

Lab #7

World Fisheries

Playing the “Fishing Game”

Learning Objectives:

- To examine the health of a fish population from the commercial fishing point of view
- Factors determining how much fishing can be done and still maintain a viable fishery?
- Issues affecting the health of a fishery

Preparation and checklist:

- ___ Read this chapter
- ___ Use WWW to conduct research on fisheries
- ___ Complete Homework #7
- ___ Extra credit on-line quiz
- ___ Finalize Earth Summit atmosphere and global climate paper

Activities Schedule:

- Class discussion of homework and introduction to FishBanks (15 min)
- Play FishBanks (60 min)
- Discuss and analyze the results of the game (20 min)

What is man without the beasts? If all the beasts were gone, men would die from a great loneliness of spirit. For whatever happens to the beasts soon happens to the man. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man does not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself.
Chief Seattle's Message, Chief Seattle.

Introduction

In this lab you will study the world's fisheries and experience the fishing industry's point of view. The "fisheries" are affected seriously by industries that harvest, process, then sell seafood to you and me. The health of the fisheries requires that only as many fish are harvested as can be replenished by natural reproduction. It also requires that the food chain remains healthy. For example, if the target fish is swordfish, but the anchovies that they feed on are over harvested, the swordfish population will suffer.

The main activity will be a simulation game called “FishBanks.” This game will allow you to experience creating your own fishing company and competing with other fishing companies in an attempt to maximize your profit. This game is remarkably effective in demonstrating some of the many inter-related factors that affect the health of a particular “fishery.”

Preparation for next week's final Earth Summit presentation

At next week's lab section, you will make your final Earth Summit presentation. In preparation, please read the article “**Fishing Down the Food Chain,**” in the resources section of this lab manual. It is an excellent paper that reads well and introduces major issues for the world fisheries.

Blank

Homework #7, due at start of lab section:

This section refers to the FishBanks game, described in this chapter of the lab manual. Read about FishBanks first, so you can answer the homework problems.

Suppose the deep water site in the FishBanks game has a population of 3,000 fish. The game rules state that the population can be between 2,000 and 4,000. In the lab section, the total could be higher, but for the sake of this assignment, a figure of 3,000 is used. All questions pertain to the deep water site. Keep in mind that this is a very simplified view of the real world that fishermen face, but it does bring out some interesting factors that must be considered. **Do not consider a weather factor.**

1. What is the criterion for success at the FishBanks game?
2. What percentage of the maximum fish density creates conditions for the most new fish to be added to the population each year?
3. Suppose we begin the game with 3,000 fish at the deep water site. Suppose also that six companies each send 10 ships to fish there. Estimate how many fish will remain at the end of the fishing season, if there is good weather.
4. If the deep ocean site holds a maximum of 3,000 fish, how many fish will be added to its population for the next season?
5. What is the fish population at the start of the second year?
6. Suppose the same six fishing companies each send 10 ships to fish the second year. How many fish does the fleet catch?
7. How many fish remain at the end of the second year's season?
8. What is the fish population at the beginning of the third year?
9. If six companies each send 10 ships the third year, how many fish does the fleet catch?

Blank

Lab Section 7 Activities

Part 1: Fishbanks Game

The Fishbanks game was developed by Dr. Dennis Meadows, of the Laboratory for Interactive Learning at the Institute for Policy and Social Science Research, at Hood House – University of New Hampshire, Durham, NH 03824 (see <http://www.unh.edu/ipssr/FishBank.html>). The game allows participants to experience many of the decisions and problems that “real life” fishing companies must face. Dr. Meadows presents FishBanks to academic groups and governmental agencies worldwide.

Description of the game:

The class divides into fishing companies of four to five people. The object of the game is to maximize your assets at the end of the game, which is at 10 rounds.

Steps of play:

1. Receive computer printout and record the results on decision sheet under “Annual Report,” (rows R:1 to R:7)
2. Bid for auctioned ships, if an auction is held. The operator will enter the results into the computer. Enter the results into the decision sheet in rows D1 and D2.
3. Buy or sell ships from/to other companies and fill out sales contract. Enter the results into the decision sheet in rows D3 and D4. Bring the sales contract to the game operator.
4. Decide on how many new ships to order and enter the number into decision sheet.
5. Calculate and record new fleet size and enter the result in row D8. Remember that ships that are ordered will not be available until next year, so don't add them to the fleet this year.
6. Allocate ships among fishing areas and harbor, and record decisions on decision sheet, row D7.
7. Give decision sheet to Game Operator. Operator enters transactions and decision into computer program.

Part #2: Results of the game

- Game Operator shows summary graphs

Part #3: Discuss the game

- What did you learn from playing this game?
- How would you do it differently next time?
- What were some of the difficulties you encountered?

After lab section, turn in Organizational Chart, with team member barcodes, Decision Sheets, and Team strategy worksheets.

FishBanks, LTD.

Role Description

And Opening Scenario

Congratulations! You have just been hired to manage one of the principal fishing companies in your country. Together with the others in your company – Captain and crew members – you will operate your fishing fleet each year according to policies you design to maximize your assets. The rules and information required for your success are provided below.

Criterion of Success:

Your team's goal is to achieve the greatest possible assets by the end of the game. Your assets equal the sum of your accumulated bank balance plus the salvage value of your ships at the end of the final year in the game.

Resources

You begin the game with a fleet of ships, a bank account of (\$200) x (number of ships), and access to two offshore fishing areas.

Decisions

Each round you must determine your fleet size by deciding whether to bid for ships at auction, make ship trades with other teams, order new ships to be constructed by the shipyard, or maintain your fleet at its current size. Then you must decide how to divide your ships among the Coastal and Deep Sea fishing areas and the Harbor. You will be most successful if your decisions are based on a long-term strategy for fleet size and allocation. You must also take into account the actions of the other teams and modify your strategy accordingly.

Bank Balance:

Your bank balance is increased by income from fish and ship sales, and decreased by expenditures for ship purchases and operation. Additionally, your account is subject to interest earnings and charges.

Your total assets equal the sum of your bank balance plus the salvage value of your ships, \$250 per ship, at the end of the game.

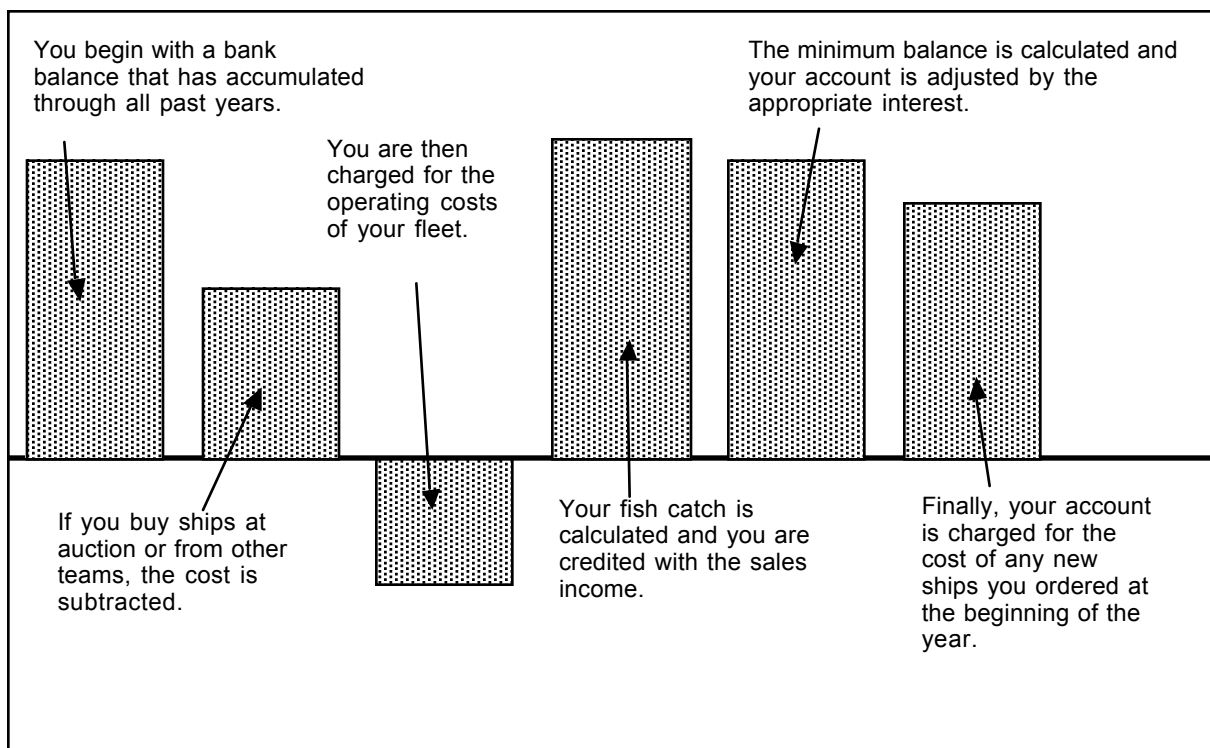
Income: You can earn income by:

- Selling your fish catch at a fixed price of \$20 per fish,
- Selling your ships to other companies at a negotiated price
- Earning 10% interest on your bank account during seasons when your minimum bank account remains positive.

Expenses: You incur expenses by:

- Buying ships at auction
- Buying ships from other companies at a negotiated price
- Ordering the construction of new ships at \$300 per ship
- Ordering and maintaining your ships in one of both of the two fishing areas or leaving them in the harbor
- Paying 15% interest on your loans during years when your minimum bank balance becomes negative.

Interest: Interest earnings and charges are based on your minimum bank balance during the year. To determine what your minimum bank balance will be, you must keep in mind the precise sequence of credits and debits to your account.



Ships

You may change the size of your fleet by buying ships at auction, negotiating to buy or sell ships from another company, and ordering new ships from the shipyard.

Ships cannot be lost or damaged, and used ships purchased in an auction or trade are as good as new ships ordered from the factory.

Auctions:	<p>From time to time a fishing company in a neighboring country will go bankrupt. Its ships are then sold in one lot to the highest bidder, and they may be used immediately.</p> <p>Only one company can win the ships, but two or more teams can agree ahead of time to divide the ships later (during the trading session) at a negotiated price.</p>
Trades:	<p>During the trading session all companies are free to negotiate the purchase or sale of ships. Ships that are traded are available to the purchaser for fishing immediately.</p> <p>Rentals can be arranged by a prior agreement to buy ships and sell them back for a lower price in a later year.</p>
Construction:	<p>Every year the shipyard accepts orders for new ships. These are available at a fixed price of \$300 per ship. The ships are picked up and paid for at the end of the year, so there is effectively a one-year construction delay before the ships may be used.</p>
Salvage:	<p>At the end of the game your ships will be scrapped. Their salvage value, \$250 per ship, is included in your total assets.</p> <p>You may not scrap ships before the end of the game.</p>

Fish

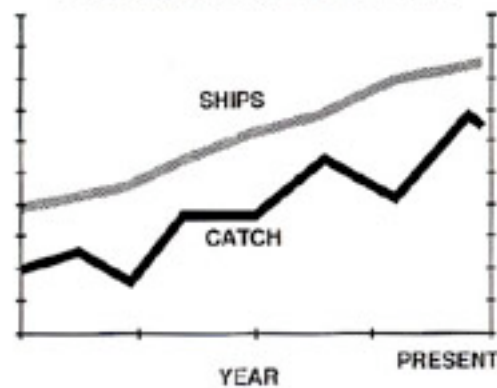
AREAS:

Two fishing areas are available to you: a large Deep Sea fisher, and a smaller Coastal fishery. Biologists have estimated that the Deep Sea could potentially support between 2,000 and 4,000 fish, while the Coastal area could support between 1,000 and 2,000 fish. Since there has been no sign of over-harvesting in the past, you are probably safe to assume that the actual populations are somewhere near these upper limits.

Note: depending on the number of fishing companies, the maximum and minimum numbers for fish population may change. Ask the game manager to post these numbers.

The normal yearly catch in the Deep Sea, 25 fish per ship, is higher than that in the Coastal area, 15 fish per ship. However, it costs \$250 per year to operate a ship in the Deep Sea, while in the Coastal area the cost is only \$150 per year. Operating costs remain fixed, but the catch in each area may vary according to factors explained below.

RECENT HISTORY OF THE FISHERIES



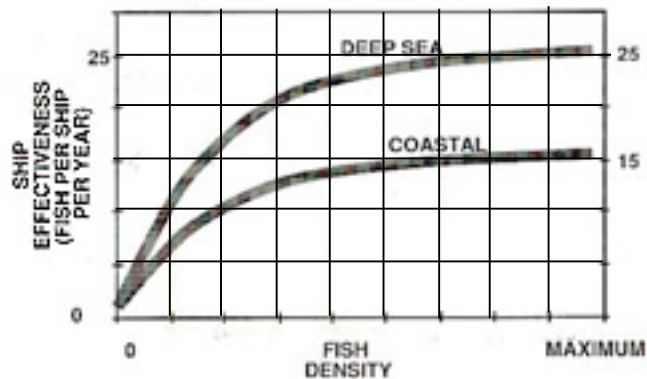
HARVEST:

Your total fish catch is influenced by the number of ships you send to sea, the ship effectiveness, and the weather. With good weather catch can be as much as 20% above normal, while bad weather may reduce catch by up to 20%. Weather is the same in both areas and for all teams in any given year.

Ship effectiveness – the number of fish caught per ship each year – depends on the normal productivity of the area where the ship is operating, and on the density of fish in the area. The general relationship between fish density and ship effectiveness is shown at the right.

The number of ships in an area does not affect ship effectiveness; in other words ship crowding is not a factor. However, if there are many ships in one area the fish population may be somewhat reduced, and the next year's harvest will be affected.

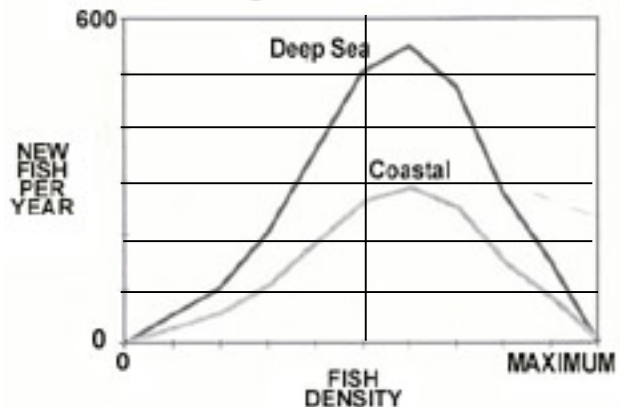
Ship Effectiveness



POPULATION DYNAMICS:

The fish population is increased by natural births; it is decreased by natural deaths and by harvesting. The fertility of the fish and their lifetime are both influenced by the density of fish. The general shape of the relationship governing new fish, net additions to the fish stock each year (births – natural deaths), is shown at right.

Regeneration of Fish



TERMS ON THE DECISION SHEET:

ANNUAL REPORT:

- R:1 Deep Sea Fishery Catch:** This is the total number of fish caught by the ships you sent to the Deep Sea fishery in the last year.
- R:2 Coastal Fishery Catch:** This is the total number of fish caught by the ships you sent to the Coastal fishery in the last year.
- R:3 Price of Fish:** The price of fish is fixed at \$20 per fish sold.
- R:4 Total Fish Sales:** This is the product of two factors: your total catch (the sum of the R:1 and R:2 above) and the price for each fish sold (R:3).
- R:5 Interest:** When your minimum bank balance during the year is negative, you are charged 15% interest. This may happen even when fish sales at the end of the year leave you with a positive bank balance. If the figure for interest on your report is positive, that means your minimum bank balance during the year was positive and you earned 10% interest on the minimum balance. You can calculate your bank balance yourself by adding your credits and debits in the sequence shown in the Bank Balance section of this role description.
- R:6 Initial and Balance:** In the first year this is typically \$200 per ship in your fleet. Thereafter the amount is calculated by the computer program.
- R:7 Ship Fleet Before Auctions and Trades:** This is the number of ships you start with at the beginning of the year. It will equal D:8 in the last year plus any new ships ordered (D:7) in the last year.

AUCTIONS, TRADES, AND ORDERS DECISIONS:

- D:1 Ships Purchased in Auction:** Normally this will be zero, since auctions are not always held, and only one firm can make the highest bid. If you win the auction, record here how many ships you obtained.
- D:2 Money Spent on Auction Purchases:** If the term above is zero, then this will also be zero. If your team did win the auction, record here the total amount of money you paid for all the ships.
- D:3 Ships Purchased in Trades:** If you bought ships from one or more of the other teams, record here the total number of ships you obtained from all other teams combined. All transactions require a transaction report that is delivered to the game administrator.
- D:4 Money Spent on Trade Purchases:** If you bought ships from one or more of the other teams, record here the total amount of money you paid to all other teams combined.
- D:5 Ships Sold in Trade:** If you sold some of your ships to one or more of the other teams, record here the total amount of money you received from all other teams combined.
- D:6 Money Received from Trade Sales:** If you sold some of your ships to one or more of the other teams, record here the total amount of money you received from all other teams combined.
- Note:** you can effectively rent ships from another team by agreeing to buy a ship this year for some price and then to sell it back in the next year for zero dollars.
- D:7 New Ships Ordered:** Here you record your decision about the number of new ships that you wish to have constructed for use in the next year. These cost you \$300 each, but you can borrow the money from the bank if your bank balance is inadequate to finance your desired purchases.

SHIP ALLOCATION DECISIONS:

- D:8 Ship Fleet After Auctions & Trades:** This is the number of ships you have for use in fishing this year. It equals $R:7 + D:1 + D:3 - D:5$. It is not influenced by your decision regarding D:7, New Ships Ordered. These ships only become available to you at the beginning of next year.
- D:9 Ships Sent to Deep Sea Fishery:** Each ship sent to the Deep Sea fishery costs you \$250 in operating costs. This money may be borrowed from the bank, if the total operating costs exceed your bank balance. However, you will then have to pay interest on the loan.
- D:10 Ships Sent to Coastal Fishery:** Each ship sent to the Coastal fishery costs you \$150 in operating costs. This money may be borrowed from the bank, if the total operating costs exceed your bank balance. However, you will then have to pay interest on the loan.
- D:11 Ships Remaining in Harbor:** Each ship left in the harbor costs \$50 in operating costs.

Fish Banks Quick Reference Sheet:

Fishing Areas:

	Deep Sea	Coastal	Harbor
Operating Cost: (per ship per year)	\$250	\$150	\$50
Normal Yield (fish per ship per year)	25	15	0
Estimated maximum fish population	2000- 4000	1000-2000	0

Ship Purchases:

	Availability	Cost
Purchase in auction	Immediate	Highest bid
Purchase in trade session	Immediate	Negotiated price
Order from shipyard	One year delay	\$300

Other Info:

Price of fish	\$20
Interest rate on loans (when minimum bank balance is negative during the year)	15%
Interest rate on savings (when minimum bank balance is positive during the year)	10%

Sample Season:

Transaction	Income	Expenses	Bank Balance
Initial bank balance			\$2000
Buy 4 ships at auction		\$1200	\$800
Sell 2 ships in trade	\$700		1500
Operate 6 ships in Deep Sea		\$1500	\$0
Operate two ships in Coast		\$300	-\$300
Sell fish from Deep Sea	\$3000		\$2700
Sell fish from Coast	\$600		\$3300
Pay interest on minimum bank balance (-\$300)		\$50	\$3250
Pay for new ship ordered		\$300	\$2950
Final bank balance			\$2950

Blank

Decision Sheet -- Company: _____

Annual Report	Year	1	2	3	4	5	6	7	8	9	10
R:1 Deep Sea Bank Catch (#fish last year)		0									
R:2 Coastal Bank Catch (#fish last year)		0									
R:3 Price of Fish (\$/fish last year)		0									
R:4 Total Fish Sales (\$ last year)		0									
R:5 Interest (\$ last year)		0									
R:6 Initial Bank Balance (\$ this year)		2400									
R:7 Ship Fleet Before Auctions and Trades		12									

Auction, Trades & Orders:	Year	1	2	3	4	5	6	7	8	9	10
D:1 Ships Purchased in Auction											
D:2 Money Spent on Auction Purchases											
D:3 Ships Purchased in Trades											
D:4 Money Spent on Trade Purchases											
D:5 Ships Sold in Trade											
D:6 Money Received from Trade Sales											
D:7 New Ships Orders											

Ship Allocations:	Year	1	2	3	4	5	6	7	8	9	10
D:8 Ship Fleet after Auctions & Trades		12									
D:9 Ships sent to Deep Sea bank											
D:10 Ships sent to Coastal bank											
D:11 Ships remaining in harbor		12									

Blank

FishBanks, LTD.

TEAM STRATEGY WORKSHEET

Your goal is to maximize your assets (assets = bank balance + scrap value of ships) by the end of the game (= 10 rounds). With this in mind, plan your company strategy.

Company Name: _____ Year #: _____ What is your plan of action for now?

Company Name: _____ Year #: _____ What is your plan of action for now?

Company Name: _____ Year #: _____ What is your plan of action for now?

Blank

FishBanks Organizational Chart*

Company Name: _____

Role	Name
Chief Executive Officer(CEO)	
1. Board of Directors	
2. Board of Directors	
3. Board of Directors	
Secretary/Treasurer	
1. Negotiator	
2. Negotiator	

Note: Each member of a company may take more than one role.

Duties	Please feel free to vary these duties, to include more people and make your group function better.
Chief Executive Officer	Group leader. Keeps group on task. Makes sure decisions are voted on in a timely manner. Makes sure all group members know their job and are participating.
Board of Directors	With CEO, are ultimate decision-makers, but get input from the stockholders on all issues. They, with the CEO, are free to decide how the group will make decisions.
Secretary/Treasurer	Keeps the master decision sheet. Brings the decision sheet and transaction contracts to the front for entry into the computer.
Negotiator	Contact persons for the purchase and sale of ships from/to other companies.
Stockholder	These are the people who have financial interest in the company. They advise the board of directors and have input on company fishing policy and goals.

*** Attach barcodes for each member to this sheet**

Blank

FishBanks Transaction Contract

If you buy or sell ships from/to more than one company, fill out a separate contract for each sale.

We, the undersigned, agree on the transfer of fishing ships. The sale shall be immediate upon the recording of this transaction. The seller assumes no liability or warranty for the good operating condition of the ship(s).

Selling company: _____

Purchasing company: _____

Number of ships: _____

Total selling price \$ _____

Agent for selling company: _____ signature

Agent for purchasing company: _____ signature

This contract must be presented to the game operator before the fleet leaves for the next year of fishing.

