

NOAA Teacher at Sea Program

Lesson Plan #3

Unit Plan: Sustainable Harvesting of Chinook Salmon; A Fisheries Management Decision

Activity Title: Analyzing Bycatch Data

Subject (Focus/Topic): Life science: marine ecology /fisheries

Grade Level: 9th – 12th Grade

Average Learning Time: 45 minutes

Lesson Summary (Overview/Purpose): Students will work investigate the issue of bycatch in the Walleye pollock fishery. Data retrieved from landings is graphed and analyzed to evaluate overall trend. The implications of this bycatch are discussed.

Overall Concept (Big Idea/Essential Question): This activity is designed to allow students to analyze fisheries data to investigate trends in Chinook salmon stock.

Specific Concepts (Key Concepts)

- The Bering Sea is a unique ecological environment that supports a very large food web.
- Chinook Salmon are accidentally caught in Pollock fisheries.
- The Chinook Salmon fisheries have suffered in recent years due to declining stocks.
- The exact reason(s) for declining Chinook Salmon stocks is unknown but correlates with a recent increase in bycatch from the Pollock industry.

Focus Questions

- 1) What has happened to the amount of Chinook salmon bycatch levels in the Pollock fisheries in recent years?
- 2) How does the Chinook salmon bycatch in Pollock fisheries compare to that of other fisheries?
- 3) According to the trend presented in the data, what impact may the Pollock fishing industry have on the Chinook salmon population if the fishery is not managed properly?
- 4) What is the Pollock fishing industry doing to limit the bycatch of Chinook salmon?

Objectives/Learning Goals

- Students will be able to graph bycatch mortality rates of Chinook salmon from a NOAA fisheries study.
- Students will be able to describe trends in bycatch data and relate finding to the future outlook of Chinook salmon stocks.
- Students will be able to describe the impact of declining Chinook salmon stocks on various stakeholders, including (but not limited to..) the local Native American population.
- Students will learn about new technologies employed to assist fisheries in limiting bycatch.

Background Information

Many of the salmon caught as bycatch of the Pollock fishing fleet were bound for

rivers in western Alaska where they would spawn. Specific analysis of the direct impacts that this bycatch has is not yet known. Yet with recent decline in Chinook salmon populations and the reliance of the Native American population in specifically the Yukon River Watershed, the bycatch levels are of much concern. The reduction of salmon bycatch is required by both US and international law. The Magnuson-Stevens Fisheries Conservation Act (MSFCA), enacted in 1976 specifically addresses under National Standard 9 that the Council and NOAA must specifically address to what extent possible, the mortality of stock as a result of bycatch. Successful management of the fishery must include the following factors as stated by Gisclair, 2009.

- A. Population effects for the bycatch species.
- B. Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).
- C. Changes in the bycatch of other species of fish, and the resulting population and ecosystem effects.
- D. Effects on marine mammals and birds.
- E. Changes in fishing, processing, disposal, and marketing costs.
- F. Changes in fishing practices and behavior of fishermen.
- G. Changes in research, administration, and enforcement costs and management effectiveness.
- H. Changes in the economic, social, or cultural value of fishing activities, and nonconsumptive uses of fishery resources.
- I. Changes in the distribution of benefits and costs.
- J. Social effects.

Resources

Gisclair, Becca Robbins. *Salmon Bycatch Management in the Bering Sea Walleye Pollock Fishery: Threats and Opportunities for Western Alaska*. American Fisheries Society Symposium 70: 799-816, 2009.

Web Resources

The Salmon People Documentary

<http://thesalmonpeople.com/>

Chinook Salmon Bycatch Management

<http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm>

Salmon Avoidance in Alaska's Pollock Fisheries

http://www.youtube.com/watch?v=qaUErta_ZK0

Salmon Bycatch Management in the Bering Sea Walleye Pollock Fishery: Threats and Opportunities for Western Alaska

www.yukonsalmon.org/news/Bycatch%20Article%202012-09.pdf

Common Misconceptions/Preconceptions

- Midwater and surface trawling brings in minimal bycatch
- The only limitation/restriction placed on fisheries involves the location of fishing grounds and harvest quotas.

Materials

Students provided an spreadsheet with the Chinook mortality data or provided a Word document from which they can copy and paste the data.

Technical Requirements

- Access to the Excel or other graphing application

Teacher Preparation

This lesson has students individually to graph scientific data for the purpose of formulating a conclusion about the trend of bycatch in the Pollock fishing industry.

Keywords: bycatch, mortality, landings, stock

Pre-assessment Strategy/Anticipatory Set (Optional)

Students may watch the short video entitled, *The Salmon People*, that pleads the case of the local native population over declining Chinook salmon populations.

Students may watch the short video entitled, *Salmon Avoidance in Alaska's Pollock Fisheries*, this provides efforts that have already been employed by the Pollock industry to avoid Chinook salmon bycatch.

Lesson Procedure

Student research

1. Students use Excel or other graphing application to create a chart that correctly analyzes landing data to view trends in Chinook Salmon Mortality rates due to bycatch.
2. Student should individually decide what type of graph would be show the trend of Chinook salmon bycatch by the Pollock fisheries compared to other fisheries.
2. Student create a graph that has a correct title and appropriately labeled axes.
3. Students copy and paste graph into a word processing document. Students write a paragraph that correctly identifies the trends and describes the impact of future lack of Pollock fisheries management to the following: (Provide at least one example for each)
 - A. Population effects for the bycatch species.
 - B. Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).
 - C. Changes in the bycatch of other species of fish, and the resulting population and ecosystem effects.
 - D. Effects on marine mammals and birds.
 - E. Changes in fishing, processing, disposal, and marketing costs.
 - F. Changes in fishing practices and behavior of fishermen.
 - G. Changes in research, administration, and enforcement costs and management effectiveness.
 - H. Changes in the economic, social, or cultural value of fishing activities, and non-consumptive uses of fishery resources.
 - I. Changes in the distribution of benefits and costs.
 - J. Social effects.

Assessment and Evaluation

For the purpose of this lesson, evaluate students based on their analysis of the Chinook Mortality data and their ability to relate this data to future implications on the various factors that are outlined in the MSFCA.

Standards

National Science Education Standard(s) Addressed:

- NSES A: Unifying Concepts and Processes

Sub-categories 1, 2, 3 and 5

- NSES B: Science as Inquiry

Sub-category 1 and 2

- NSES D: Life Science

Sub-categories 4 and 6

- NSES F: Science and Technology

Sub-category 2

- NSES G: Personal and Social Perspectives

Sub-categories 1, 2, 3, 4, 5 and 6

- NSES H: History and Nature of Science

Sub-categories 1, 2 and 3

Ocean Literacy Principles Addressed:

- Principle 1: The Earth has one big ocean with many features.

Fundamental Concept: h

- Principle 5: The ocean supports a great diversity of life and ecosystems.

Fundamental Concepts: d, e, and f

- Principle 6: The ocean and humans are inextricably interconnected

Fundamental Concepts: e and g

- Principle 7: The ocean is largely unexplored.

Fundamental Concept: b, c, d, e, and f

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Chinook Salmon Mortality in Gulf of Alaska Groundfish Fisheries

Taken from NOAA Fisheries, Alaskan Regional Office

<http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm>

Year	Annual Total	Annual Total From GOA Pollock Fisheries	Annual Total From Other Fisheries
1991	38,894	8,439	30,455
1992	16,787	8,210	8,578
1993	19,260	13,578	5,682
1994	13,615	7,219	6,396
1995	14,652	4,917	9,735
1996	15,761	11,380	4,381
1997	15,230	9,443	5,787
1998	16,984	14,228	2,755
1999	30,600	26,428	4,173
2000	26,729	18,413	8,317
2001	15,104	9,531	5,573
2002	12,920	5,161	7,758
2003	15,399	4,403	10,996
2004	17,779	13,153	4,626
2005	31,271	27,927	3,344
2006	19,005	15,945	3,060
2007	40,539	35,177	5,362
2008	16,170	10,650	5,520
2009	8,480	3,196	5,285
2010	54,561	44,781	9,780
2011	22,492	15,903	6,589

Copy and paste this table into an Excel workbook or other graphing application.