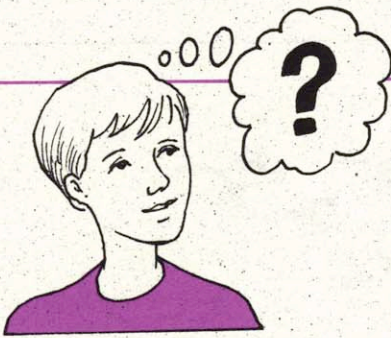




5. GETTING INVOLVED

This chapter includes ideas and suggestions on what each individual or citizen group can do to become actively involved in the protection, conservation and management of their estuary.

Public Awareness



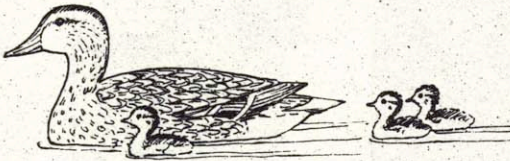
We should all be seriously concerned about the overall health of the estuary, especially if one considers the following:



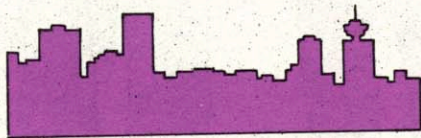
1. We are part of the earth's biosphere. We need clean soil, water and air to sustain ourselves. The health of our estuary is a good indication of how well we are protecting and managing the environment and, in the long run, how well we are protecting our own health and that of future generations.



2. The Fraser River Estuary supports a valuable salmon fishery worth several hundred million dollars annually from commercial, recreational, and aboriginal food catches. Indeed, the Fraser River is the largest salmon producing river in the world.



3. The wetlands of the estuary are vital to the survival of millions of migrating waterfowl. Again, the Fraser River Estuary has world class status with respect to its bird habitat and its important position on the Pacific Flyway.



4. On a global perspective, we are exceptionally privileged to have such a rich natural heritage as the Fraser River Estuary adjacent to an urban population (Greater Vancouver Regional District) of more than 1.5 million.

What can we, as individuals, do to help protect, conserve and possibly improve the aquatic environment of the Fraser River Estuary? Much of the pollution entering the estuary originates from our own actions. So, to begin with, we can make some changes in our personal habits which, collectively, will make a big difference in the amount of pollution entering the environment.

Secondly, as organized groups, we can take political action to help improve the government rules and regulations that protect and manage the ecosystem of the estuary.

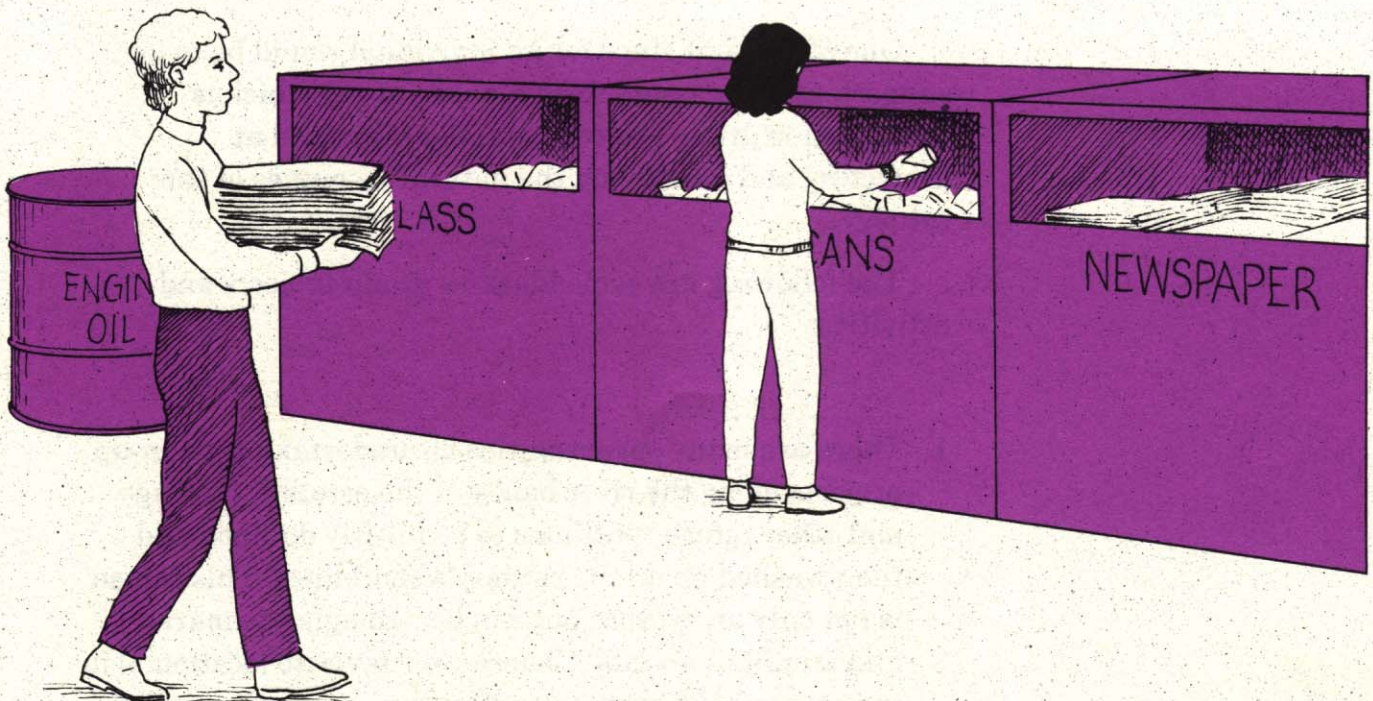
Individual Actions

Hundreds of good ideas on what individuals can do for their environment are available from government publications such as the federal Department of the Environment's *What We Can Do For Our Environment*. Contact your local federal and provincial environment office, or your local municipal hall to receive these free publications. These, and a continuing supply of new publications, provide ideas on simple things that can be done by anyone, right now:

- how to conserve water
- how to conserve energy
- how to dispose of household hazardous wastes
- how to find safe alternatives to hazardous substances
- how to prevent and reduce air pollution
- how to reuse, repair, recycle, and reject waste material
- how to shop for environmentally friendly products
- how to read and learn more about the above topics



FIGURE 5-1
Recycling is Now
Everyones' Business



Group Actions



Public groups and organizations are an increasingly effective force in helping to protect and conserve the natural resources of the Fraser River Estuary. Public groups can consist of youth groups, business groups, civic organizations, faith groups, union organizations, women's groups, neighborhood or community associations, and special interest organizations.

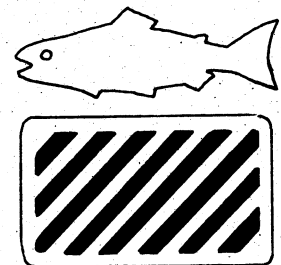
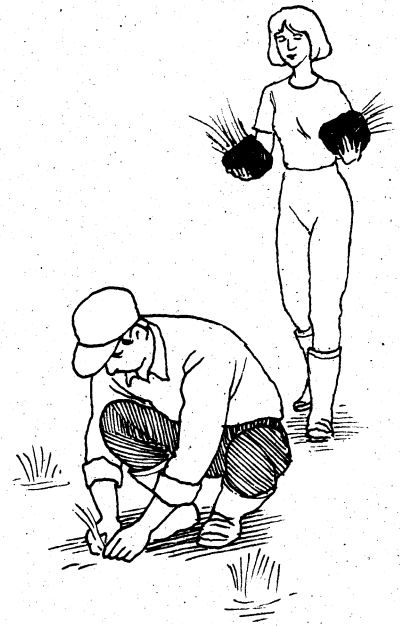


One of the first steps for an individual would be to join, support, or if necessary form a public group which is interested in group projects or actions directed at protecting and conserving the natural resources of the estuary.

The following are some ideas on group projects and activities:

1. There are many opportunities for undertaking clean-up projects along the river banks of the estuary. Garbage and other refuse continues to be illicitly dumped and then washed up on the estuary's shorelines. This refuse is not only an eyesore but can be damaging to marsh and mudflat habitats. Choose your favorite location(s) in the estuary and organize a clean-up.

2. Degraded marsh habitats are now being restored by government and industry. These are interesting projects which typically involve the transplanting of marsh vegetation to unvegetated sites. With technical assistance from the Department of Fisheries and Oceans (DFO) or an environmental consultant, a school or other public group could provide the much-needed manual help required for a marsh restoration project. Monitoring the marsh growth could provide a valuable project activity.
3. The federal Environmental Partners Fund program makes funds available to groups on a 50-50 cost-sharing basis for approved environmental clean-up and restoration projects. The Public Conservation Assistance Fund is a similar program sponsored by British Columbia Environment, Lands & Parks (ELP).
4. Environmental groups are always in need of financial support. Your group can hold a fund-raising event and donate the money to a local environmental organization which is involved in a particular cause for the estuary.
5. Enhance the environmental education and awareness of your group by organizing presentations by environmental experts from government, universities, consultants or other environmental groups. Obtain free publications and videos from government offices. Project Wild, an education program which emphasizes awareness, appreciation and understanding of wildlife and natural resources, can be tapped by your group (contact ELP). Arrange tours of industries located in the estuary, bird sanctuaries, and municipal and regional parks which support estuarine habitats.
6. Use your increased knowledge and awareness of the estuary's ecology, its pollution problems, and how the public can help, to involve other, uninformed people in your community. The Storm Drain Marking Program sponsored by the British Columbia Conservation Foundation, DFO and ELP is a good way to increase your community's awareness about pollution in the estuary. Storm drains have been marked to prevent people from disposing of hazardous waste which could harm fish and other aquatic life.



If you require some technical information about a particular commercial, industrial or household hazardous material, contact the Canadian Chemical Producers Association (1-800-267-6666).

7. Your group can start a pollution watch program. Any suspicious looking effluent discharges, illegal dumping, vandalism and fish kills can be reported to local enforcement authorities. The following telephone numbers may be useful in case you observe a problem or environmental emergency:

Provincial Emergency Program

Report on oil or chemical spills and advice on the disposal of hazardous materials.

1-800-663-3456.

B.C. Environment Hotline

Observe, record, and report any violation of fish and wildlife regulations.

1-800-663-9453

8. Businesses and industries which are environmentally irresponsible can be approached directly. Use the influence of your group's name and membership numbers to address letters to the president of the offending companies. Most corporations hate bad publicity and are usually understanding and cooperative if approached in a polite and objective manner.
9. Get your group involved in environmental issues which may be of concern. All large and most small development proposals are subject to an environmental review process. Government agency reviews of development proposals on the foreshore and in the river are now coordinated by the Fraser River Estuary Management Program (FREMP) office. FREMP will also facilitate public input in these environmental reviews. The best time to voice a concern is before the proposed project is granted approval. Issues related to the land side of the dike can usually be pursued most effectively through your local city council.



The Fraser River Basin Management Program, which is supported by Federal, Provincial and local governments, encourages and provides the opportunity for the public and other interested groups to participate in management of the Fraser River basin. If you require more information on this program, please contact:

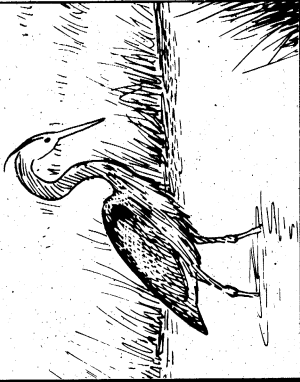
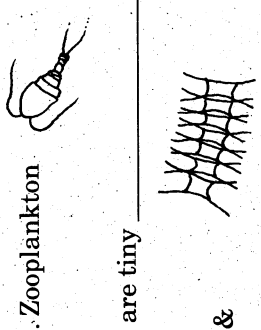
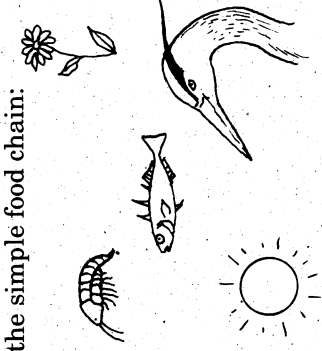
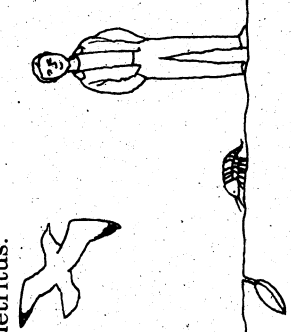
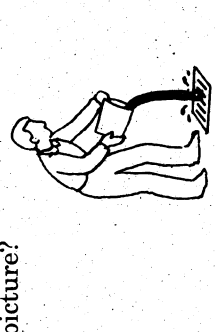
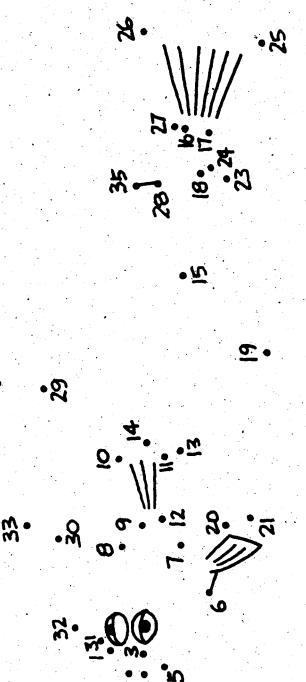
Environment Canada
Communications
224 West Esplanade
North Vancouver, B.C.
Canada V7M 3H7
Tel: (604) 666-5900



ACTIVITY 11: FRASER RIVER ESTUARY WHIZ QUIZ!

My name is: _____

(adapted from: *The Estuary Program - Level II*)

<p>1. Where a river meets the sea is an _____</p> 	<p>2. _____ water and _____ water mix in an estuary to form _____ water.</p>	<p>3. Zooplankton are tiny _____ & _____ plankton are tiny plants.</p> 	<p>4. Draw connecting lines for the simple food chain:</p> 	<p>5. Circle those that eat detritus.</p> 												
<p>6. How many estuarine organisms, starting with the letter S can you think of?</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>7. Which plants grow in an estuary?</p> <p>_____ spinach _____ algae _____ roses</p> <p>_____ cat-tails _____ eelgrass _____ papaya</p> <p>_____ saltgrass.</p>	<p>8. Which one of the following plants are trees or shrubs?</p> <p>_____ Bulrush</p> <p>_____ Snowberry</p> <p>_____ Hardhack</p> <p>_____ Sedge</p> <p>_____ Black Cottonwood</p>	<p>9. CONNECT:</p> <table border="0"> <tr> <td>Animal</td> <td>Habitat</td> </tr> <tr> <td>Plankton</td> <td>eelgrass</td> </tr> <tr> <td>Crab</td> <td>slough</td> </tr> <tr> <td>Salmon</td> <td>tidal flat</td> </tr> <tr> <td>Snail</td> <td>channel</td> </tr> <tr> <td>Sandpiper</td> <td>marsh</td> </tr> </table>	Animal	Habitat	Plankton	eelgrass	Crab	slough	Salmon	tidal flat	Snail	channel	Sandpiper	marsh	<p>10. What's wrong with this picture?</p>  <p>_____</p> <p>_____</p>
Animal	Habitat															
Plankton	eelgrass															
Crab	slough															
Salmon	tidal flat															
Snail	channel															
Sandpiper	marsh															
<p>11. True or False?</p> <p>A freshwater plume is a type of marsh flower _____.</p> <p>Detritus is the base of the food web in estuaries _____.</p> <p>Ghost shrimp live in mudflat burrows _____.</p> <p>Bacteria found in estuaries are always harmful _____.</p> <p>Answer: _____</p>	<p>13. Unscramble the following words:</p> <p>TTIAAHB</p> <p>ONTIULLOP</p> <p>RAMSH</p> <p>KRABSCHI</p> <p>NOMALS</p>			<p>14. Connect the dots.</p>  <p>What is it?</p> <p>_____</p>												

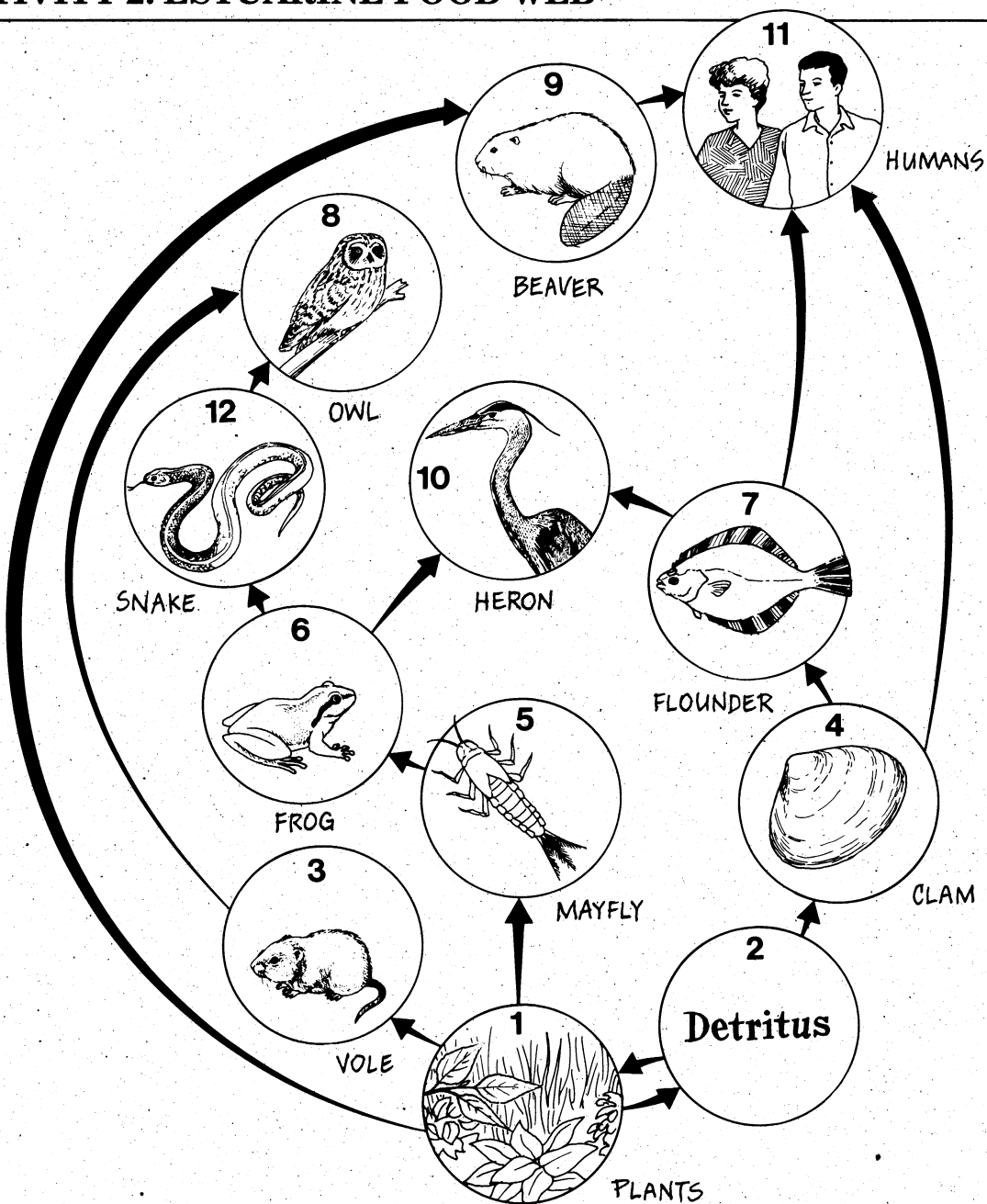
APPENDIX 1:

ANSWERS

ACTIVITY 1: ESTUARINE FOOD CHAIN

SUN ⇒ PLANT ⇒ DETRITUS ⇒ CLAM ⇒ SEAGULL CHICK ⇒ BALD EAGLE

ACTIVITY 2: ESTUARINE FOOD WEB



ACTIVITY 3: CRITICAL TIDAL ELEVATIONS

Start of mudflat and end of the marsh	2.8 m
Beginning and end of bulrush zone	2.8 m and 3.7 m
Beginning and end of sedge zone	3.7 m and 4.5 m
Beginning and end of cat-tail zone	4.5 m and 4.8 m
Top of dike	5.8 m

The following is a brief explanation on how to predict tides using the *Canadian Tide and Current Tables, Volume 5*. You should also take the time to carefully read the instructions provided with these tide tables.

Turn to the section in the tide tables with the heading "POINT ATKINSON". This set of tide tables predicts tide levels for the **outer** Fraser River Estuary (i.e. Sturgeon Bank, Roberts Bank, and Boundary Bay). Next, select the appropriate month and day shown in the table columns. For the purpose of this explanation, we shall use Wednesday, August 26, 1992, which is shown below exactly as it appears in the tide table.

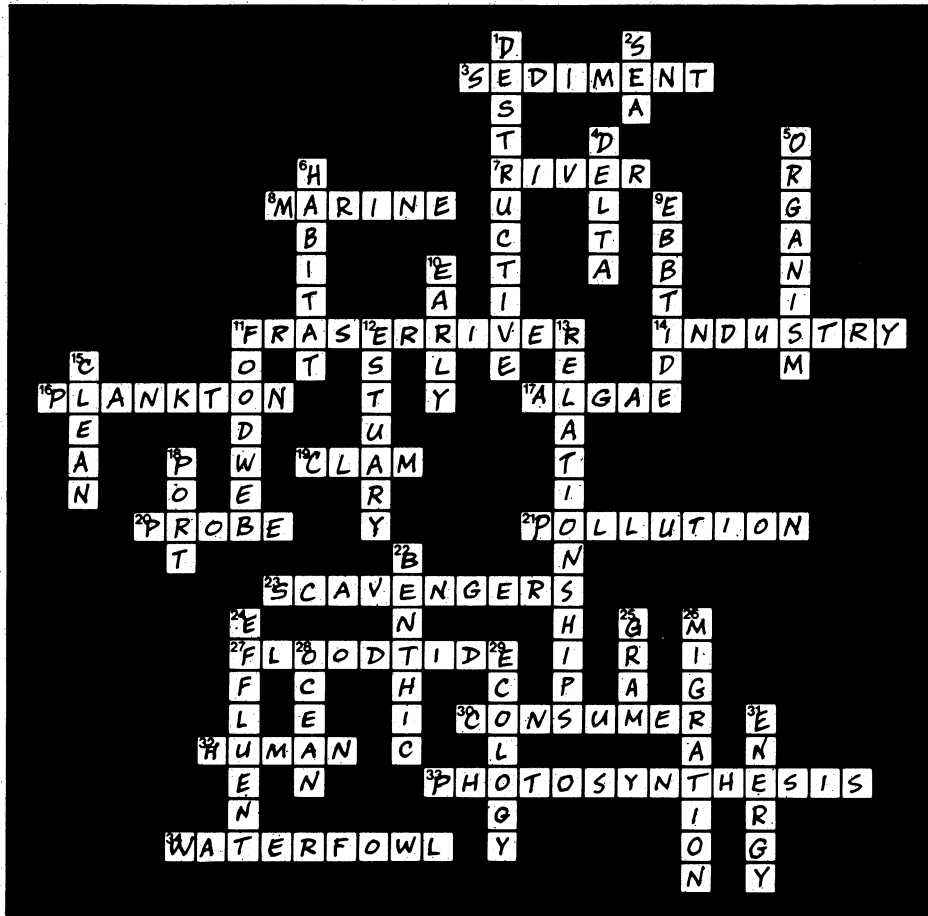
DATE	TIME	FEET	METRES	
26	0230	13.4	4.1	In this example, the predicted times and heights of the high and low tides are as follows:
	0940	2.1	.6	At 0330 hours, the Lower High Water will be 4.1 m
WE	1650	14.8	4.5	At 1040 hours, the Lower Low Water will be 0.6 m
ME	2225	9.3	2.8	At 1750 hours, the Higher High Water will be 4.5 m
				At 2325 hours, the Higher Low Water will be 2.8 m

Note that the times in the tide tables are given in Pacific Standard Time (PST). In the above example, one hour has been added to PST, to convert it into Daylight Savings Time. Daylight Savings Time is when we turn our clocks ahead one hour, and this occurs between the first Sunday in April and the last Sunday in October.

If you are interested in predicting the tide for locations **inside** the Fraser River Estuary (i.e. upstream of Steveston), you'll need to use the "FRASER RIVER" table, usually located near the front of the *Canadian Tide and Current Tables*. The Fraser River tide table takes into consideration the river discharge (flow of water) and location (Steveston, Deas Island, New Westminster). Instructions on how to use this table are provided with the table.

ACTIVITY 4: PRE-TRIP FUN

Answers to Crossword Puzzle



ACTIVITY 8: THE CHANGING ESTUARY

Period of Pre-white Settlement

Food Gathering, Fishing, Hunting

1820's to 1830's

Fur Trading, Food Gathering, Hunting, Fishing, Exploring

1840's to 1860's

Surveying, Hunting, Gold Rush Traffic,

1870's to 1890's

Land Clearing, Gillnet Fishing, Floodplain Logging, Road Building, Diking, Steamboat Travel, Farming, Fish Canning

1900's to 1940's

Industrial Development, Land Clearing, Gillnet Fishing, Upland Logging, Road Building, Diking, Dredging, Port Development, Farming

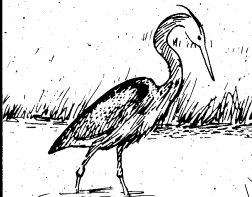
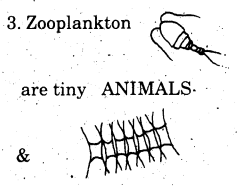
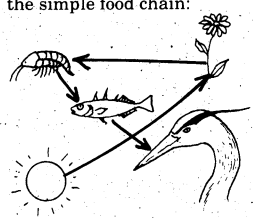
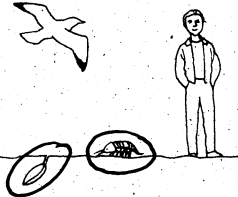

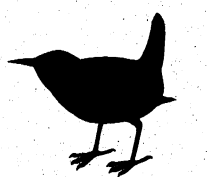
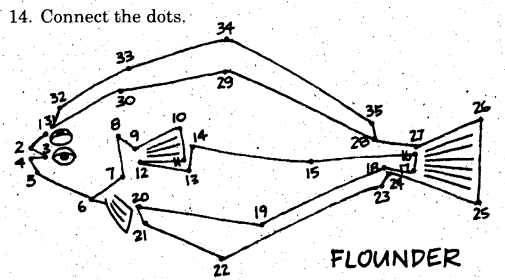
1950's to Present

Industrial Development, Land Clearing, Freighter Traffic, Road Building, Diking, Dredging, Port Development, Urban Development

ACTIVITY 10: MATCHING POLLUTANTS AND SOURCES

POLLUTANTS	POLLUTION SOURCES			
	Household	Pulp Mill	Farm Field	Automobile
Bacteria	X		X	
Copper	X			
Dioxins		X		
Herbicides	X		X	
Lead				X
Oil				X

ACTIVITY 11: FRASER RIVER WHIZ QUIZ

<p>1. Where a river meets the sea is an ESTUARY.</p> 	<p>2. FRESH water and SALT water mix in an estuary to form BRACKISH water.</p>	<p>3. Zooplankton are tiny ANIMALS & PHYTO plankton are tiny plants.</p> 	<p>4. Draw connecting lines for the simple food chain:</p> 	<p>5. Circle those that eat detritus.</p> 												
<p>6. How many estuarine organisms starting with the letter S can you think of?</p> <p>SALMON SNOWGOOSE</p> <p>SALTGRASS SEDGE</p> <p>SHRIMP SANDPIPER</p>	<p>7. Which plants grow in an estuary?</p> <p>___ spinach</p> <p>___ <input checked="" type="checkbox"/> algae</p> <p>___ <input checked="" type="checkbox"/> roses</p> <p>___ <input checked="" type="checkbox"/> cat-tails</p> <p>___ <input checked="" type="checkbox"/> eelgrass</p> <p>___ papaya</p> <p>___ <input checked="" type="checkbox"/> saltgrass</p>	<p>8. Which one of the following plants are trees or shrubs?</p> <p>___ Bulrush</p> <p>___ <input checked="" type="checkbox"/> Snowberry</p> <p>___ <input checked="" type="checkbox"/> Hardhack</p> <p>___ Sedge</p> <p>___ <input checked="" type="checkbox"/> Black Cottonwood</p>	<p>9. CONNECT:</p> <table border="0"> <tr> <td>Animal</td> <td>Habitat</td> </tr> <tr> <td>Plankton</td> <td>eelgrass</td> </tr> <tr> <td>Crab</td> <td>slough</td> </tr> <tr> <td>Salmon</td> <td>tidal flat</td> </tr> <tr> <td>Snail</td> <td>channel</td> </tr> <tr> <td>Sandpiper</td> <td>marsh</td> </tr> </table>	Animal	Habitat	Plankton	eelgrass	Crab	slough	Salmon	tidal flat	Snail	channel	Sandpiper	marsh	<p>10. What's wrong with this picture?</p> 
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<p>11. True or False?</p> <p>A freshwater plume is a type of marsh flower ___ F ___.</p> <p>Detritus is the base of the food web in estuaries ___ T ___.</p> <p>Ghost shrimp live in mudflat burrows ___ T ___.</p> <p>Bacteria found in estuaries are always harmful ___ F ___.</p>	<p>12. Can you identify this estuarine bird?</p>  <p>Answer: MARSH WREN</p>	<p>13. Unscramble the following words:</p> <p>HABITAT</p> <p>POLLUTION</p> <p>MARSH</p> <p>BRACKISH</p> <p>SALMON</p>	<p>14. Connect the dots.</p>  <p>FLOUNDER</p>													

APPENDIX 2:

ACTIVITIES & FIELD TRIP DESTINATIONS

ACTIVITY	PAGE
1. ESTUARINE FOOD CHAIN (Design a Food Chain).....	13
2. ESTUARINE FOOD WEB (Food Web Puzzle).....	14
3. CRITICAL TIDAL ELEVATIONS (Learn How to Predict Tides).....	27
4. PRE-TRIP FUN (Estuary Crossword Puzzle and Word Challenge).....	33
5. LIFE BENEATH THE TIDEFLAT (Study Life on a Tideflat).....	45
6. A FLOODPLAIN FOREST MICRO-HABITAT STUDY (Field Trip).....	61
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10. MATCHING POLLUTANTS AND SOURCES (Pollution Quiz).....	100
11. FRASER RIVER ESTUARY WHIZ QUIZ (General Quiz).....	108

FIELD TRIP DESTINATION

1. RICHMOND DIKE (Foreshore Marshes of Sturgeon Bank).....	37
2. BOUNDARY BAY (Tideflats and Saltmarshes).....	47
3. RIVERSIDE PARKS (Floodplain Forests).....	59
4. DEAS ISLAND PARK (Sloughs and River Channels).....	71
5. FURTHER SUGGESTIONS (see Figure 2-3 and Table 2-3).....	30

APPENDIX 3:

RELEVANT CONTACTS

Organization	Telephone
<i>Federal Government</i>	
Department of Fisheries and Oceans	666-6098
Canadian Coast Guard	631-3702
Canadian Wildlife Service	666-0143
Environmental Protection Service	666-6711
Inland Waters Directorate	666-6711
<i>Provincial Government</i>	
B.C. Environment	584-8822
Recycling Hotline	1-800 667-4321
<i>Municipal Government</i>	
Richmond	276-4000
Burnaby	294-7944
New Westminster	521-3711
Delta	946-4141
Coquitlam	526-3611
Port Coquitlam	941-5411
Pitt Meadows	465-5454
Surrey	591-4011
Langley	534-3211
Maple Ridge	463-5221
Greater Vancouver Regional District	432-6200
<i>Other Governmental Organizations</i>	
Fraser River Estuary Management Program	525-1047
Fraser River Harbour Commission	524-6655
North Fraser Harbour Commission	273-1866
<i>Environmental Non-Government Organizations</i>	
B.C. Environmental Network	733-2400

GLOSSARY

- anadromous:* a type of fish life cycle in which maturity is reached in saltwater, and the adults enter freshwater to spawn.
- algae:* term applied to small, one-celled or colonial plants without vascular systems.
- bacteria:* microscopic organisms living in soil, water, sediments and the bodies of plants and animals (including man).
- benthic:* organisms living in or on the bottom sediments of a body of water.
- bioaccumulation:* the process whereby pollutants are taken up, retained and concentrated by aquatic plants or animals.
- bioindicator:* an organism which is sensitive to pollution and can therefore be used to measure the degree of pollution in its environment.
- biosphere:* the region around the earth that can support life including the atmosphere, the soil and the water.
- brackish:* describes water having a salinity between freshwater (0.5 parts per thousand) and seawater (17 parts per thousand).
- climax:* a kind of natural community which can continue and sustain itself for as long as the local climate remains the same.
- crustacean:* any of the large class of mostly aquatic animals having an outer skeleton; includes shrimps, crabs, barnacles, etc.
- decomposition:* the biochemical process where biological materials are broken down into smaller particles and eventually into basic chemical compounds and elements.
- delta:* a deposit of sediment (e.g., island, sand bar, mudflat) at the mouth of a river emptying into the sea.
- detritus:* dead organic matter, both plant or animal.
- diatoms:* small, microscopic algae with plate-like, brown structures composed of silica.
- dioxin:* a toxic chemical produced when chlorine interacts with organic materials as in the pulpmill bleaching process, in garbage incinerators, and as a byproduct of other industrial chemicals.
- dike:* an elevated ridge of material constructed to prevent water in a river from overflowing its banks during flooding conditions.

<i>ecosystem:</i>	a community of organisms that can be identified and described on the basis of specific and unique physical, chemical and biological properties (e.g., a lake, stream, marsh, forest, desert, etc.).
<i>effluent:</i>	liquid waste material (e.g., sewage) discharged into the environment.
<i>Eulachon:</i>	a member of the smelt family of fishes, with elongated body, about 20 cm in length, and high in oil content.
<i>estuary:</i>	a semi-enclosed body of water, which has a free connection with the open sea, and within which seawater is measurably diluted with freshwater derived from land drainage.
<i>floodplain:</i>	the area of land adjacent to a river channel which is subjected to flooding when floodwater levels reach a predetermined height.
<i>foreshore:</i>	with respect to land use in British Columbia, the land between mean high tide and mean low tide.
<i>freshet:</i>	a sudden increased flow period in a river as a result of spring snowmelt or heavy rainfall.
<i>fungi:</i>	a non-vascular plant that sustains itself without the use of chlorophyll and sunlight (e.g. mushrooms).
<i>gillnet:</i>	a net set upright in the water to catch fish by entangling their gills in the mesh of the net.
<i>habitat:</i>	a place or "home" in the environment where an organism lives or is expected to live in order to fulfill an important function such as feeding or rearing.
<i>herbivores:</i>	animals that consume plant material as their main source of nourishment.
<i>invertebrate:</i>	animals without backbones (e.g., insects, worms, snails), which includes most of the animal kingdom.
<i>larva:</i>	an animal at some pre-adult stage of development.
<i>micro-habitat:</i>	a small local habitat (e.g., rotton log) within a larger habitat type (e.g., floodplain forest).
<i>midden:</i>	a refuse heap or pile of discarded garbage which, if old and from a special culture, can have archeological value.
<i>molluscan:</i>	describing any animal belonging to the molluscs that include most of the shellfish (except for crustaceans).
<i>nutrient chemical:</i>	a substance containing phosphorus, nitrogen, and potassium, which are essential to the health and for the growth of plants.
<i>nymph:</i>	an animal at some pre-adult stage of development.

- organic matter:* biological material or chemicals based on carbon and hydrogen.
- Pacific Flyway:* the migratory path used by birds along the west coast of North America.
- photosynthesis:* the process by which plants use sunlight, in the presence of chlorophyll, to manufacture their food (carbohydrate) from carbon dioxide and water.
- phytoplankton:* floating or drifting microscopic plant life.
- plume:* the volume of water discharged by a river into the sea, and which retains some characteristics of the original river water (e.g., suspended sediments).
- pollutant:* a substance which is harmful to living organisms because it is not normally found in the environment or its concentration is too large.
- primary production:* organic matter produced by plants which serves as the primary source of energy and nutrition for other consumers in the ecosystem (e.g. herbivores).
- protozoa:* microscopic single-celled animal or colony of animals capable of ingesting microscopic food particles.
- salinity:* a measure of the quantity of dissolved salts in seawater, defined as the total amount of dissolved solids in parts per thousand.
- saltmarsh:* a vegetation community where the plants tolerate high levels of salt in the water table or flood waters.
- salt wedge:* a wedge-shaped layer of salty water that is pushed along the bottom into an estuary on every flood tide.
- sediment:* material such as sand, silt, and clay that is suspended in moving water but will settle to the bottom in still water.
- slough:* a shallow, quiet backwater channel connected to some larger body of water such as a river, estuary or lake.
- sturgeon:* a bottom-feeding fish covered with bony plates and a large head with sucking mouth. Sturgeons, highly prized for their eggs (caviar), are the largest freshwater fish of Canada.
- succession:* the replacement of one type of natural community by another through a progressive change in plant and animal life over time.
- tideflat:* a flat expanse of land, usually mud or sand, situated between the high and low tide level, exposed at low tides, and flooded at high tides.
- toxic:* of, relating to, or caused by a toxin or poison which, through chemical action, kills, injures or impairs an organism.

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