

PBL Unit Title: Fishing for El Nino

Primary Subject Area: Earth Science

Interdisciplinary Areas also Covered: Math

Grade/Age Level: 7th-9th Grade

Description of students' role and problem situation: As a worker on a fishing boat, student are asked to explain why the fish are in their usual location. With clues, research, and a fake letter from their friend in North Carolina, all signs point to El Nino.

Educational Objectives: (Indicate if unit is interdisciplinary, but only list the objectives from primary subject area)

- ◆ Global Atmospheric Trends
- ◆ Climate
- ◆ Relationship Between Humanity and the Environment

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Meet The Problem Scenario

It is early June in southern California. As a worker on a fishing boat, your days off are few and far between. You have some leave time accumulated, but because of all the rain lately, it's not worth using it just to sit indoors. When you report to work one morning, you hear your captain talking to one of the workers at the dock:

[Editor's note: students would receive this document to refer back to as needed, but in class, a tape recording of this conversation would be played, so the student would actually "overhear" the conversation]

W: How's business these days?

C: It's getting pretty stressful. Our wholesaler was in a foul mood today.

W: What's got him so up in arms?

C: Well, according to the record books, this year's catch is the lowest that anyone's seen in years.

W: I could see how that would affect someone who sells fish, but don't you just catch them?

C: The wholesaler seems to think that we're just holding back to drive the prices up. But I've been going to the same spots for a couple of years now, and the fish just aren't there.

W: I wonder what could be causing that?

C: That's what I'm trying to figure out. If I knew what was going on, I could tell the wholesaler, and he'd be off my back. Then, I could get around to choosing my new second-in-command. But with this fish situation as it is, I might not have a wholesaler at the end of the week. I wish I knew what was going on...

(Jokingly, he calls out to workers on the ship)

ATTENTION ALL HANDS: IF ANYONE KNOWS WHERE THE FISH HAVE GONE, PLEASE SUBMIT A WRITTEN REPORT TO THE CAPTAIN

Being chosen as second-in-command means one thing: more money. Coupled with that vacation time, a promotion and pay raise would really help out in the near future. You decide that the best way to get ahead in the second-in-command considerations is to write a memo to your captain that explains why the fish aren't coming in (See product guidelines for the specifics on what should be included in this memo). You heard the captain's concerns about the wholesaler's patience, so you'll need to have the memo on the captain's desk by the end of the week.

Curriculum Alignment for Problem

- **Science Competency Goals Involved in Lesson**
 - **1.01** Explain the composition, properties, and structure of the atmosphere.
 - **1.03** Examine evidence that atmospheric properties can be studied to predict atmospheric conditions and weather hazards:
 - **1.05** Assess the use of technology in predicting, monitoring, and recording atmospheric phenomena.

- **Goals from other disciplines**
 - **Language Arts 2.02** Develop informational products and/or presentations that use and cite at least three print or non-print sources
 - **Language Arts 3.02** Use the problem-solution process by:
 - Analyzing problems and solutions within various texts and situations.
 - Utilizing the problem-solution process within various contexts/situations.
 - Constructing essays/presentations that respond to a given problem by proposing a solution that includes relevant details.

 - **Math 4.01** Interpret and construct histograms

Note: All goals taken from North Carolina Standard Course of Study 7th grade curriculum:

<http://www.ncpublicschools.org/curriculum/>

Significant characteristics of learners

- Very interested in using technology
- Emphasis on emerging social lives
- Tend to look for a correct answer rather than the process in finding an answer
- Will test limits until limits are found
- Need for acceptance

Know

1. It is June
2. I am in California
3. I work on a fishing boat
4. I have some vacation time
5. There has been a lot of rain lately
6. This year's fish catch is particularly low
7. The captain thinks that the wholesaler is going to stop buying the boat's catch
8. The fish can't be found in the location that they have been found in the last couple of years
9. The captain is looking for a new second in command
10. Becoming second in command would mean an increase in pay
11. The captain said he wanted a written report about where the fish have gone

Need To Know

1. What is the normal rainfall for June in CA?
2. What is the normal fish catch
3. What method does the boat use to catch fish?
4. At what locations does the boat catch fish?
5. Was the captain actually being serious when he wanted a report about the fish?
6. Why does the wholesaler seem to think that we're not catching fish on purpose?
7. How much of a pay raise is the promotion? Is it worth the effort?

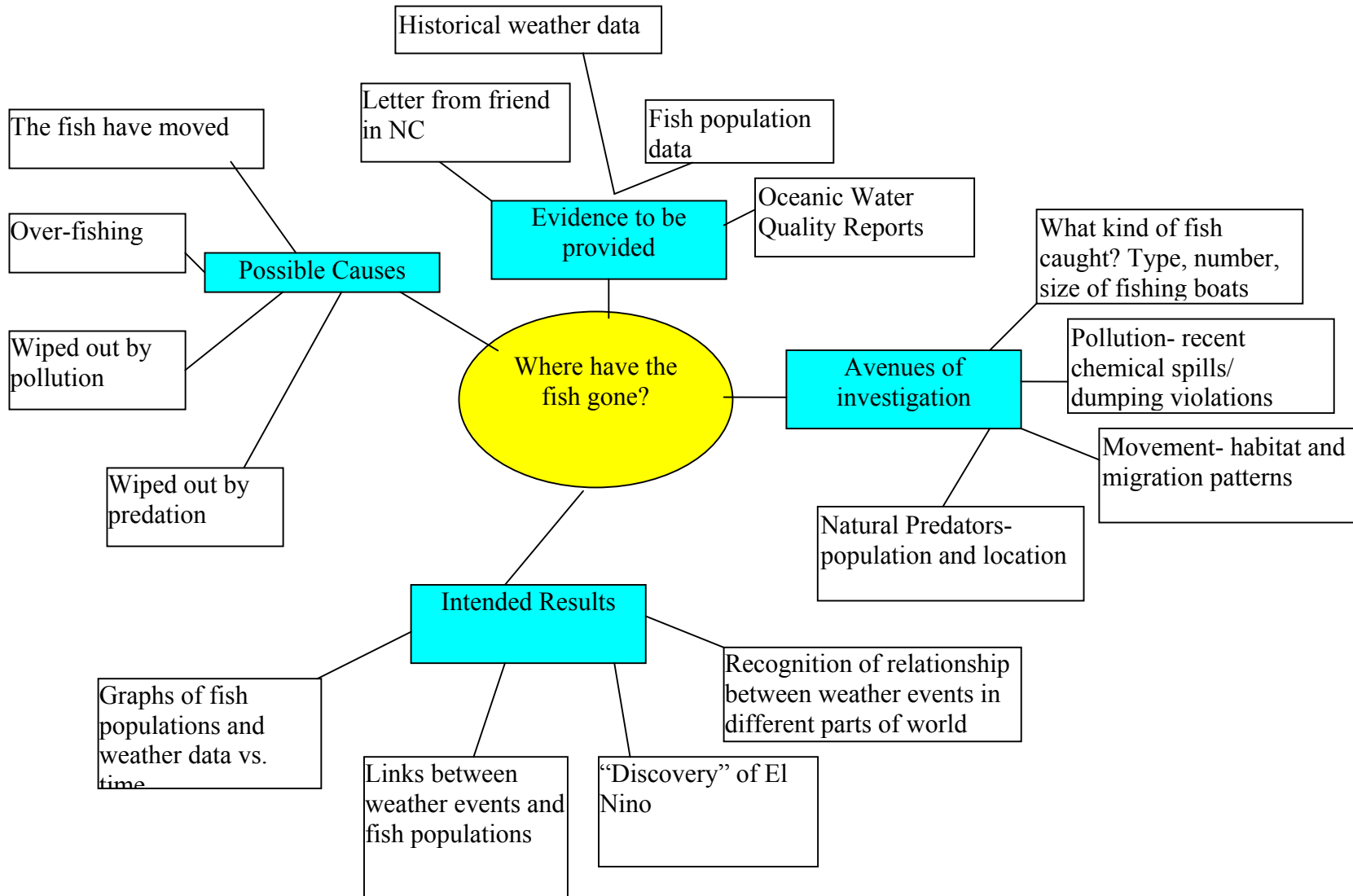
Sample Problem Statement

How can I, as a worker on the fishing boat, determine the cause of the decrease in the fish population and present it to the captain in such a way that:

- The captain will be able to provide a sufficient explanation to the wholesaler
- The information presented can become the foundation of an action plan for finding and catching more fish
- The presentation shows myself to be a capable assistant and a suitable candidate for the open promotion

My findings are ready for presentation by the end of the week.

Problem Map



Resources

Journal Articles

Levy, S. (1998) Where the Sea Meets the Sky. New Scientist , 160(2154), pp. 40-44.

Roberts, Callum M. (2002). Deep Impact: The Rising Toll of Fishing in the Deep Sea. Trends in Ecology & Evolution, 17(5), pp. 242-245.

Video

National Geographic Society (producers) Michael and Mimi deGruy (writers). (1999) Forest of the Deep [Videorecording]. (Available from NGT, Inc. National Geographic Video, Washington DC).

Newspaper

'El Nino' Better Off On Its Own (2001, January 21). San Francisco Chronicle, Sunday Datebook, Pg. 39.

Internet

El Niño to continue wreaking havoc into summer
<http://www.cnn.com/WEATHER/9802/12/el.nino/>

American Oceans Campaign - Fisheries- Fish Habitat Database
<http://www.americoceans.org/fish/fhdthreat.htm>

IRI/LDEO Climate Data Library <http://ingrid.ldeo.columbia.edu/>

The Hurricane Weather Center <http://hurricane.weathercenter.com/>

Capstone Performance

Part A

Write a memo to the captain that contains your group's explanation for the disappearance of the fish. In your memo,

- Cite three related pieces of evidence that support your explanation.
- Indicate whether this is a permanent or temporary problem (explain your reasoning behind your conclusion)
- Suggest a course of action for the rest of the fishing season

Your memo will need to be in an accepted format, using proper spelling, grammar, and punctuation. The memo must be turned in by _____

Part B

Perform a short skit where you inform the captain of your group's explanation for the disappearance of the fish. During the skit, find a way to work in all three points from your memo. These will be performed during class on _____. A random drawing will be held to determine the performance order.

Assessment of these products will take place in two phases. The skit and the memo will be graded by the teacher according to the rubric you will receive. In addition, each group member will complete a peer evaluation sheet that will be handed out at the end of our class presentations.

Scoring Rubric For Capstone Performance

Criteria	Excellent (Points)	Mediocre (Points)	Poor (Points)
Explanation and Evidence	An explanation is given and is supported by three pieces of evidence (10)	An explanation is given with a reason (4)	Some explanation is given without a reason (1)
Time period and action plan	The duration of the problem is addressed with supporting evidence, at least one future action is suggested (6)	Only one of the duration or future recommendation requirements are present in product (3)	Neither the duration problem or action plan are addressed in the product (0)
Memo Mechanics	MLA or other accepted format is followed in memo, no more than two spelling or grammar errors. (4)	Some deviations from accepted memo format, or more than two spelling or grammar errors (2)	Memo is peppered with poor grammar and spelling, and has significant deviations from accepted format (1)
Skit Presentation	Skit has all elements required in the memo- see bullets in product guidelines (4)	Skit contains two out of the three required elements for memo (2)	Skit is missing two or more of the required elements for memo (1)

Alternative Solutions

Solution	Pro	Con	Consequences
Overfishing caused the disappearance	<ul style="list-style-type: none"> explains why there are no fish requires long-term steps to correct, which will be better for environment and fishermen in the long run leads to an understanding of relationship between humans and environment raises awareness about a true environmental problem 	<ul style="list-style-type: none"> does not explain weather evidence means we (in our role as fishermen) are part of the cause of the problem nature could be damaged beyond repair cannot return to normal fishing spot next year or near future 	<ul style="list-style-type: none"> must change fishing methods/locations permanently to allow fish populations to recover might be forced out of business
El Nino caused the disappearance	<ul style="list-style-type: none"> is only a temporary problem current methods and locations of fishing do not have to change in future years also explains odd weather patterns humans feel better (did not cause this problem) 	<ul style="list-style-type: none"> lets humans off the hook- does not explore relationship between humans and environment gives people an excuse to overlook tough issues such as overfishing gives the impression that environmental issues are temporary doesn't give much hope for this year 	<ul style="list-style-type: none"> change methods/locations for this year only must keep track of climate conditions to predict future variances

The preferred solution is to identify that El Nino is the cause of the fish disappearance.. Throughout the problem, hints about weather are dropped such as low incidences of hurricanes in the Atlantic, above average rain in the west coast's dry season, etc. that coach the students to a weather related solution. While overfishing is a significant problem in our oceans, the goal of this lesson is to demonstrate the global scale of weather patterns on Earth. A solution identifying overfishing or another man-made problem (there are plenty to choose from, and certainly should be included in the discussion) does not account for the weather data that would be presented to the students.

Description of Debriefing Session

Review of Student-Generated Solutions

Each group will produce a skit (as stated in the capstone performance product guidelines) to be performed in front of the class. By doing so, all members of the class will have access to other groups' solutions.

Rating of Solutions

During each skit, students who are not performing will be filling out a table:

Group #	Explanation of disappearance and action recommendation	Pros/Supporting Evidence	Cons/Inconsistencies	Comments

At the conclusion of all performances, the class will discuss the presentations and formulate a consolidated table using the pattern above.

One Best Solution

With a class-wide table filled out, pros and cons will be discussed, and a solution statement will be generated. This solution statement is flexible enough that one group's solution can be used verbatim, or parts can be lifted from several groups and be placed into the statement. Anything that was not present in the groups' solutions but was thought of in the consolidation process can also be added. It will have a format similar to the problem statement:

We, the [ROLE] conclude that [SOLUTION] for the following reasons:

- ◆ [Pro / Evidence]
- ◆ [Pro / Evidence]
- ◆ [Pro /Evidence]

Coaching by Teacher

The central tool for the coaching process is the pro/con table. Notice that pro is synonymous with supporting evidence, while inconsistencies are brought up in the con column. If certain facets of an issue are missing, then the teacher, when facilitating the construction of the consolidated pro-con table, can bring up the issue. The students would be asked whether the missing issue would tend to support or detract from a particular solution.

Coaching Questions

Meeting the Problem

C: Can you underline three key pieces of information that the first paragraph provides you with?

M: What was your initial reaction to the conversation after you heard it?

E: Who would this problem be important to?

Know/Need to Know

C: What statement in the meet the problem document tells you that?

M: How will knowing that help your thought process?

E: How important is that in the overall scheme of the scenario?

[editor's note: "that" in the previous three questions refers to a particular item on the k/ntk board]

Writing Problem Statements

C: What conditions are imposed on you by the meet the problem document?

M: How did you come to the conclusion that this was the central issue?

E: Are there other stakeholders who would agree with you on the central issue? Are there other stakeholders who would focus on a slightly different aspect?

Information Gathering and Sharing

C: What are some of the pieces of information that you have found from this source?

M: Explain why this source might be more helpful to you than some of the others.

E: What impact does this information have on your (the stakeholder's) options for solving this problem?

Generating Solutions

C: What facts that we have collected serve as evidence for that solution?

M: How would you convince someone that this was the best solution?

E: Explain this group's solution is a temporary solution as opposed to a long-term solution.