Autumn 1996 ISSUE # 10

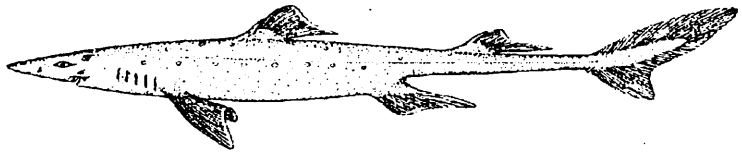
FUNDY ISSUES

EXPANDING FUNDY'S HARVEST

Targeting Untapped Treasures

Trash or treasure?

Fisheries managers use the term "underutilized species" for marine organisms that have long been ignored by most fishermen, but have suddenly become very marketable. Marine scientists, on the other hand, tend to be uncomfortable with the expression. To them, it implies that a species is wasted simply because it is not being scooped up for human consumption or other commercial use. It glosses over the point that, although these species may be "underutilized" economically, they are invariably "fully utilized" ecologically. In fact, most are food for the very species that are harvested in the "traditional fisheries". By harvesting these prey organisms ourselves, we are directly competing with the valuable species that have long sustained our fishing industry. We must carefully consider these "food chain" linkages in assessing the feasibility of any new fishery. The various "diners" and "dinners" in the sea tend to be arranged in rather fuzzy, but recognizable, "trophic" or feeding levels. For example, dolphins, near the top of a food chain, eat large fish, which in turn eat small fish, which eat crustacean zooplankton, which then eat the microscopic single-celled, floating plants (phytoplankton) that make their own food, and are thus at the bottom of the chain. The traditional fisheries have usually exploited the species at the higher trophic levels, because they are often larger and more palatable to North American consumers. The practice of harvesting "underutilized species" at lower and lower levels in the food chain increases the likelihood of adversely effecting more commercially important species at the higher trophic levels. Regrettably, we don't know enough about most marine food chains to be able to predict the extent or seriousness of these ecological "chain" reactions.



The spiny dogfish, although "underutilized" by Canadian fishermen may be "fully utilized" by foreign fleets fishing in east coast waters.

Perhaps "Cinderella species" would be a more descriptive term for these newly discovered resources. They certainly fit the dictionary definitions of "one suffering undeserved neglect" or even more aptly "one suddenly lifted from obscurity to honour or significance". When stocks of valued groundfish were abundant, few fishermen were interested in harvesting worthless sea urchins, tasteless periwinkles or leathery sea cucumbers. They especially despised the abundant dogfish that frequently tangled and damaged their fishing gear. Only during the past decade, with many traditional stocks collapsing disastrously and inexplicably, did government

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departments and fishermen start looking about for new harvests and untapped markets. Mark Butler, of the Ecology Action Centre in Halifax, wryly notes that "species once ignored or thrown overboard as 'trash' are now being re-examined for their marketability". It didn't take long to realize that the teeming populations of south east Asia regard most of the "trash" species as culinary delicacies, and are willing to pay accordingly. In short order, a huge, lucrative export market has sprung up for a growing range of seafood spurned by North American consumers. This has contributed to a practice of shifting excess fishing capacity from species to new species, severely depleting each in turn, in a "cascade effect". Each year ever more species are being swept up in the cascade.

"species once ignored or thrown overboard as 'trash' are now being re-examined for their marketability"

Feasible fisheries?

The following are a few of these "Cinderella species" that are found in the Bay of Fundy or nearby waters. Some are already being harvested, while others are, as yet, only a twinkle in a promoters eye. Although rockweed clearly falls into the "Cinderella" category, its commercial exploitation is particularly controversial, and has been characterised as "harvesting habitat". It is thus treated at greater length in a separate issue (Number 4) of this series.

Periwinkle - These hazelnut-sized, greyish-brown snails of the genus *Littorina spp.* adhere tightly to intertidal rocks in huge numbers. They have long been harvested in the region, particularly in Digby County, Nova Scotia and Charlotte County, New Brunswick. Traditional harvesting by hand, collects mostly large snails, and misses many in inaccessible crevices and tide pools, permitting rapid recovery of the populations. A hand harvester typically collects about 75 pounds of periwinkles per day in the summer and up to 300 pounds in winter when they are more concentrated. The New Brunswick Conservation Council (NBCC) notes that "the fishery has existed for many years with no signs of significant resource decline". However, in recent years efforts have been made to make the fishery "more efficient" and lucrative. Harvesting accelerated dramatically with the introduction in the summer of 1993 of diver-operated suction harvesters. These devices can suck up several hundred to several thousand pounds of periwinkles per day. Also, they not only vacuum up almost all of the standing stock in the area, but harvest all sizes of periwinkles, greatly hampering population recovery. The NBCC is fearful that "after decades of sustainable harvest, the periwinkle fishery in the Bay of Fundy may be in jeopardy". There are also concerns that the suction harvesters collect many other seashore animals as well.

In view of the intensified harvest, there is a worrisome lack of reliable information about the abundance and distribution of the periwinkles in the Bay, as well as about the maximum level of harvesting that might be sustainable in the long run. Scientists from the Department of Fisheries and Oceans' (DFO) St. Andrews laboratory have begun surveying periwinkle populations near Deer Island in New Brunswick. Other studies, by Martin Thomas of the University of New Brunswick, show that periwinkles are important food for many types of invertebrates, fish and waterfowl. Eider ducks, in particular, forage for them among the seaweeds. Large numbers of snails also die from stress in winter on the exposed rocky coasts. Their constant grazing over the rock surfaces is effective in controlling the growth of algae. Little is known about the effects on other marine organisms of removing large numbers of snails from extensive intertidal areas.

Green sea urchin - Urchins have long been regarded as a pest by lobstermen. They devour the kelp forests that serve as refuges for young lobsters and raid lobster traps for the bait. These abundant echinoderms (Latin for spiny skin), with the tongue-contorting scientific name of *Strongylocentrotus droebachiensis*, are at first glance unlikely additions to any gourmet buffet. Their hard round shell, bearing fearsome rows of waving spines make them about as

The green sea urchin, Strongylocentrotus droebachiensis, is abundant in Maritime waters, and its roe is highly prized in Asian markets.

appetizing as an animated cactus. However, in late winter, their calcareous bodies, ranging in size between a golf and a tennis ball, fill almost completely with five large, yellow-orange reproductive organs. This colourful "roe" is much in demand in the orient, where it is deemed such a great delicacy that it may command up to $132 per kilogram. The urchins are harvested nearshore, at depths of 5 to 15 metres, by hand picking by Scuba divers on rougher bottoms, or by towing a dredge on sedimentary bottoms. Although there were test fisheries in the Bay in the 1970's, it was not until the late 1980's that a commercial fishery began in SW New Brunswick. The harvest rose from 47 tonnes in 1986 to 822 tonnes in 1992, and to almost 1000 tonnes in 1993. In recent years the fishery has also begun expanding rapidly in SW Nova Scotia.

Urchins in the Maritimes are highly susceptible to a devastating disease caused by an amoeba. In the late 60's and early 70's urchins were abundant. However, in the early 80's populations were decimated by the disease, and another outbreak occurred in 1995. Bob Scheibling, a marine biologist at Dalhousie University, cautions that "this is a boom fishery at the moment, but it could go bust with one big outbreak of disease". These are triggered by unusually high water temperatures near shore, resulting from largely unpredictable changes in ocean currents such as the Gulf Stream. The outbreaks kill large numbers of animals, and the coastal rocky shallows change from being rather barren when urchins are abundant, to heavily kelp covered when they are absent. Recovery of the urchin populations and subsequent decimation of the kelp forest can take years to decades, depending on environmental conditions.

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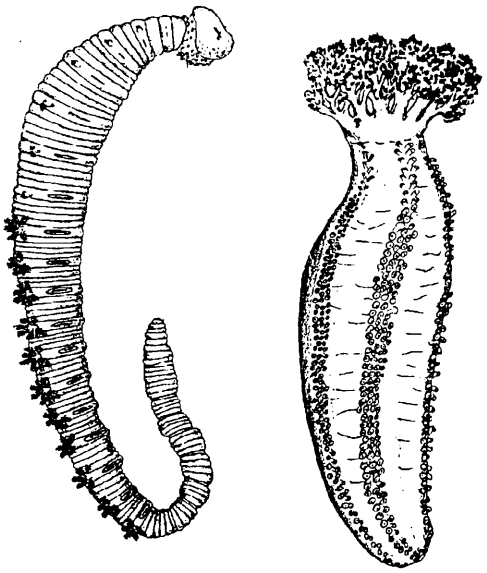
There is also a growing interest in farming urchins, which addresses a number of problems in the current wild fishery. The harvest season runs from November to April, a time of notoriously poor sea conditions in the Maritimes. It helps greatly if they can be collected in seasons when conditions are more favourable for divers, and then held in cages until ready for market. Captive urchins can also be fed special diets which increase both the quantity of roe produced and its quality, particularly its colour, which can be better tailored to the differing consumer preferences in some countries. It may also prove easier to control the temperatures by moving cages between shallower and deeper waters as needed, and thereby minimize the likelihood of disease outbreaks.

However, there is great concern that this rapid expansion is taking place in the absence of clear management policies based upon sound scientific information about populations and sustainable harvesting levels. Scientists participating in a 1993 Moncton Workshop on underutilized species expressed great concern that "the Fundy sea urchin fishery is desperately short of the ecological research necessary for informed management advice". In particular, there is little information about factors that influence the large scale distribution of the urchins or the periodic fluctuations in their populations. Even less is known about the effects of urchin harvesting on species that feed on them, such as lobsters, crabs, sea stars, flatfish, wolffish, sculpins and seabirds.

Sea cucumbers- *Cucumaria frondosa* are bottom-dwelling organisms related to sea urchin, although quite different in appearance and habit. They can be up to 50 cm in length. Their reddish-brown to grey, cylindrical body bears 10 orange-red tentacles at one end that are used for gathering up the bottom sediments upon which it feeds. These leathery, slippery-skinned, cucumber-shaped animals appear to be even less palatable than their kin. However, they are considered a tasty delicacy in many parts of Asia. Their muscular body wall is dried as "trepang" and used in making soup. There is a major fishery for them in northern Pacific waters, where some 18,000 tonnes are landed annually. They are abundant in many parts of the Bay of Fundy, but up to now the fishery has been relatively small, with most collected secondarily during the sea urchin harvest. There is growing interest in a more directed fishery to supply the seemingly insatiable oriental markets. In support of this, DFO has conducted experimental fisheries to assess their abundance and distribution, as well as to evaluate the processing and marketing requirements. Scientists from the St. Andrews laboratory have been studying the structure and dynamics of sea cucumber populations in the Passamaquoddy area.

Polychaetes: Several species of marine worms are harvested on Fundy mudflats, primarily to supply the lucrative market for bait for recreational fishermen. Baitworm populations along the eastern seaboard of the U.S. were decimated by years of overexploitation. As a result, there has been an increasing demand for worms from more northerly unexploited populations. There is little reliable information about their overall abundance in the Bay or about production rates, making it difficult to estimate sus-



Two invertebrates harvested from Fundy: the lugworm, Arenicola spp., used for fish bait, and the sea cucumber, Cucumaria frondosa, highly marketable as a southeast Asian delicacy.
Wells, G.P.1937. J.Exp. Biol. 14:290-301.
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tainable harvest levels and develop meaningful long-term management policies. There is also considerable concern about the potential effects on the stability of intertidal mudflats of the continual disturbance of surficial sediments by large numbers of diggers working particular areas intensively and repetitively. Mud flats are dynamic, often ephemeral structures, and we know little about the longer-term impacts of such continuing human disturbance. The sensitivity and critical importance of these mudflats to the marine ecosystem of the upper Bay are more fully explored in other issues in this series (Numbers 3 and 9).

Sharks/dogfish - Several types of sharks are seen in the Bay, including white, blue, short-finned mako, smooth hammerhead, thresher, porbeagle, basking sharks and spiny dogfish. A few of them get caught in herring weirs, so we know that they are out there. However, at present there is little reliable information about their numbers, distribution or life history. Some are subtropical species that venture to the northern limits of their range with the warm Gulf Stream. The most abundant of them, and probably the only ones suitable for a sustained commercial fishery, are the porbeagle (also called mackerel shark) and the ubiquitous spiny dogfish. The porbeagle is a cold water animal that is fished on a small scale (about 10 tonnes per year) in the Grand Manan area. It is unlikely that this fishery can be expanded much further because of the small size of the population and its seasonal occurrence in the Bay. The smaller, more abundant spiny dogfish may be another matter entirely. Long considered a worthless nuisance and a "trash" fish by commercial fishermen, they were routinely killed and dumped. However, there has been a rising demand in recent decades for North American dogfish to supply European and Asian markets. In Britain, most is used in the fish and chip trade, and euphemistically called "rock salmon". The fins and tails are in demand in far eastern countries, where they are often considered an aphrodisiac.

Dogfish are caught and counted during the regular groundfish surveys carried out by DFO, so there are reasonable estimates of their numbers from year to year. They are sometimes so abundant in the Bay that fishermen remove their groundfish gear from the water to avoid damage. They are found from Labrador to Florida, and are particularly abundant between Cape Hatteras and Nova Scotia. They migrate northward along the continental shelf in the spring from southerly offshore wintering areas. In the Bay of Fundy their migration pattern is similar to that of the shad, appearing along the Nova Scotian coast in the spring, becoming abundant in the upper Bay in summer and moving out along the New Brunswick shore in fall. Foreign fleets have harvested them off the east coast for decades, while a small Canadian fixed gear fishery has existed only since 1987. The number of dogfish caught by foreign fleets increased dramatically in the early 1970's as the fishing effort expanded considerably. But by 1978 catches fell to low levels and remained depressed throughout the 1980's. By the early 1990's catches again began increasing sharply. This upsurge coincided with the collapse of groundfish stocks in the region, leading some scientists to speculate that there was a new ecological balance developing, with cartilaginous fish such as dogfish and skates replacing the boney fish such as cod and haddock. Some even suggested that this new balance might be stable and permanent. Changes in water temperatures on the coastal shelves may have been largely responsible for both phenomena, although overfishing of groundfish stocks undoubtedly contributed. There has been growing pressure to expand

"There has been growing pressure to expand the harvest of dogfish in Maritime waters to partially compensate for the down turn in the groundfish harvest"

the harvest of dogfish in Maritime waters to partially compensate for the downturn in the groundfish harvest. However, the fact that these animals live long, grow slowly and have few young, combined with indications that stocks along the eastern seaboard may be almost fully exploited by foreign fleets, has caused DFO to adopt a conservative approach in expanding the commercial and recreational fisheries for dogfish.

krill - Among the most recent, and potentially controversial, candidates for exploitation as an "underutilized species" are the great shoals of "krill" that swarm in the productive waters of southwestern Nova Scotia, particularly in upwelling areas at the mouth of the Bay of Fundy. At least one fishing company has applied to DFO for a permit to harvest these shrimp-like planktonic crustaceans (technically known as Euphausiids) off the south coast of Nova Scotia. The krill would be fed to salmon being raised in the dozens of fish farms that have sprung up throughout the Maritimes in recent years. The salmon grow exceptionally well on this natural food, and it also gives their flesh a desirable pinkness. Although DFO appears to favour a small scale exploratory fishery for krill, there is great opposition from many scientists, environmentalists and fishery interests. The krill are a vitally important component of marine food chains leading to many commercially harvested species of fish, as well as to marine mammals such as the endangered right whale and to a number of threatened seabirds.

"Too often in the fisheries the shrill, insistent clamour of vested economic and political interests have drowned out the voices of ecological reason"

Others: - Many other species have been labelled "underutilized" in eastern Canadian waters in recent years. Some may be present in the Bay of Fundy in harvestable quantities, while a few are already fished on a limited scale. These include several species of fish such as silver hake (or whiting), argentine, skate, grenadier, mackerel, lumpfish, eel and tuna. While the flesh of the common hagfish is virtually inedible, its skin is much in demand for the manufacture of fine leather goods, such as briefcases and purses. Underutilized species of invertebrates, for which there are actual or potential markets, include several molluscs such as the ocean quahog, Stimpson's surf clam, blue mussel, whelk and moonsnail, and a number of crustaceans such as red crab, jonah crab, rock crab and pink shrimp. Efforts are also being made in the St. Lawrence Estuary to develop a fishery for benthic amphipods (bottom-dwelling, shrimp-like crustaceans). These can be caught in large quantities (up to 10 Kg per day) in baited traps, and are marketed frozen or dried as fish food. Amphipods are also abundant in the Bay of Fundy, and it is probably only a matter of time before application is made for an exploratory fishery. However, DFO scientist Bernard Sainte-Marie urges caution in exploiting this resource because amphipods are also near the base of many marine food chains and "play a major role in the diets of juveniles and adults of commercially important groundfish". It is likely that in the near future other "trash" species will be carefully scrutinized as new markets for them are found. One industry cynic has even suggested that "soon we will be scraping slime off rocks".

The management tightrope.

Perhaps the greatest worry of those concerned by the rapid development of these new fisheries is the lack of reliable biological information on which to base sound management plans. The lion's share of funding for studies in marine biology over the last few decades, particularly in government laboratories, has been devoted to the commercially important species, such as cod, haddock, lobster and scallop. Much of this has involved monitoring the abundance and distribution of these stocks and measuring their recruitment and reproductive success, in short, "stock assessment". There has been little research on species that, up to now, have had little commercial value. It is unfortunate that many of the new fisheries were launched just as severe financial cut backs were being imposed on government departments. Shawn Robinson, of DFO's St. Andrews Laboratory, laments that "shrinking budgets no longer support monitoring and development of underutilized species". As a result, we know little about the abundance, distribution, population cycles and ecological roles of most of these species that have suddenly become valuable.

Fisheries scientists and managers thought that they had done their homework, and knew enough to manage the traditional fish stocks that have sustained the Maritime economy for centuries. And yet, within the last decade several of these closely monitored stocks have collapsed, catastrophically and inexplicably. Are resource managers likely to be any more successful in managing these new stocks about which they know virtually nothing? Fortunately, fisheries scientists and some managers are recognizing the danger and urging caution. For example, a recent DFO stock assessment report on dogfish concluded that "there may be room for expansion of this fishery but

more information is required. Until such time a conservative approach is warranted". However, as in the past, these cautionary voices may go unheeded. Too often in the fisheries, the shrill, insistent clamour of vested economic and political interests has drowned out the voice of ecological reason. As scientists and managers attending the Moncton Workshop gloomily concluded in their final report, "socio-political and economic pressures often force overexploitation in the face of inadequate or inappropriate research". All too often, these new fisheries are being prosecuted with what Shawn Robinson aptly terms "a gold rush mentality".

Resource managers are, nevertheless, struggling to balance the competing pressures for exploitation and conservation, in the face of inadequate information about the stocks on which to make sound decisions. The tools they have to work with are those used for managing traditional fisheries. These include limiting the number of licenses, restricting the type of gear used, limiting the fishing season, setting a minimum catchable size and applying realistic annual quotas. Participants at the Moncton Workshop made a number of other recommendations that could assist managers in this unenviable task. They suggested that a proportion of the funding provided for the development of new fisheries should be used for scientific research on the stocks. They also recommended that adequate baseline data be collected before a fishery is developed, so that there is some benchmark against which to gauge management effectiveness. Perhaps their most innovative and contentious, recommendation was that all harvesting should be banned in designated areas. These would serve as sanctuaries or refuges for exploited stocks. This concept is well-accepted on land (e.g. national parks, refuges and wilderness areas), but has been resisted in the marine environment. Such marine reserves would not only serve as nursery areas to enhance recolonization of nearby exploited areas, but would also be invaluable reference sites for monitoring harvesting impacts and environmental changes. With such prudent management, we may indeed be able to continue harvesting many of these "Cinderella species"..... **happily ever after.**

Further Reading

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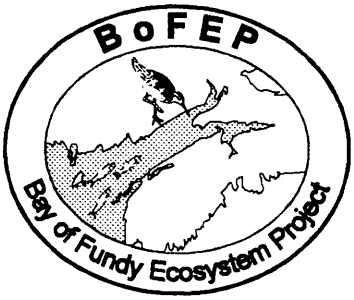

The Fundy Issues Series is an initiative of the Bay of Fundy Ecosystem Project. These publications describe our present scientific understanding of some of the environmental issues confronting the Bay. We hope that they will enhance your understanding of the biological richness and complexity of this unique marine area. Such awareness may encourage you to help in protecting it for the use and enjoyment of all, particularly future generations who may also come to rely on its bounty and rare beauty.

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