



## NOAA FISHERIES

Grade Level  
8-12

### Materials

- Computers with Internet access
- Chart Paper
- Markers
- Graph Paper
- Colored Pencils
- Ruler
- *Annual Commercial Landings of the King Crab* worksheet

### Audio/Visual Materials

Computers for each pair of students

### Teaching Time

Two 45-minute class periods

### Seating Arrangement

Flexible

### Key Words

- Sustainability
- Sustainable (seafood)
- Over-fishing
- Over-fished
- Bycatch
- Catch landings
- Stock
- Individual Fishing Quota (IFQ)

# The Red King Crab Revitalized

For use with Fish Watch at [www.fishwatch.gov](http://www.fishwatch.gov)



### Focus

- Sustainability and the king crab fishery

### Focus Questions

- What is sustainability and how does it apply to fisheries?
- How did the red king crab become sustainable?
- How is sustainability being promoted in our fisheries?

### Learning Objectives

- Explore the concept of sustainability and how it pertains to fisheries management
- Analyze catch landings data and draw conclusions about how the king crab was revitalized

### Background Information

In this lesson, students will learn about sustainability and draw conclusions about how the red king crab reached sustainable levels after being overfished.

Alaska is famous for its red king crab. The fishery dates back to the 1930s when it was initially dominated by foreign fleets. U.S. fishermen started harvesting king crab in 1947. The U.S. fleet expanded in the late 1960s and

## National Science Education Standards

### Grades 9-12

#### Content Standard C: Life Science

- Matter, energy, and organization in living systems
- Interdependence of organisms

#### Content Standard F: Science in Personal and Social Perspectives

- Environmental quality

## Ocean Literacy Essential Principles

### Essential Principle 5

The ocean supports a great diversity of life and ecosystems.

#### Fundamental Concept a

Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

#### Fundamental Concept c

- Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land

### Essential Principle 6

The oceans and humans are inextricably connected.

#### Fundamental Concept b

From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

took over in the 1970s, when the Magnuson-Stevens Act prohibited foreign fishing in U.S. waters. Catch in the Bering Sea peaked in 1980 at almost 130 million pounds, but the stock collapsed shortly thereafter. Catch subsequently dropped sharply in the early 1980s and remained low for the next 2 decades. Under several years of conservative harvest levels and innovative management, Bristol Bay red king crab has finally bounced back. According to the most recent estimates, mature females are almost 3 times more abundant than they were in 1985, and mature males are 2.2 times more abundant. Most of today's red king crab harvest comes from Bristol Bay and represents one of the most valuable fisheries in the United States.

The red king crab fishery in Bristol Bay hasn't always been the model of sustainability it is today. Shortly after peak harvests in 1980, the red king crab stock collapsed and managers cut harvest levels for the next two decades to rebuild the stock. The fishery was also operating as a "derby"— anyone could enter and the fishery was closed when the catch limit was reached. This meant that when the fishery opened, everyone raced out to get as much of the allowed catch as quickly as they could, regardless of the weather and market conditions or the environment. This made for an inefficient, unsafe fishery that wasn't very profitable. And it wasn't doing much to help the crab resource rebuild either.

To improve these conditions, managers implemented an individual fishing quota (IFQ) under the crab rationalization program for the fishery in 2005, replacing the derby-style fishery. Under the IFQ system, individual fishermen are given a share of the harvest and can catch their share at any time during the fishing season. This has resulted in a safer and more efficient fishery with a longer season, as fishermen can take weather and economic factors into account when deciding when to fish.

Unfortunately, king crab populations in other areas of Alaska have not been as responsive to management actions. Despite being closed to fishing since 1995, the populations of red king crab in the Aleutian Islands and Gulf of Alaska remain low. Scientists are uncertain about the abundance of red king crab around the Pribilof Islands in the Bering Sea. This fishery has been closed since 1999 due to this uncertainty as well as concerns over bycatch of the depressed blue king crab stock. Scientists continue to monitor these populations through periodic surveys and observations of catch.

Source: [www.fishwatch.gov](http://www.fishwatch.gov)

For more background information on the red king crab visit:

[www.fishwatch.gov/seafood\\_profiles/species/crab/species\\_pages/red\\_king\\_crab.htm](http://www.fishwatch.gov/seafood_profiles/species/crab/species_pages/red_king_crab.htm)

## Learning Procedure

Bookmark websites on the computers prior to the lesson so the sites are easy to access during the lesson.

*Essential Principle 7: The ocean is largely unexplored.*

*Fundamental Concept c*

- Over the past 40 years, use of ocean resources has increased significantly; therefore, the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.

1. Separate the students into groups of four. Have them brainstorm what they know about the fish they eat, such as the names of the fish, where and how they were caught, and any other information they know about the fish, such as its abundance in the ocean.
2. After the brainstorming session, have each group record their information on a chart, and bring the class back together to share ideas.
3. Now ask students what they believe the word “sustainability” means. Again, have them record their thoughts and ideas on chart paper. Groups can then share their ideas with the class.
4. Once the students have shared, allow them time to explore the FishWatch site ([www.fishwatch.gov](http://www.fishwatch.gov)) with a partner to find out more about sustainability. Students should find information on the site about sustainability under the “Managing Fisheries” link under the “Wild Caught Seafood” tab in addition to many other locations including articles. Students should take notes on what they learn about sustainability.
5. As a class, share ideas about sustainability and formulate a class definition of it. Record the class definition on chart paper for display. Ask students how sustainability applies to the king crab. Have students read about the crab rationalization program at [www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm](http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm)
6. Direct students to the NMFS Fisheries Landings database [www.st.nmfs.noaa.gov/st1/commercial/landings/annual\\_landings.html](http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html) where students will query data about the king crab. Students should enter the following search parameters:

Year:	From: 1970 to: 2011
Species:	crab, king
State:	Alaska
Format:	Table

This table will generate some data about the catch landings of the king crab. Make sure that students understand that annual catch landings represent the total catch of a particular species for a particular year. A copy of the data table is attached for use if no student computers are available.

7. Students need to create a graph to represent the data. When their graph is finished, students will need to analyze the data by completing the Annual Commercial Landings of the King Crab worksheet (see attached). Discuss as a class.

## The Bridge Connection

[www.vims.edu/bridge](http://www.vims.edu/bridge)

Click on Ocean Science Topics in the navigation menu to the left, then navigate to (1) Human Activities, then Environmental Issues, then Sustainability or Conservation; (2) Human Activities, then Seafood or Fisheries.

## The “Me” Connection

Have students write letters to an area business establishment presenting what they have learned and actions they would like to see the business take to help promote sustainability.

## Connections to Other Subjects

Math, Social Studies, and Geography

## Evaluation

The graphing activity and the handout can serve as individual assessments. Responses should give evidence of an understanding of sustainability.

## Extensions

1. Students can complete the same graphing activity from the lesson using a different Alaskan crab fishery. Students can write a response about the conclusions they draw from that data. Fish that were once overfished, but are now sustainable are good examples to use; one such example is the summer flounder fishery.

2. Have students visit [www.oar.noaa.gov/k12/html/fisheries2.html](http://www.oar.noaa.gov/k12/html/fisheries2.html) and complete the activities on fisheries management.

## Additional Resources

Alaska Fisheries Science Center – A Journey from Sea to Market  
[www.afsc.noaa.gov/education/Activities/seafood\\_intro.html](http://www.afsc.noaa.gov/education/Activities/seafood_intro.html)

NOAA Fisheries – Office of Sustainable Fisheries  
[www.nmfs.noaa.gov/sfa/sfweb](http://www.nmfs.noaa.gov/sfa/sfweb)

Safe Sustainable Seafood Supply – National Sea Grant  
[www.seagrant.noaa.gov/focus/sss\\_page.html](http://www.seagrant.noaa.gov/focus/sss_page.html)

NOAA Fisheries - BSAI Crab Rationalization FAQs  
[www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm](http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm)

The NOAA Research K-12 Education Site  
[www.oar.noaa.gov/k12/html/fisheries2.html](http://www.oar.noaa.gov/k12/html/fisheries2.html)

## NMFS Landings Query Results

- Year 1970 To: 2011
- Species: crab, king
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- State: Alaska
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Year	Species	Metric Tons	Pounds	\$
1970	CRAB, KING	23,614.7	52,061,000	13,189,672
1971	CRAB, KING	32,070.7	70,703,100	19,077,253
1972	CRAB, KING	42,749.1	94,244,700	31,839,526
1973	CRAB, KING	34,847.2	76,824,100	47,702,211
1974	CRAB, KING	43,188.7	95,213,800	39,153,941
1975	CRAB, KING	44,283.1	97,626,600	38,251,448
1976	CRAB, KING	48,035.6	105,899,200	68,688,972
1977	CRAB, KING	44,633.3	98,398,600	102,028,717
1978	CRAB, KING	55,012.9	121,281,370	155,873,143
1979	CRAB, KING	67,884.5	149,658,089	148,853,181
1980	CRAB, KING	84,063.0	185,325,374	174,339,680
1981	CRAB, KING	40,176.0	88,572,013	123,058,872
1982	CRAB, KING	18,008.9	39,702,384	106,488,520
1983	CRAB, KING	12,178.5	26,848,652	74,909,840
1984	CRAB, KING	8,438.1	18,602,572	43,637,534
1985	CRAB, KING	7,299.8	16,093,202	33,588,770
1986	CRAB, KING	12,609.5	27,798,948	92,312,548
1987	CRAB, KING	13,807.4	30,439,880	99,009,063
1988	CRAB, KING	9,520.1	20,988,031	84,478,800
1989	CRAB, KING	11,097.2	24,464,842	97,806,829
1990	CRAB, KING	15,471.9	34,109,272	148,205,877
1991	CRAB, KING	12,693.4	27,983,835	86,597,555
1992	CRAB, KING	8,732.6	19,251,865	71,577,009
1993	CRAB, KING	12,230.6	26,963,626	91,660,530
1994	CRAB, KING	5,881.4	12,966,229	57,141,985
1995	CRAB, KING	6,480.6	14,287,223	41,305,911
1996	CRAB, KING	9,664.5	21,306,441	64,820,705
1997	CRAB, KING	9,373.6	20,665,121	57,672,941
1998	CRAB, KING	10,760.5	23,722,639	56,212,077
1999	CRAB, KING	7,674.6	16,919,447	88,073,619
2000	CRAB, KING	6,847.9	15,096,884	61,638,849

2001	CRAB, KING	7,280.7	16,051,074	65,556,283
2002	CRAB, KING	7,616.1	16,790,529	84,753,384
2003	CRAB, KING	10,381.0	22,886,056	105,454,503
2004	CRAB, KING	10,012.7	22,074,076	93,597,078
2005	CRAB, KING	10,858.6	23,938,929	91,042,174
2006	CRAB, KING	9,816.5	21,641,434	67,060,076
2007	CRAB, KING	11,765.8	25,938,834	97,882,051
2008	CRAB, KING	12,341.3	27,207,605	120,202,588
2009	CRAB, KING	10,156.3	22,390,526	86,226,284
2010	CRAB, KING	10,905.1	24,041,459	122,410,582
2011	CRAB, KING	7,712.3	17,002,520	110,595,279
GRAND TOTALS:	-	868,176.6	1,913,982,081	3,463,975,860

## Annual Commercial Landings of the King Crab

1. Looking at your graph, and the table of catch landings for the King Crab, why do you believe the total catch declined sharply from 1980 to 1981?
2. Using your knowledge of sustainability, what does the catch landings data tell us about the status of the king crab fishery?
3. Read the article “The King (Crab) of Sustainable Seafood” ([http://www.fishwatch.gov/features/deadliest\\_catch\\_7\\_30\\_12.html](http://www.fishwatch.gov/features/deadliest_catch_7_30_12.html)) on NOAA’s FishWatch site ([www.fishwatch.gov](http://www.fishwatch.gov)) and BSAI Crab Rationalization FAQ page (<http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm>) to learn more about measure taken to help rebuild the stock of king crab. What were the key components to the revitalization of the king crab?
4. What are the three P’s of sustainability and how do you think each of them played in a part in promoting the sustainability of the red king crab fishery?
5. How can consumers help to promote sustainability of the king crab?