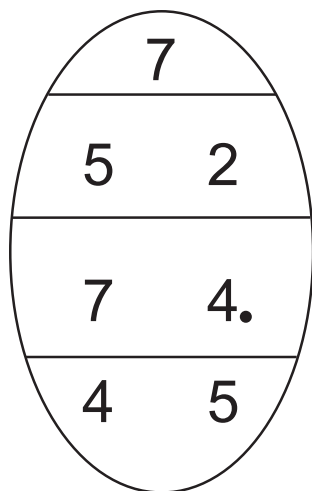
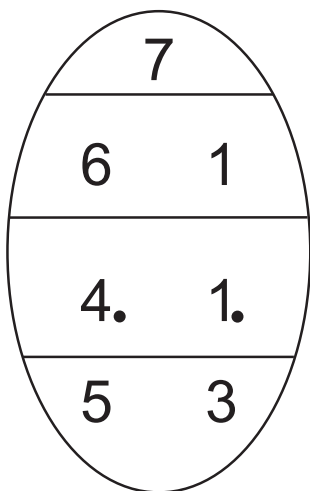
# Egg Code Cards

## Student Information Sheet (page 1 of 2)

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# Egg Code Cards

## Student Information Sheet (page 2 of 2)



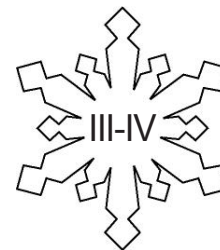


Name: \_\_\_\_\_

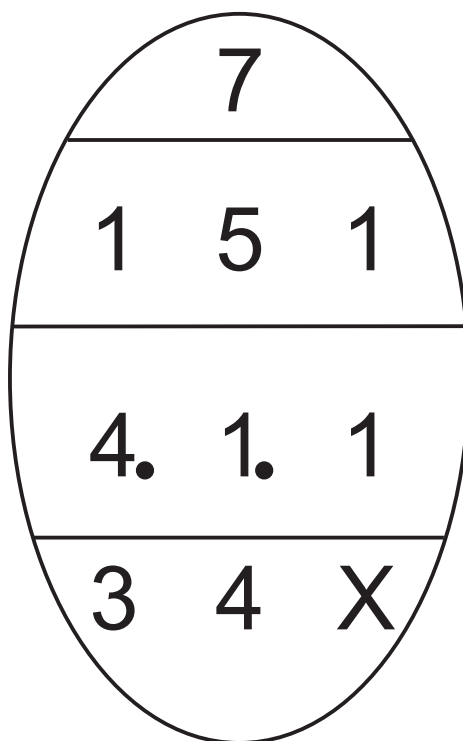
# Cracking the Egg Code

## Student Worksheet (page 1 of 2)

Levels



**Directions:** Use the **Stages of Sea Ice Development Chart** and **Forms of Sea Ice Chart** to help you complete this worksheet. Study the completed egg code below to answer questions 1-4.



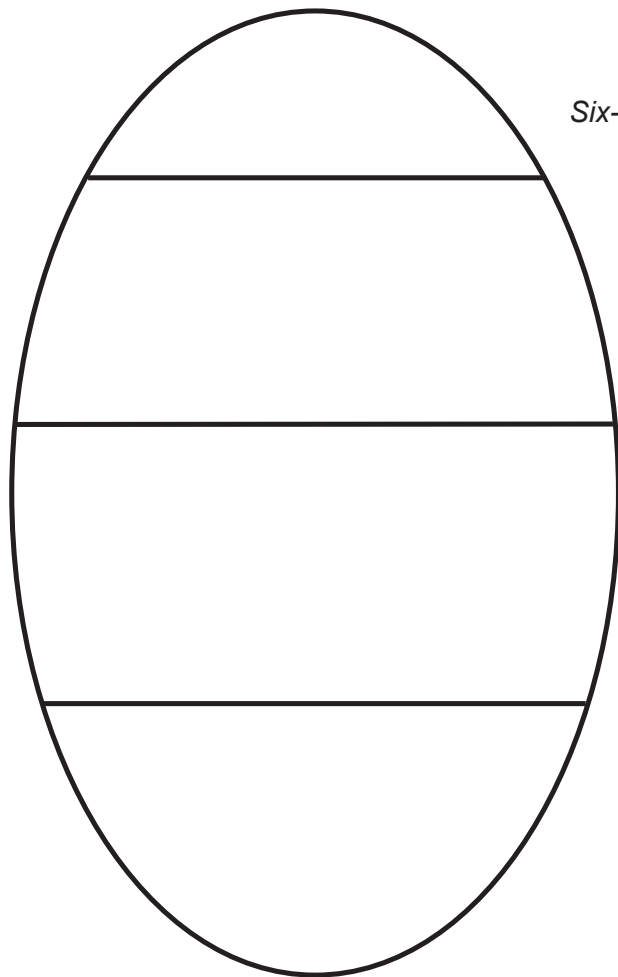
1. How much of the sea in this region is covered by ice? \_\_\_\_\_ tenths
2. How thick is the thickest ice in this region? \_\_\_\_\_
3. What size of ice floe does the 4 in the bottom section of the Egg Code represent?  
\_\_\_\_\_
4. Challenge: What stage of ice covers the most area of the sea in this region?  
*Hint: Use the second and third rows of the egg to determine the answer to this question.*  
\_\_\_\_\_

Name: \_\_\_\_\_

## Cracking the Egg Code

### Student Worksheet (page 1 of 2)

5. Create an egg code for the region described below:



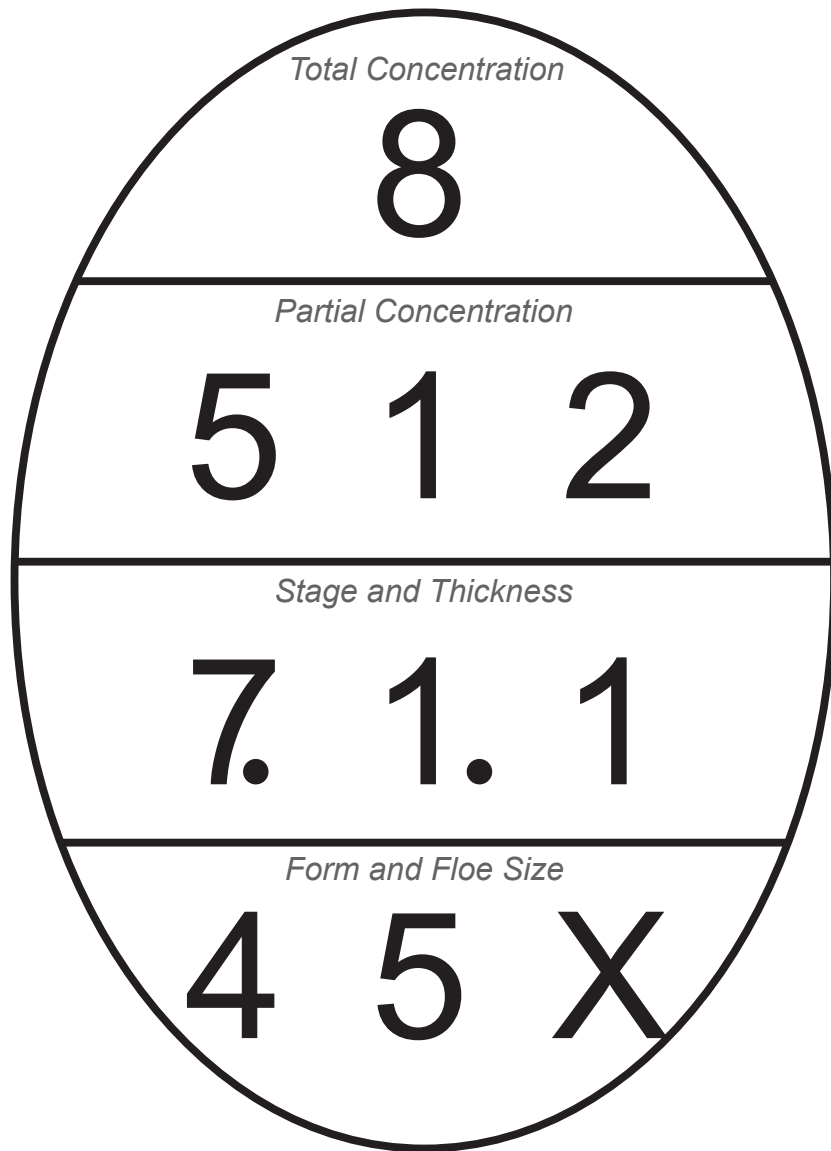
*Six-tenths of the sea in this region is covered by ice.*



*Of this, four-tenths is the thickest ice in the region, one-tenth is ice of medium thickness, and one-tenth is the thinnest ice found in this area.*



*The thickest ice is Medium First Year Ice 70 - 120 cm thick. The ice of middle thickness is Gray-White Ice that is 15 - 30 cm thick. The thinnest ice in the region is New Ice 0 - 10 cm thick.*

*The Medium First Year Ice is made up of medium ice floes 100 m to 500 m across. The Gray-White Ice is in small ice floes 20 m to 100 m across. The New Ice is 10 cm or less across.*

# Cracking the Egg Code Overhead



 <b>Stages of Sea Ice Development</b> 		
Stage	Thickness	Code
New Ice - Frazil, grease, slush	0-10 cm	1
Nilas, Ice Rind	0-10 cm	2
Young Ice	10-30 cm	3
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Gray-White Ice	15-30 cm	5
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First Year Thin Ice	30-70 cm	7
First Year Thin-First Stage Ice	30-70 cm	8
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Thick First Year Ice	More than 120 cm	4.
Old Ice - survived at least 1 melt season	More than 200 cm	7.
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Multi-Year Ice	More than 200 cm	9.
Ice of Land Origin		▲.

 <b>Forms of Sea Ice</b> 		
Form	Size of Floe	Code
New Ice	0 cm - 10 cm	X
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Ice Cake	3 m - 20 m	2
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Undetermined or Unknown (icebergs, growlers, bergy bits)		/