

ESTUARY

User's Guide

"An estuary is such an ordinary place: a bit of sand and mud and grass, to mark the place where a river meets the sea."



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Introduction

Although river estuaries may sometimes be regarded as barren, muddy places, they are in fact the most highly productive natural environments on earth, essential to a variety of marine and bird life, and to humans as well. *Estuary* provides an informative and entertaining introduction to the estuarine environment, and to Man's place in that environment. With many underwater sequences and simple narration, this film is suitable for a wide audience, from elementary level science classes to senior secondary levels of science, geography and social studies.

For biology classes, the film reveals a fascinating underwater world not easily observed by students in the field or in the laboratory. It discusses the food web of an estuary, and shows the interaction of organisms in this particular environment.

For science students, the film offers a starting point for discussion of environmental and ecological topics, e.g., water pollution, habitat protection, wildlife conservation, and the human impact on the balance of nature. Similarly, the film provides a focus for geography and social studies classes studying the effect on the environment

of human settlement and basic economic activities such as farming, forestry, and industrial development.

Synopsis

Filmed in the Strait of Georgia region of British Columbia, *Estuary* begins with a description of the natural features of an estuary (river, marshes, mudflats) and indicates how the interaction of river and tides affects life in the estuary.

A simplified food chain is outlined, from grasses and algae to detritus – the basic food for tiny organisms and small fish – to larger fish, marine animals, birds, and eventually to humans. Underwater sequences show feeding activities in progress.

The economic importance of estuaries is illustrated by salmon fishermen at work, and by scenes of urban and industrial development on the flatlands.

Estuary concludes with a gentle reminder that further careless destruction of estuarine environments may not be wise, nor necessary.

Terms Used in The Film

An *estuary* is the entire region where the salt water of the ocean is diluted by the fresh water of a river.

Salinity refers to the amount of dissolved salts present in the water. The average salinity of the ocean is around 34 parts per thousand.

Detritus refers to small particles of dead organic material (mainly estuarine plants, algae, and leaf material carried down by the river) and bacteria engaged in the decomposition of that material.

Plankton are tiny organisms drifting in the water. There are two types – phytoplankton, that are plants, and zooplankton, that are animals which feed on phytoplankton and detritus.

Isopods and *amphipods* are small crustaceans that live in the sand and mud of the estuary.

Estuaries: The Natural Realm

In biological terms, estuaries are the most productive areas of the world. Although they vary in detail from place to place, the essential features are constant. Rivers carry sediment from the land and deposit it in the sea.

The flow of river water combines with the action of tides and currents to set up a pattern of water circulation that brings nutrients from the ocean to the estuary. Sunlight warms the shallow waters and promotes rapid growth of plants and animals. Marsh grasses take root along the foreshores, and algae and small marine organisms flourish in the sand and mudflats. Eelgrass grows in shallow sub-tidal areas. The result of these processes is an intricately balanced natural environment.

The marsh vegetation (commonly sedges and rushes in the west, cordgrass in the east) retards erosion by floods and tides, provides food and shelter for migratory waterfowl, and offers excellent habitat for a variety of wildlife.

Algae is abundant, from microscopic forms in the inter-tidal flats – it is algae that makes the mud so slippery – to different types of green seaweed.

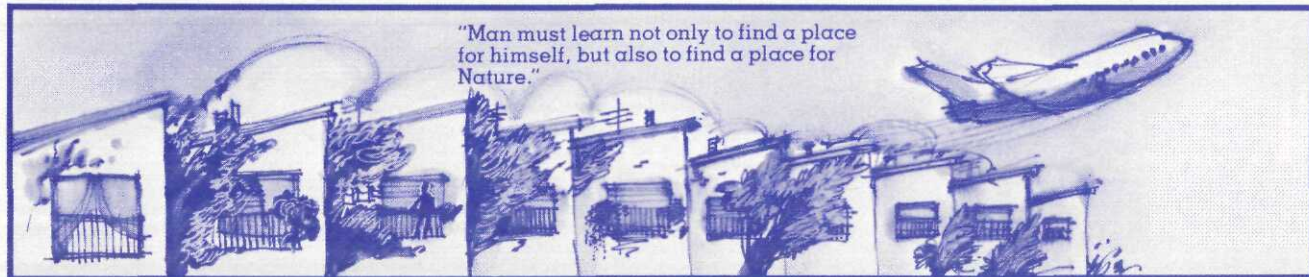
As mentioned in the film, bacterial action on dead grass, algae and leaves brought down by the river produces detritus. This is the principal food of a host of marine organisms: zooplankton, benthic invertebrates (the amphipods and isopods that live in the sand and mud among the grass) and larger creatures such as clams, mussels, barnacles, oysters (mainly in eastern Canada), shrimp and crabs.

Many fish spend their entire lives in estuaries. Staghorn sculpins and Starry flounders are common in the west; eels, herring and flounders are the most common species in the east. But estuaries are especially important to a number of species that are sought by commercial and recreational fishermen – salmon, herring, sea-run trout, char and eels. Current scientific knowledge indicates that estuaries are valuable nursery areas for juvenile salmon. Their chances of survival in the ocean appear to be improved by par-

ticularly rapid growth during their estuarine life.

Just as salmon depend on estuaries as they make their way from river to ocean, millions of birds rely on estuaries as staging areas along their migration routes. From Arctic breeding grounds (which include estuaries such as the Mackenzie and the Coppermine), and from as far away as Siberia, birds arrive at the Strait of Georgia, the St. Lawrence estuary and the Bay of Fundy. Some stay for only a few days, feeding and resting before moving on; others stay for the winter. The Fraser estuary has the largest winter population of waterfowl (ducks, geese and swans) in Canada.

Thousands of shorebirds feed on the estuarine mudflats. Gulls, grebes, loons, mergansers and herons feed on small fish in the water of the estuary, and raptors such as eagles and falcons are attracted by the concentrations of ducks and shorebirds.



"Man must learn not only to find a place for himself, but also to find a place for Nature."

Estuaries: The Human Impact

Except in the more remote coastal areas, estuarine wildlife has been reduced considerably since the early days of European settlement in Canada. Seals and white whales are still seen in the St. Lawrence estuary; seals, and occasionally sea lions, are found in west coast estuaries. Deer, raccoons, otters, mink, muskrats and small rodents may be seen in the marshes or along the shore.

In historical terms, estuaries have long been favorable locations for human settlement. Many of the world's major cities are built on or near estuaries. The reasons are not hard to find.

River soils were excellent for agriculture. Marshes provided an abundance of game birds for food and sport. Estuary waters yielded rich harvests of seafood. It was easy and economical to build houses, factories, and port facilities on the unforested flatlands. Rivers were traditional lines of communication and transportation, and were also used to carry away sewage and industrial wastes.

While cities and towns were relatively small, there was little concern for the natural environment. But today the continued productivity of estuarine envi-

ronments is threatened by unchecked urban expansion, industrial development, irresponsible agricultural practices, dam construction and logging and mining activities in watershed areas far from the sea. Today, there is growing concern about habitat loss and deteriorating water quality.

Diking, filling, and reclamation projects, for whatever purpose, simply reduce the amount of productive marshland. Log booms moored in estuaries damage marsh grasses by abrasion. Dredging and channeling rivers tends to alter the distribution of sediment in the estuary, and affects water circulation patterns that in turn affect salinity and temperature.

In general, the increase in population has been accompanied by an increase in the amount of water pollution. Sewage treatment plants are barely adequate in many areas, and few of them are equipped to handle the wide array of toxic by-products of modern technology and agriculture.

The impact of these substances on the estuarine environment is not easily measured. Habitat loss is usually permanent, but scientists know that areas and organisms damaged by pollution can be rehabilitated – though it takes time, money and public concern.

With due consideration for the natural environment, urban expansion and industrial development can represent true social and economic progress. As long as the marshes remain and the water is clean, the cycle of estuarine production is continuous and free. And for more and more city dwellers, estuaries can be ideal natural areas for recreation, nature study, and wildlife conservation.

"It's so easy to be careless of an estuary; an estuary is such an ordinary place."

Some Suggestions for Student Activities

- Before screening the film, students could use maps to locate major Canadian rivers and their estuaries. Students could note some of the natural, social, and economic features of such regions as the Strait of Georgia, the Mackenzie Delta, the St. Lawrence estuary, and the Bay of Fundy.
- Students could review the food webs in other environments they have studied, or compare the food web of an estuary with that of a salt marsh or freshwater lake.
- After screening the film, students may wish to find out more about bird migration or the life cycle of salmon. This knowledge would provide a broader context in which to evaluate the importance of estuaries.
- For students in coastal areas, a field trip to an estuary can be a valuable learning experience. Access to different parts of an estuary is not always easy, and care must be taken when moving about in marshes or on mudflats. But natural features can be identified, and mud and water samples taken for later study. Spring and fall are good times for bird-watching, and for observing wildlife. Human activities could also be noted, e.g., location of

urban areas, types of industry and amount of shipping along the river. After the field trip, students could discuss their findings. Was the estuary a barren, muddy place? How many species of birds and wildlife were identified? Could any of the human activities be carried on equally well outside the estuary?

- Inland students could develop a class project to study in some detail a river system that is linked to their particular geographic location. The objective would be to better understand the relationships between the estuary, the watershed, and the ocean into which the river flows.

For Further Reading:

Special Estuary Series,
Dept. of Fisheries and Oceans
(8 studies of B.C. estuaries
published 1974-1979).

Fundy Tidal Power and the Environment,
Daborn, G. (Ed.), Wolfville,
Acadia, 1977.

Pacific Seashores,
Carefoot, T., Vancouver,
Douglas, 1977.

The St. Lawrence Valley
Lefolii, K., Toronto, Natural
Science, 1970.

The Atlantic Coast,
Russell, F., Toronto, Natural
Science, 1970.

Exploring the Seashore,
Snively, G., Vancouver, Soules,
1978.

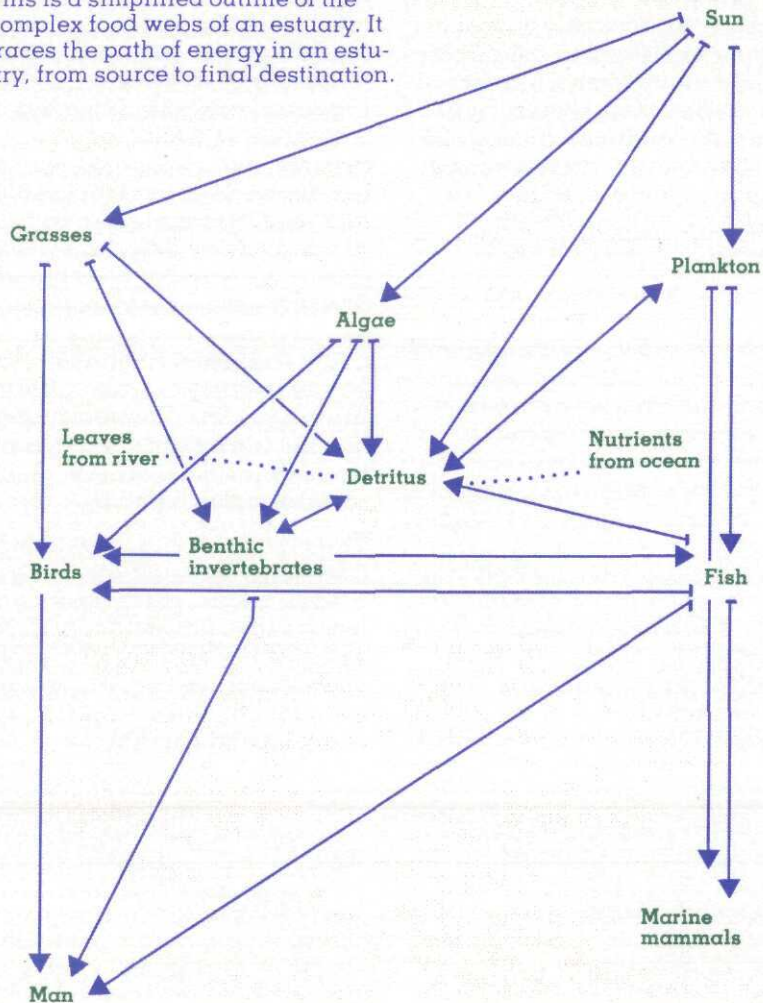
The Atlantic Coast,
Wilkinson, D., Toronto, Natural
Science, 1970.

Beaches and Coasts,
King, C.A.M., Butler & Tanner,
London, 1972.

Our Coastal Environment,
Committee of Atlantic
Environment Ministers, 1978.

The Estuarine Food Web

This is a simplified outline of the complex food webs of an estuary. It traces the path of energy in an estuary, from source to final destination.



Estuary

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