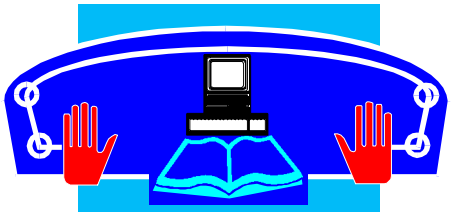

Mitiq Co-op Seafood Project - Sanikiuaq, N.w.t.

Type of Study: Feasibility Studies Arctic Foods, Food Marketing/prod Development

Date of Report: 1986

Author: Department Of Indian And Northern Affairs

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MITIQ CO-OP SEAFOOD PROJECT

Sanikiluaq, N. W. T.

1984-86

funded by

DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS

TABLE IIF CONTENTS

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INTRODUCTION

The blue mussel, Mytilus edulis, the green sea urchin, Strongylocentrotus droebachiensis, the dark brown sea cucumber, Cucumaria frondosa, and the 6 -raged sea starfish, Leptasterias polaris, occur along the eastern coast of Canada to Labrador and in the lower Hudson Bay (Lubinsky, 1958: Grainger, personal communication). (Appendix 16)

A limited sampling of the marine waters around the Belcher Islands occurred on the Calanus expeditions of_ 1953, 1954, 1958-61 (Grainger, 1955), using nets and dredges. These studies were designed to determine the species present and no attempt was made to determine abundance.

Inhabitants of the Belcher Islands, in the southeastern corner of Hudson Bay have probably harvested these 4 edible invertebrates during all of their 3000 gears of residency. Their present method of harvesting would not differ significantly from their ancestors. Presently, the most common method of gathering specimens is strapping a fish landing net onto a 3 or 4 metre pole and probing the net along the bottom. This labour intensive method yields quantities that are consummed almost immediately. In the winter, the ice is greater than 1 metre deep and only a limited area is sampled. The majority of the harvesting is done at a location called Katapik, a narrow channel noted for its strong tidal current. Frequently a storm will wash ashore many specimens around the islands which are quickly gathered by the harvesters.

There is an existing consumer market for 3 of the 4 edible products: mussel s, sea urchins and sea cucumbers. (Appendix 1, 2) There is a newly developing mussels farming industry on the east coast of Canada. Paul Budreski (personal communication) farms mussels and rnarketsthen as far as Toronto and down to New York City. Dr. Paul Ke of the Dept. of Fisheries and Oceans, initiated a study into-operation with the Dept. of Regional Industrial Expansion, on the east coast to market sea cucumbers and sea urchins. tie has developed an unlimited market for sea cucumbers in the Orient (Appendix). In addition, they market fresh sea cucumbers and sea urchins in New York City.

Since the waters around the Belcher Islands were known to contain 4 species consumed and enjoyed by the local population and since these same species were marketed in southern Ca nadaandto off -shore consumers., the Mitiq Co - Op designed a study and initiated an attempt to seek funding to quantify the species of edible invertebrates around the waters of the

Belcher islands, and to determine ways of harvesting. Markets were to be sought and sample shipped for environmental testing.

The Mitiq Co-Op realized that before any possible future renewable resource can be developed, it is necessary to lag an underpinning of scientific data. The first step must be to survey the waters using available biological techniques and attempt to estimate the concentration of harvestable invertebrates. This was the first objective of the research.

In addition, the Mitiq Co-Op wanted to initiate training of local villagers in scuba diving. This section would be gradually phased in, starting 'YYltha 'W8teraCCllmltlZat10n phase in the first summer to determine if the local villagers liked working in the water. This would be followed by classroom theory during the winter. In the following summer, a certifying instructor would be brought to the islands and local villagers would engage in underwater activity, this section is expected to be gradual at all phases, since in-water activity is new to the local population. If the harvesting study did not show economic possibilities, the community could possibly have trained drivers which could open several job opportunities, involving recreational scuba diving as a tourist attraction, possible off-shore work with oil companies or local work for scientific information.

In June of 1984, the Dept. of Indian and Northern Affairs funded the proposal of the Mitiq Co-Op {Appendix 3). Thus, a scientific survey was to be initiated along with hat-vesting tests and developing possible markets for the produce. Equipment to fully suit 2 divers was to be ordered and elementary water acclimatization was to be initiated followed by classroom theory in the winter. (Appendix 3)

The Dept. of Fisheries and Oceans was to assist in the design of the project and monitor the results, providing assistance when required. The Dept. of Economic Development offered assistance in evaluating the economic feasibilities.

MATERIALS AND METHODS

Manpower

This proposal required 1 scuba diver., 1 saftey assistant and 1 or 2 students to assist in carrying and cleaning edible species.

Equipment

Complete diving equipment. to sui t 1 diver was required along with a 2.8 cubic feet/minute air compressor.

Hand held harvesting bags with strong handles and mesh were used. A harvesting cage made of metal mesh was used in strong tidal currents.

Travel between sampling areas was with a 22 foot aluminum boat using 260 HP motors

Ohaus massing scales accurate to within 1/10 of a gram and outside calipers were used to measure the species,

Locations

The locations used for transects and harvesting are shown on Map 2.

Various other areas were covered by having the diver with a dry suit, snorkle and mask, pulled behind the boat on a rope. A sanded plexiglass surface and a pencil noted concentrations of organisms. This permitted a quick assessment of the fauna.

Scientific Sampling

A normal biological sampling technique is to construct a line transect and collect all the relevant species from wi thin. A 1 metre by 3 metre rectangle was used, made with 2.5 cm aluminum electrical conduit,

These rectangles were placed in the water at the start of biological life and extended out perpendicular to shore, usually starting in shallow water and proceeding to deeper water.

The 4 species were collected using scuba gear and recorded from each consecutive retangle, each representing $3 m^2$.

Each of the species were quantified slightly differently., but the focus being on the edible material present.

The mussels were boiled and the length of the shell recorded along with the edible mass. As data became more time consumming, the total number of mussels and the total edible mass was recorded.

For the sea urchins, outside calipers were used to measure the diameter of the test, not from tip of spine to tip of spine. The test was cracked open and a small spoon used to extract the edible gonads. As with the mussels, time constraints forced massing a large number of gonads, and recording test diameter only.

The beginning and the end of the line transects were marked by 60 cm aluminum rods. They will be left there for future reference.

Areas were selected that had different substrates and bottom profiles.

Harvesting

Collecting to determine harvested produce per time was done adjacent to line transects. Some areas were 'speed' hat-vested that did not have any scientific quantification using transects.

Times were recorded in traveling to area, assembling equipment, dressing, entering water, water time, removal and clean-up of equipment and filling of diving cylinders.

The most common method speed' harvesting was to have 1 diver enter the water carrying 1 or more harvesting bags, with an approximate volume of 40 litres. The bag was made of netting with 1 cm openings and having steel handles. Rectangular measurements 3.5 dm x 7 dm.

The specimens were gathered by hand and inserted into the bag. For the mussels, a knife was usually used to pry a group of them from the gravel bottom or off rocks. Mussels on fine sediment were removed by inserting a hand under them and lifting them up.

The bag of harvested material was taken to the surface and attached to a throwing line with a float, or left on the bottom and attached to a

submerged line. A safety assistant on shore, or in a boat, would pull the bag to shore or the boat.

Areas were selected that were rich in numbers and size, passing by smaller sized animals. Specimens were collected according to size, regardless of species, thus there was usually always mixed produce. The harvesting was always done with time as an important factor.

At Katapik, the strength of the tide presented new problems. The diver could not maintain position. Therefore a mesh cage was made, 2 metres wide with a 7 metre opening, tapering to a "v" at the end. The diver could hold onto the cage and lift the animals up and quickly place them into the cage. The tide would float them into the cage. The full cage would be pulled to the surface beside the boat and dragged ashore. On shore, the assistants wearing hip waders would seperate the species and put them into the boat container.

All produce., except starfish, were placed into a pot-container with a fluid volume of 7 litres. This container is a common pot sold in town. The produce was stripped of rocks and placed level to the top. The produce was removed and heed edible material extracted, boiling for mussels and slicing and gonadal removal for sea urchins. Sea cucumbers required no special attention.

Experimental-Long Term

Since the transects denude the area of all specimens, future repopulation would be by planktonic larva and migration. The areas were marked by aluminum piping for future reference.

Four experiments were designed to investigate the possible setting of spat, planktonic mussel larva.

Experiment 1

Three metal screen beds were designed, standing 4 dm high and 3 metres by .6 metres. These setting beds were set on top of high density mussel populations. The legs of 2.5 cm aluminum tubing would make it difficult for predators., primarily starfish, to climb.

Experiment 2

Two sheets of metal screening, .5 metres by .5 metres were set directly on a rich mussel bed and the corners weighted with rocks.

Experiment 3

Apiece of 2.5 cm tubing was used to tie 30 pieces of 6 mm rope, 2 metres long. It was set on the bottom of a rich mussel bed and the ends of the rope floated vertically to the top of the water.

Experiment 4

A similar design to experiment 3, except the loose end of the rope was knotted to another piece of piping. Thus the rope was closely adhered to the mussel bed when the pipes were drawn apart and weighted down.

Trolling

The diver using mask, snorkle, fins and dry suit was pulled behing the boat attached to a 15 metre rope, at an approximate elevation of 3 - 4 metres from the bottom. This afforded visiblity to the shore and to the deeper water.

Most of Sanikiluaq Harbour was covered, and limited areas in the Falkland Islands and near the soapstone mine around Tukarak Island. (Figure 3).

Drying of Sea Cucumbers

The sea cucumbers were processed in several ways. The most convenient way was "flash" freeze therein the refrigerator or in the snow. This would freeze the internal contents and immobilize the animal making evisceration with a longitudinal cut very easy. The cucumbers were also chopped up randomly with no "flash" freezing. This resulted in extreme contraction.

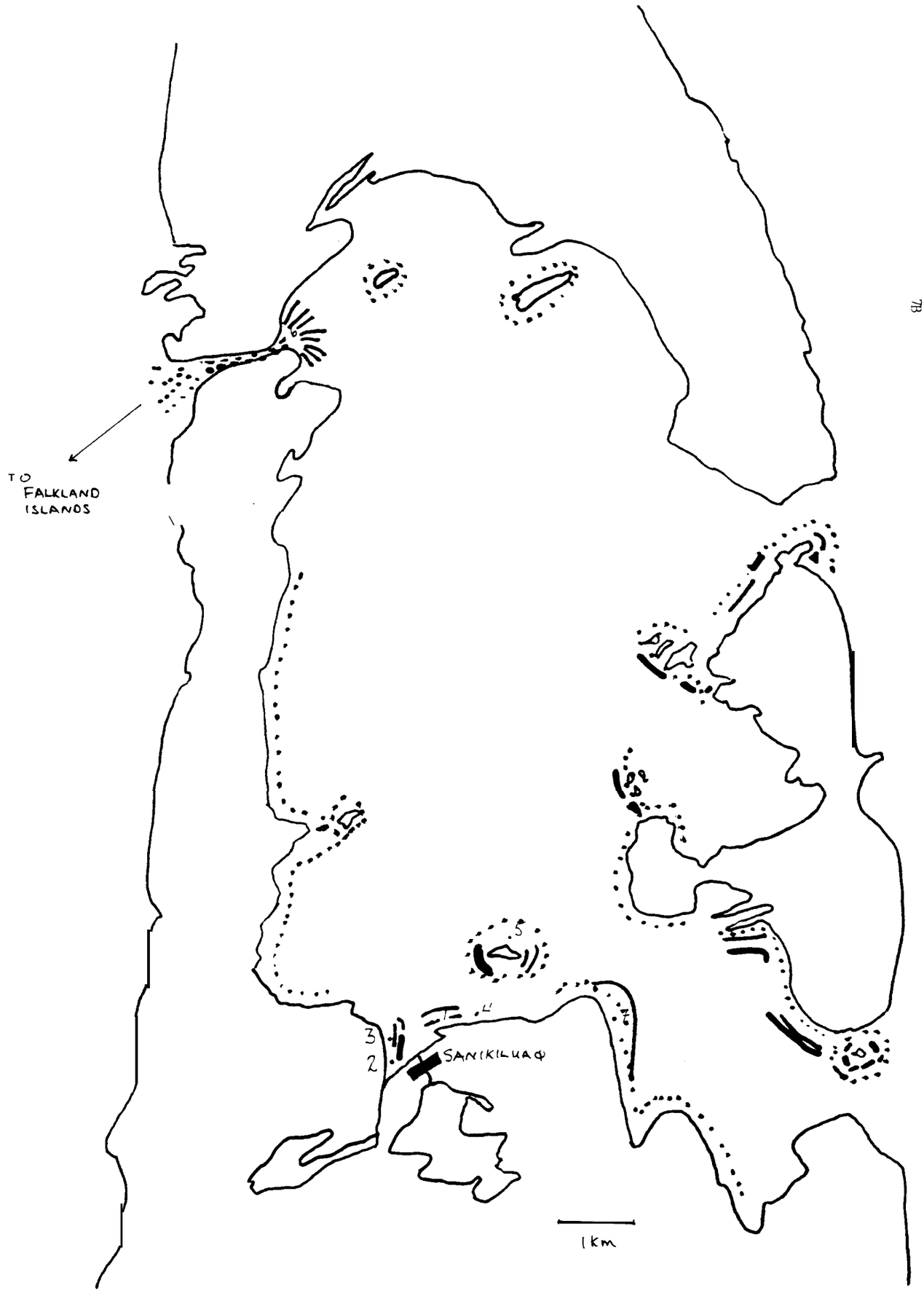
The prepared tissue was dried on clay plates in a kitchen oven.

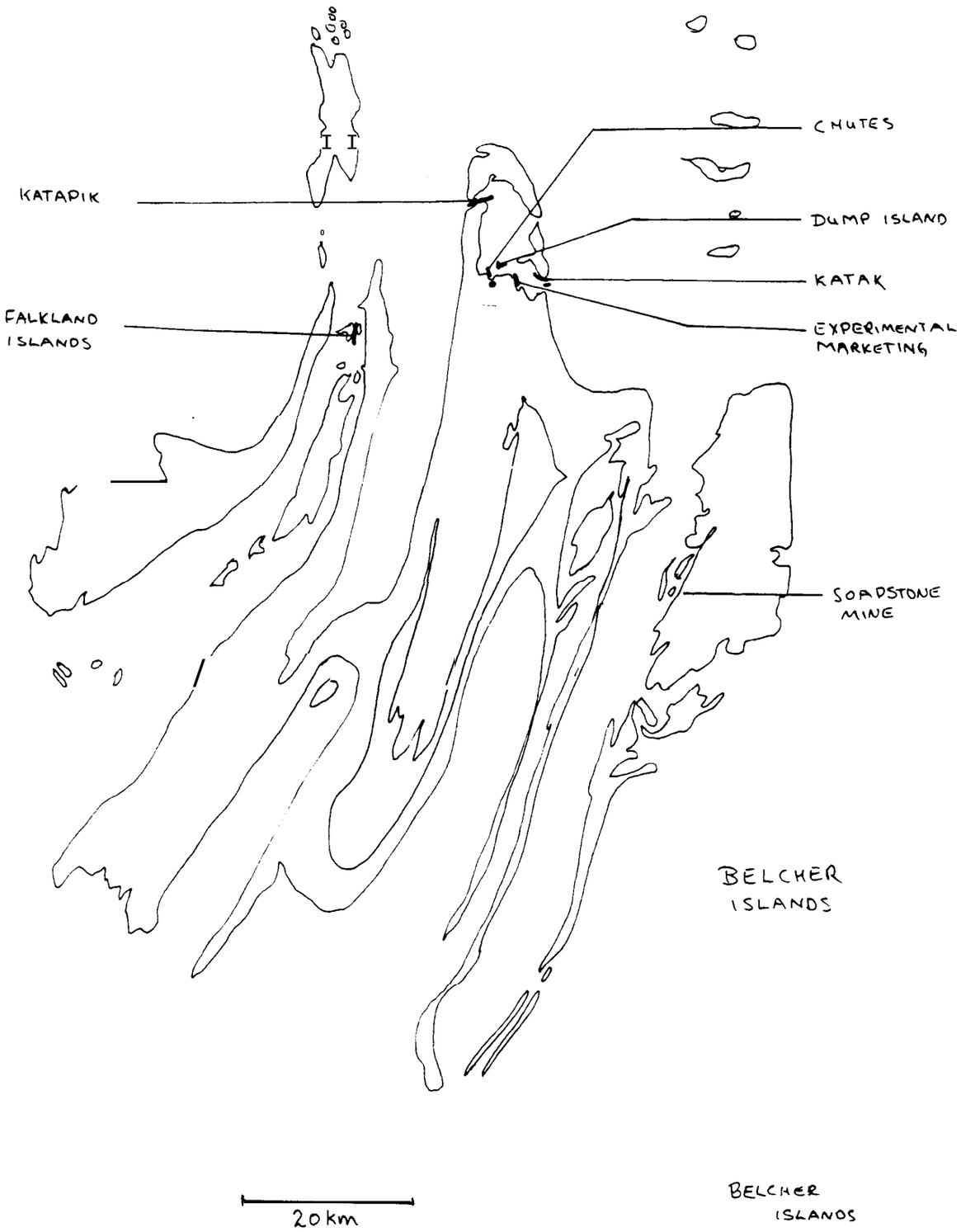
LEGEND
MAP 2

Mussels
Sea urchins —
Sea cucumbers
Scale 1:50 1 kilometre

1.) Breakwall
2.) Chutes
3.) Urchin Rock
4.) East of Big Rock
5.) Dump
6.) Katapik
7) Experimental Marketing Area
Trolled area

FIGURE


TO
FALKLAND
ISLANDS
5
3
2
SANIKILUAQ
1km


CHUTES
KATAPIK
DUMP ISLAND
KATAK
FALKLAND ISLANDS
EXPERIMENTAL MARKETING
SOAPSTONE MINE
BELCHER ISLANDS
20 km
BELCHER ISLANDS

RESULTS

Overview of Shallow Sublittoral Zone

Approximately 40 kilometres of shoreline was viewed during the course of the summer. Although there is diversity, several commonplace substrates became apparent.

Commonplace 1

If the bottom is 'very flat and extends out for a substantial distance, then the bottom is very often sandy, sedimentous, with a mix of gravel. There is virtually no harvestable invertebrates, although clams are seen extending ft-orn their burrows in the sand.

Commonplace 2

If the substrate falls at approximarely 1 metre vertically for every 8 - 10 metres horizontally, then there will be a brown filamentous algal growth that will dominate the substrate over a very wide area., forming a band parallel to shore and occcupying a width of up to 15 metres wide. The algae will obscure the mussels and they are smaller. Sea urchins are scarce and sea cucumbers non -existent, except for the occasional cluster on large rocks.

Commonplace 3

If the substrate falls faster than above mentioned commonplace 2, then the brown algae will be compressed into a band of 2 - 4 metres in width.

Mussels will be found in the band of algae and extend out to deeper water, small er ones closer to shore, becoming larger and less numerous away from the algae.

Sea urchins are found in the. band and extend into deeper water. Usually they are very numerous on the outside of the band. Sea cucumbers are found in deeper water, usually 3 -6 metres, although a few will climb onto rocks closer to shore. They seem to dislike the areas occupied by algae.

Commonplace 4

If the bottom falls off quickly, then there will be a highly sedimentous slope, perhaps at an angle approaching 45 degrees.

There will not be any filamentous algae, but mussels and sea urchins will be found. Sea cucumber will gather around rocks at the bottom of the slope in deeper areas.

Transects

Breakwall

The breakwall is a man - made projection created to enable some protection to moored boats.

The bottom falls off quickly to a depth or 1.5 m then gradually slopes to a depth of 6 metres approximately 20 metres from shore.

The bottom has a mix of stones 1 -3 dm and gravel 1 -4 cm. There is a slight covering of shore filamentous algae, forming a 3 metre band parallel to shore, hut it disappears with perpendicular distance from shore.

Breakwall

Table 1 Results of 12 transects, 1 m x 3 m, layed end to end and extending out 36 m from shoreline. All weights are for edible material. The starfish has total weight.

Transect number	*Mussels g	Sea cucumbers g	Sea urchins g	Starfish g
1	1109			
2	550			
3	109			
4	4	62	11(2)	
5		106	30(3)	12
6		131	20(5)	65
7		432	53(11)	61
8		584	65(6)	
9	-	667	118(23)	73
10	25	3527	145(27)	169
11	105	2806	185(28)	138
12	44	3841	173(31)	186

* see Appendix 4 for a complete description of length, total shell weight and edible weight..

Urchin Rock

This area is primarily rocky from shore. There is a good concentration of rocks, 2 - 4 dm in diameter approximately 10 meters from the shoreline. This becomes increasingly sedimentous with distance from shore.

The mussels are found in a band of 3 metres wide running parallel to shore. Although there are filamentous algae, it reaches approximately 1 dm high and did not hamper harvesting. Patches of mussel were found on gravel, strongly attached to it, but easy to put into the bags.

Urchin Rock

Table 2 Results of 10 transects, 1m x 3m placed end to end and extending out from biological growth. All weights are for edible material. The starfish has total weight. Number of organisms shown in brackets.

Transect Number	mussels g	Sea Cucumber g	Sea Urchins g	Starfish g
1	2107 (438)		153 (26)	
2	3092 (618)	-	243 (44)	
3	4921 (894)	173 (4)	587 (87)	
4	1375 (218)	378 (6)	152 (33)	
5	644 (92)	901 (20)	249 (37)	
6	529 (108)	1132 (18)	86 (12)	
7	890 (131)	371 (7)	168	210 (1)
8	*	*	*	*
9	209	613 (9)		591 (3)
10		823 (15)	56 (7)	195 (1)

Appendix 5 and 6 show the measurements from 2 - 7 litre containers of mussels.

* results lost

Chutes

This area is reached by 3 wheeler by crossing the river near the airport and following the bay for approximately 150 metre.

The transect covered a variety of substrates. The shoreline consists of rocks 2 - 4 dm in diameter. After 3- 6 metres this becomes a steep slope, heavily ladden with sediment.

The mussels are clumped together on the sediment., making them easy to pick up. There is no filamentous algae to hide the specimens. Each clump of mussels would contain from 10 to 20 individuals.

Chutes

Table 3 Results of 10 transects, 1 m x 3 m, placed end to end and extending out 30m from shore. All weights are for edible material. Numbers of organisms shown in brackets.

Transect. Number	Mussels g	Sea Cucumbers g	Sea Urchins g	Starfish g
1			56 (8)	
2			222 (20)	
3	346 (58)		147(16)	
4	505 (99)		308 (34)	
5	302 (54)		423 (49)	
6	586 (299)		360 (24)	345 (2)
7	432 (243)	124 (3)	*	106 (1)
8	305 (228)	158 (3)	264 (14)	400 (2)
9	602 (107)	79 (2)	122 (7)	
10	782 (124)		112 (4)	

*result lost

Appendix 7 contains the test diameters and edible weights for 1 -7 litre container of sea urchins.

Dump Island

This island is only 5 minutes by boat from the hamlet.

The north east section was dived. The bottom is made of a mix of rocks 2 - 4 dm and gravel 2-4 cm.

The 10th transect was approximately 6 metres underwater.

Dump Island

Table 4 Results of 10 transects, 1 m x 3 m placed end to end from the beginning of biological life and extending out 30 metres. All weights are for edible material. Number of organisms shown in brackets.

Transect Number	Mussels g	Sea Cucumbers g	Sea urchins g	Starfish g
1	92		**157 (36)**	***
2	998 (140)		190 **(52)**	
3	**3322(553)**		**165 (29)**	
4	2073 (439)	148 (3)	361 (76)	
5	493 (84)	408 (8)	461 (79)	
6	371 (58)	326 (8)	192 (32)	
7	*	870 (19)	165 (33)	
8	*	1973 (47)	**	
9	*	2914 (52)	**	
10	*	2007 (33)	**	

* Not sampled due to scarcity of mussels.
** Results lost
***Not sampled for starfish in any transect

Appendix 8 contains measurements from 1 - 7 litre container of mussels.

East of Big Boat

This dive location is approximately 100 metres east of the Pooytook boat located on the beach in Sanikiluaq.

The bottom from shore is very sandy, mixed with fine gravel, 0.5 to 2 cm. There are lots of bottom algae, filamentous, held in place by holdfasts and rising 3 to 5 dm above the bottom. It is very shallow during most of the 30 metres of transect, reaching 3 metres deep at the very end.

Beyond the transect area there were more sea cucumbers, but only on large protruding boulders.

Due to the mat of filamentous algae growing over the area, it is to be expected that the error in harvesting, especially mussels, is high.

Very few sea urchins were found in the area 50 metres past the end of the transect.

East of Big Boat

Table 5 Results of 10 transects, 1 m x 3 m, placed end to end and extending out 30 m from the beginning of biological life. All weights are for edible material.

Transect Number	Mussels g	Sea cucumbers g	Sea urchins g	Starfish g
1	128(91) *			
2	62(41)			
3	104(69)		-	
4	85(53)		12(3)	
5	285(242)			
6	244(174)			
7	104(60)			
8	38(26)		17(4)	
9	22(13)	84(3)		
10	-	105(3)	49(8)	

* Number of organisms shown in brackets

Harvesting Time for Mussels

Table 6 This table represents the use of 3 tanks of air, approximately 2 hours, to harvest mussels from selected locations. Harvested by handbag by one diver.

Location	Number of 7 litre container
Breakwall	17
Breakwall	15
Wiegand Island	20
Dump Island	18
Chutes	16
Urchin Rock	16
	16.6 container average

Exceptional Case of Mussel Harvesting

The above Table 6 represents usual areas of good mussel concentration inside Sanikiluaq Harbour. A seventh area harvested for speed, called the Falkland Islands, was not included above because it was a singularly unique location and unusual amounts of mussels were found. It is not known how many of these beds may be located around the Belcher Islands.

This bed is 3 metres from shore, located on a steep sediment bank The mussels were very large, dense and extremly easy to harvest by slicing a hand under them.

A cursory survey determined by being pulled behind the boat shows this area to cover several hectares. Since it represents only 1 of the areas surveyed, it is the unusual case, but certainly the area to look for

In 1.5 hours of diving, 40 - 7 litre containers of mussels were harvested. Assuming edible weight of .838 kg per container (Appendix 11), this is 33.52 kg/1.5 hours or 44.7kg per 2 hours. A cursory view of Figure 3 showing the Belcher Islands suggests that there may be other areas due to the extent of the coastline.

Harvesting time for Sea Cucumbers

Table 7 This table represents the harvesting of sea cucumbers at various locations.

Location	Method	Time	Number of 7L pails	Containers per hour	Edible Wt./ hour
Breakwall	handbag	1 hr	4	4	20.1 kg
Urchin Rock	handbag	.5 hr	1.5	3	14.8kg
				3.5 / hr	

399 sea cucumbers from the breakwall weighed 20,125 grams, averaging 50.4 g. At urchin rock 305 weighed 14,820 for 48.6 g average.

Harvesting Time for Sea Urchins

Table 8 This represent. s the harvesting of sea urchins at selected locations. Also consult Experimental Community Marketing, page 17A.

Location	Method	Time	Number of 7 L pails	Containers per hour	Edible Wt/ hour
Katapik	wire cage	.5hr	10	20	*
Urchin Rock	handbag	.5hr	9	18	**
Chutes	handbag	.5hr	8	16	9.6kg
Chutes	handbag	1hr	14	14	7.8kg
Breakwall	handbag	1hr	16	16	4.48kg
Falkland Islands	handbag	.5hr	9	18	7.1kg

* see Discussion - Sea Urchins from Katapik

** no recorded results

Harvesting Starfish

Due to the scarcity of specimens no attempt was made to separately harvest them. They are widely separated. They should be considered a bonus when found close to other harvestable material, but not worthy of a diversion of effort.

Total Time Consumption of Harvesting Produce

Table10 shows the times involved in preparing equipment, traveling to a dive site, pre-entry times, water time., clean-up time and maintence of equipment time.

It is difficult to exactly fix the times for travel since the occurance of seals in the water would divert the boat forhuritin gpurposes. Almost always there were other activities when in the boat, especially searching for eggs on the isolated islands.

Experimental Community Marketing

Sea urchins were harvested on 4 occasions from a location 2.5 km east of town, accessable by 3 wheeler in 10 minutes. The produce was taken to the Co-Op immediately and sold in the afternoon of the same day.

The produce was collected by scuba_ diving in 1-2 metres of water and harvested by hand. An on-shore assistant pulled the full bag to shore and filled a wooden box on the back of a 3-wheeler. The box was lifted into the Co-Op store and placed on a piece of cardboard on the floor.

The experimental marketing on Oct. 5, Oct. 19, Nov. 2 and Nov. 16 resulted in complete sale of the sea urchins within 2 hours on all but Nov. 2. On Nov. 2 the. power to town was cut just after the produce arrived at the Co-Op. It remained off until 6 pm. There were no plans to open the Co-Op in the evening and so the author claimed the produce at 7 pm and emptied them into the hat-hour. Only half of the box was sold.

Thirty-five containers of 7 litres were harvested per occasion. The recommendation to the Co-Op personnel was to use the 7 litre container used by the diver to measure the sea urchins and to sell the produce at $8 per container-. This would have resulted in a retail value of $280 produced from 1.25 hours of water diving and a total of 2.5 hours involvment each from a diver and safety assistant.

Thus suggested scenario would have the Co-Op making a profit of 0.4 along with the diver and the assistant getting 0.2. (Both the diver and the assistant were urtdet-cent.t-act to the Co-Op and did not receive any money for the over the counter sales). Unfortunately the Co-Op personnel used a container that later tested out to be 14 Litres and not 7 Litres. This lead to an actual situation differing from the suggested by exactly one-half.

	Containers	Unit Value	Retail Value	Co-Op Profit	Diver's Wage	Assistant's Wage
Suggested	35	$8	$280	$112	$112	$56
Actual	18	$8	$144	$57.60	$57.60	$28.80

Although the actual selling price was too low, it did establish the fact that country food will sell, and in a hurry. The suggested scenario for 2.5 hours of total involvment on the part of the diver and assistant)is probably a suitable incentive to involve people. Since making money in Sanikiluaq should always be compared to time involved in making and selling soapstone carvings, it is doubtful that a carver could make money at a faster rate, and have the fringe benefit of bringing several meals home to his family and friends at no cost.

The diver received several phone calls and had numerous inquiries about why there were not sea urchins at the Co-Op on a regular basis.

TABLE 10 This Table represents the timesinvolved in travellin

Location	Assemblying Equipment	Transportation	Round trip travel time	Pre- Prepar
Katapik	.5 hr	boat	1 hr	20
Falkland Islands	.5 hr	boat	2 hr	20
Breakwall	.5 hr	3 wheeler	10 min	20
Urchin Rock	.5 hr	3 wheeler	40 min	20
Chutes	.5 hr	3 wheeler	40 min	20

(1) assembly time, dressing, entering water
(2) includes sorting specimens, stripping rocks from mussels
(3) includes time from boat to air compressor, maintenance of compress

DISCUSSION

Sampling Limitations

Due to the amount of sediment of brown filamentous algae, it is realized that sampling in the transects missed some specimens. In other areas the mussels were wedged between rocks and very difficult to locate. All moveable rocks were taken from the transect, but larger ones had to remain.

Sea Urchins from Katapik

The sea urchins were harvested from the deeper parts of the channel during the 1st week of August, 1984.

A cursory comparison of the edible weights from a 7 litre sample at Katapik (appendix 10) and a similar sample from the chutes (appendix 5) shows the Katapik sea urchins to be very poor in gonadal material. This was substantiated by the poorer colour of the gonads, varying from dark to light brown. Very few had the characteristic orange colour.

Johnny Meeko Jr., assistant on the project, and a life - long resident of Sanikiluaq sags that this is common knowledge. He says that the sea urchins from this area are only "fat" in the winter.

Closer to shore, the sea urchins are "fat", possessing the usual characteristics of large, orange gonads.

Dr. Ted Grainger (personal communication) of the Arctic Biological Station has speculated that perhaps the early breakup of ice at Katapik affects the photoperiodicity of their breeding season, advancing it over other areas.

Determining Market Prices for Harvested Produce

If the possibility of selling locally harvested produce from the sea is to become a reality, then the cost of the edible material harvested must approximate the cost of edible material imported from the south.

Various items in the Co-Op were surveyed and the weight of each item (unit weight) and the cost of each item (unit cost) were recorded. This was converted to cost per kilogram and cost per dollar of edible material

Table 11 Existing Market Prices of Selected Items from Mitiq Co-Op, April 17, 1985

Item	Unit Weight(k)	Unit cost $	$/kg	$/'lb
Bifteck T-Bone Steak	.415	7.29	17.57	7.99
Lamb chops	.74	8.27	11,18	5.08
Chicken breasts	1,16	9.75	8.41	3.82
Cube de Boeuf	.76	6.31	8.30	3.77
Shoulder Roast	1.42	11.76	8.28	3.76
Bacon	.5	4.47	8.94	4.06
Whole Chicken	4.07	24.22	5.95	2.70
Weiners	.45	2.75	6.11	2.78
All Beef Sausages	.5	4.50	9.00	4.09
Coorsh Smoked Meat	.2	4.95	24.75	11.25
T. V. Dinners	.32	3.75	11.72	5.33
Kraft Single Sliced Processed Cheese	.25	5.70	22.80	10.36
Cheddar Cheese	.454	5,75	12.67	5.76
Black Diamond Extra Strong Cheese	.34	4.95	14.56	6.62
Potato Chips	32 gram bag	.60	18.75	8.52

Two of the most consumed foods in Sanikiluaq are Chicken Breasts and T.V. Dinners.

In 17 experiments involving the extraction of edible mussel mass from a 7 litre container of mussels (Appendix 1 1), it was approximated that there is .838 kg per container.

Thus if the cost of selected items taken from the Co-Op is taken to the cost per kilogram and multiplied by .838 kg, then the cost of a 7 litre pot of mussels is equated to that selected item.

Table 12 Determining cost of a 7 litre container of mussel s relative to equivalent cost of selected items from the Mitiq Co-Op priced on April 17, 1985. The edible mass of mussels /7 litre container is .838 kg (Appendix 11)

Item	$ / kg	cost of 7 litre pot mussel equivalent to shelf item
Bifteck T - Bone Steak	17.57	14.72
Lamb Chops	11.18	9.37
Chicken Breasts	8.41	7,05
Cube de Boeuf	8.30	6.96
Shoulder Roast	8.28	6.94
Bacon	8.94	7.49
Whole Chicken	5.95	4.99
Weiners	6.11	5.12
All Beef Sausages	9.00	7.54
Coorsh Smoked Meat	24.75	20.74
T. V. Dinners	11.72	9.82
Kraft Single Sliced Processed Cheese	22.80	19.10
Cheddar Cheese	12.67	10.62
Black Diamon Extra Strong Cheese	14.56	12.22
Potato Chips	18.75	15.71

Example: Potato chips at $18.75/kg would cost $15.71/.838 kg. Thus a pot of mussels with .838 kg of edible material would cost $15.71 if priced the same as Potato chips.

Since the cost of a pot of harvested produce of mussels can be equated to selected items from the Co-Op (Table 12), then it is possible to determine the retail value of total mussels harvested in a 2 hour period. Table 13 shows the retail equivalence of 16.6 pots of 7 litre volume determined from Table 6.

Table 13 This table assumes a harvesting rate of 16.6 containers of 7 litre capacity/2 hours/diver for mussel s, and converting the cost of selected equivalent items for the 16.6 containers.

Item	$ / kg	Retail Equivalence of 1 - 7 L container $	Retail Equivalency of 16.6 - 7 L containers $
Bifteck T-bone Steak	17,57	14.72	244.35
Lamb Chops	11.18	9.37	155.54
Chicken Breasts	8.41	7.05	117.03
Cube de Boeuf	8.30	6.96	115.54
Shoulder Roast	8.28	6.94	115.20
Bacon	8.94	7.49	124.33
Whole Chicken	5.95	4.99	82.83
Weiners	6.11	5.12	84.99
All Beef Sausages	9.00	7.54	125.16
Coorsh Smoked Meats	24.75	20.74	344.28
T.V. Dinners	11.72	9.82	163.01
Kraft Single Sliced Cheese	22.80	19.10	317.06
Cheddar Cheese	12.67	10.62	176,29
Black Diamond Extra Strong Cheese	14.56	12.22	202.52
Potato Chips	18.75	15.71	260.79

Profit Scenarios - Mussels for local consumption

The realization of obtaining quantities of produce is a function of the desire of the divers. Since it is almost impossible to monitor them on the land and under the water, it may be futile to attempt to log their hours and place them on an hourly basis.

It is possible that piece work is the best way of producing acceptable amounts of produce. Thus, when the weather is suitable they can make up for days when they were unable to work.

The following scenarios assumes 2 divers and 1 assistant on shore or in the boat. A unit cost per 7 litre container is shown varying from $8 per 7 litre pail to $26 per 7 litre pail. The produce is consumed locally. The Co-Ops rate of profit is 0.4 times the amount of remaining after the on-shore worker is paid $2 per pail. Table 14 assumes a total harvesting rate of 33.2 containers total for 2 divers for 2 hours of water time. Table 15 assumes a total harvesting rate of 107 pails per 2 hours harvesting, taken from the Exceptional Case of Mussel Harvesting on the Falkland Islands. The Retail Value per kilogram is shown to compare the hourly rate of the divers with the retail value. The edible material/pail is .838 kg.

Table 16 and Table 17 show the results if the Co-Op profit is reduced to 0.3. Table 16 assumes 2 divers harvest 33.2 containers in 2 hours and Table 17 assumes 107 containers.

If a comparison is made between Tables 14, 15, 16 and 17 with Table 13, then a determination can be made as to the food type to choose for determining the cost of a pail of mussels, For example if T.V. dinnerware selected, then they cost $11.72 taken to 1 kilogram. By looking at Table 14, it can be seen that the Retail value /kg that closest matches $11.72 is $11.90 and that turns out to be a value of $10 per pail. No prices are given at less than $8 per pail.

In Tables 14 through 17 no diver is working more than 2 hours per day. This is indeed the minimal work required to make suitable amounts of

money to make it desirable to harvest produce. It is to be assumed that the divers will work a minimum of 4 hours per day. (During this study it was the usual situation to work 5 hours in the water). This will substantially increase the amount of money made by the divers since the travel times will he the same regardless of hours worked in the water. An added benefit for t he diver will probably be the ability to supply his family with some of the days results. This factor has not been folded into the equation,. but is a fringe benefit.

The best possible scenario involves the harvesting of 53.5 pails per diver or 107 pails for 2 divers in 2 hours.

	A	B	C	D	E	F
1	Value per Pail	Number of Pails	Total Value	Wages to Assistant	Co-op Profit	Amount/2 Divers/Day
2	8	33.2	265.6	66.4	79.68	119.52
3	9	33.2	298.8	66.4	92.96	139.44
4	10	33.2	332	66.4	106.24	159.36
5	11	33.2	365.2	66.4	119.52	179.28
6	12	33.2	398.4	66.4	132.8	199.2
7	13	33.2	431.6	66.4	146.08	219.12
8	14	33.2	464.8	66.4	159.36	239.04
9	15	33.2	498	66.4	172.64	258.96
10	16	33.2	531.2	66.4	185.92	278.88
11	17	33.2	564.4	66.4	199.2	298.8
12	18	33.2	597.6	66.4	212.48	318.72
13	19	33.2	630.8	66.4	225.76	338.64
14	20	33.2	664	66.4	239.04	358.56
15	21	33.2	697.2	66.4	252.32	378.48
16	22	33.2	730.4	66.4	265.6	398.4
17	23	33.2	763.6	66.4	278.88	418.32
18	24	33.2	796.8	66.4	292.16	438.24
19	25	33.2	830	66.4	305.44	458.16
20	26	33.2	863.2	66.4	318.72	478.08

TABLE 14 This table shows the various dollar values that can be appli
per pail. The Number of Pails is the amount collected in
assistant, %2/pail, have been taken off. A 5 hour day is assu

	A	B	C	D	E	F
1	Value per Pail	Number of Pails	Total Value	Wages to Assistant	Co-op Profit	Amount/2 Divers/Day
2	8	107	856	214	256.8	385.2
3	9	107	963	214	299.6	449.4
4	10	107	1070	214	342.4	513.6
5	11	107	1177	214	385.2	577.8
6	12	107	1284	214	428	642
7	13	107	1391	214	470.8	706.2
8	14	107	1498	214	513.6	770.4
9	15	107	1605	214	556.4	834.6
10	16	107	1712	214	599.2	898.8
11	17	107	1819	214	642	963
12	18	107	1926	214	684.8	1027.2
13	19	107	2033	214	727.6	1091.4
14	20	107	2140	214	770.4	1155.6
15	21	107	2247	214	813.2	1219.8
16	22	107	2354	214	856	1284
17	23	107	2461	214	898.8	1348.2
18	24	107	2568	214	941.6	1412.4
19	25	107	2675	214	984.4	1476.6
20	26	107	2782	214	1027.2	1540.8

TABLE 15 This table shows the various dollar values that can be applied per pail. The Number of Pails is the amount collected in 2 assistant, $2/pail, have been taken off. A 5 hour day is ass mussel concentrations similar to the "Falkland Islands'

	A	B	C	D	E	F	G	H	I	J	K
1	Value per Pail	Number of Pails	Total Value	Wages to Assistant	Co-op Profit	Amount/2 Divers/Day	Amount/Diver/Day	Amount/Diver/Hour (5 hr Day)	Retail Value/Kg	Retail Value/lb	
2	8	33.2	265.6	66.4	59.76	139.44	69.72	13.944	9.55	4.34	
3	9	33.2	298.8	66.4	69.72	162.68	81.34	16.268	10.74	4.88	
4	10	33.2	332	66.4	79.68	185.92	92.96	18.592	11.93	5.42	
5	11	33.2	365.2	66.4	89.64	209.16	104.58	20.916	13.13	5.97	
6	12	33.2	398.4	66.4	99.6	232.4	116.2	23.24	14.32	6.51	
7	13	33.2	431.6	66.4	109.56	255.64	127.82	25.564	15.51	7.05	
8	14	33.2	464.8	66.4	119.52	278.88	139.44	27.888	16.71	7.6	
9	15	33.2	498	66.4	129.48	302.12	151.06	30.212	17.9	8.14	
10	16	33.2	531.2	66.4	139.44	325.36	162.68	32.536	19.09	8.68	
11	17	33.2	564.4	66.4	149.4	348.6	174.3	34.86	20.29	9.22	
12	18	33.2	597.6	66.4	159.36	371.84	185.92	37.184	21.48	9.76	
13	19	33.2	630.8	66.4	169.32	395.08	197.54	39.508	22.67	10.3	
14	20	33.2	664	66.4	179.28	418.32	209.16	41.832	23.87	10.85	
15	21	33.2	697.2	66.4	189.24	441.56	220.78	44.156	25.06	11.39	
16	22	33.2	730.4	66.4	199.2	464.8	232.4	46.48	26.25	11.93	
17	23	33.2	763.6	66.4	209.16	488.04	244.02	48.804	27.45	12.48	
18	24	33.2	796.8	66.4	219.12	511.28	255.64	51.128	28.64	13.02	
19	25	33.2	830	66.4	229.08	534.52	267.26	53.452	29.83	13.56	
20	26	33.2	863.2	66.4	239.04	557.76	278.88	55.776	31.03	14.1	

TABLE 16 This table shows the various dollar values that can be applied to a pail (7 Litres) of mussels with a n edible weight of .838 kg per pail. The Number of Pails is the amount collected in 2 hours by 2 divers. The Co-Op's profit is .3 after the wages of the assistant, $2/pail, have been taken off, A 5 hour day is assumed. Transportation costs are not included,

	A	B	C	D	E	F	G	H	I	J	K
1	Value per Pail	Number of Pails	Total Value	Wages to Assistant	Co-op Profit	Amount/2 Divers/Day	Amount/Diver/Day	Amount/Diver/Hour (5 hr Day)	Retail Value/Kg	Retail Value/lb	
2	8	107	856	214	192.6	449.4	224.7	44.94	9.55	4.34	
3	9	107	963	214	224.7	524.3	262.15	52.43	10.74	4.88	
4	10	107	1070	214	256.8	599.2	299.6	59.92	11.93	5.42	
5	11	107	1177	214	288.9	674.1	337.05	67.41	13.13	5.97	
6	12	107	1284	214	321	749	374.5	74.9	14.32	6.51	
7	13	107	1391	214	353.1	823.9	411.95	82.39	15.51	7.05	
8	14	107	1498	214	385.2	898.8	449.4	89.88	16.71	7.6	
9	15	107	1605	214	417.3	973.7	486.85	97.37	17.9	8.14	
10	16	107	1712	214	449.4	1048.6	524.3	104.86	19.09	8.68	
11	17	107	1819	214	481.5	1123.5	561.75	112.35	20.29	9.22	
12	18	107	1926	214	513.6	1198.4	599.2	119.84	21.48	9.76	
13	19	107	2033	214	545.7	1273.3	636.65	127.33	22.67	10.3	
14	20	107	2140	214	577.8	1348.2	674.1	134.82	23.87	10.85	
15	21	107	2247	214	609.9	1423.1	711.55	142.31	25.06	11.39	
16	22	107	2354	214	642	1498	749	149.8	26.25	11.93	
17	23	107	2461	214	674.1	1572.9	786.45	157.29	27.45	12.48	
18	24	107	2568	214	706.2	1647.8	823.9	164.78	28.64	13.02	
19	25	107	2675	214	738.3	1722.7	861.35	172.27	29.83	13.56	
20	26	107	2782	214	770.4	1797.6	898.8	179.76	31.03	14.1	

TABLE 17 This table shows the various dollar values that can be applied to a pail (7 Litres) of mussels with an edible weight of .838 kg per pail. The Number of Pails is the amount collected in 2 hours by 2 divers. The Co-Op's profit is .3 after the wages of the assistant, $2/pail, have been taken off. A 5 hour day is assumed. Transportation costs are not included. This scenario assumes mussel concentrations similar to the "Falkland Islands"

Profit Scenario - Sea Urchins

Due to the wide variation in amount of edible material harvested/ hour, varying from practically nil at Katapik, to 4.48 kg at the Breakwall, to 9.6 kg at the Chutes, no attempt was made to determine possible prices.

An attempt should be made to determine reasons for the variations and repeat the collection in the following summer.

Since. sea urchins in a 7 litre container would contain less edible mass than a 7 litre container of mussels, they would be priced lower. But, since it would take substantially lesser number of sea urchins to fill the container, the profit margin would still exist..

Since sea urchins are considered a delicacy in the south, especially in the oriental community, they would assume a high price.

profit. Scenario-Sea Cucumbers

Sea cucumbers harvested at 2 locations averaged 17.45 kg/diver/hour. The represents 3.5- 7 litre pails (Table 7). Each pail approximated 5 kilograms of sea cucumbers.

Since a 7 litre container would cent.din too much produce for a single retail sale, a smaller container would have to be sought and new details designed to determine wages.

It is common to find sea cucumbers and sea urchins occupying the same rocky area. Therefore, probably both species would be harvested together. This would affect the wages made by the divers.

Table 18 and Table 19 work out scenarios involving pricing of sea cucumbers relative to selected products from the shelf of the Co-Op. Since the number of pails is small compared to mussels and sea urchins, there must be another way of determining the wages of the assistant. In Table 18 a flat rate of $5/hour is used, and in Table 19 a rate of 0.2 times the retail value is used.

Drying Sea Cucumbers

The average wet weight of sea cucumbers approximates 50 grams. When dried, the weight shrinks incredibly to a value between 1 to 3.5 grams, but averaging 2.5 grams. Thus only 5 % of the wet weight of a sea cucumber is dry biomass. Thus a 7 L pail with 5 kg of wet sea cucumbers would have approximately 100 specimens and this would be approximately 250 grams.

The volume of the dried sea cucumbers was measured in a beaker both whole and crushed. It was found that on average, 52 grams of crushed

	A	B	C	D	E	F	G	H	I	J
1	Item	$/Kg	$/Pail Sea Cucumber	$ of pails/diver/hour in water	Wages to Assistant/hr water	Co-Op Profit	$/diver/day	$/diver/hr (5 hour day)	$/kg dry wt/water hr	
2	Bifteck	17.57	87.85	307.48	25	122.99	159.49	31.9	351.41	
3	Lamb Chops	11.18	55.9	195.65	25	78.26	92.39	18.48	223.6	
4	Chicken Breasts	8.41	42.05	147.18	25	58.87	63.31	12.66	168.21	
5	Cube de Boeuf	8.3	41.5	145.25	25	58.1	62.15	12.43	166	
6	Shoulder Roast	8.28	41.4	144.9	25	57.96	61.94	12.39	165.6	
7	Bacon	8.94	44.7	156.45	25	62.58	68.87	13.77	178.8	
8	Whole Chicken	5.95	29.75	104.12	25	41.65	37.47	7.49	118.99	
9	Weiners	6.11	30.55	106.92	25	42.77	39.15	7.83	122.19	
10	Sausages	9	45	157.5	25	63	69.5	13.9	180	
11	Coorsh Meats	24.75	123.75	433.12	25	173.25	234.87	46.97	494.99	
12	T.V. Diners	11.72	58.6	205.1	25	82.04	98.06	19.61	234.4	
13	Kraft Cheese	22.8	114	399	25	159.6	214.4	42.88	456	
14	Cheddar Cheese	12.67	63.35	221.72	25	88.69	108.03	21.61	253.39	
15	Potato Chips	18.75	93.75	328.12	25	131.25	171.87	34.37	374.99	

TABLE 18 This. table compares the harvesting with different items from the Co-Op store. It is assumed that a diver harvests 3.5 containers of sea cucumbers per hour and the weight per container is 5 kg or a total of 17.5 kg/pail. The value of a pail relative to the self item is determined and the Co-Op profit at .4 is taken after the wages for the assistant at $5./hour are taken off. Column 1 assumes a 5% dry biomass, therefore .875 kilograms of dry material are harvested per hour. This is related back to Column D for for the total dollar valueharvestedrelative to the shelf item.

	A	B	C	D	E	F	G	H	I	J
1	Item	$/kg	$/Pail Sea Cucumber	$ of pails/diver/hour in water	Wages to Assistant/hr water	Co-Op Profit	$/diver/day	$/diver/hr (5 hour day)	$/kg dry wt/water hr	
2	Bifteck	17.57	87.85	307.48	61.5	122.99	122.99	24.6	351.41	
3	Lamb Chops	11.18	55.9	195.65	39.13	78.26	78.26	15.65	223.6	
4	Chicken Breasts	8.41	42.05	147.18	29.44	58.87	58.87	11.77	168.21	
5	Cube de Boeuf	8.3	41.5	145.25	29.05	58.1	58.1	11.62	166	
6	Shoulder Roast	8.28	41.4	144.9	28.98	57.96	57.96	11.59	165.6	
7	Bacon	8.94	44.7	156.45	31.29	62.58	62.58	12.52	178.8	
8	Whole Chicken	5.95	29.75	104.12	20.82	41.65	41.65	8.33	118.99	
9	Weiners	6.11	30.55	106.92	21.38	42.77	42.77	8.55	122.19	
10	Sausages	9	45	157.5	31.5	63	63	12.6	180	
11	Coorsh Meats	24.75	123.75	433.12	86.62	173.25	173.25	34.65	494.99	
12	T.V. Diners	11.72	58.6	205.1	41.02	82.04	82.04	16.41	234.4	
13	Kraft Cheese	22.8	114	399	79.8	159.6	159.6	31.92	456	
14	Cheddar Cheese	12.67	63.35	221.72	44.34	88.69	88.69	17.74	253.39	
15	Potato Chips	18.75	93.75	328.12	65.62	131.25	131.25	26.25	374.99	

TABLE 19 This table compares the harvesting with different items from the Co-Op store. It is assumed that a diver harvests 3.5 containers of sea cucumbers per hour and the weight per container is 5 kg or a total of 17.5 kg/pail. The value of a pail relative to the self item is determined and the Co-Op profit at .4. The wages of the assistant are set at .2 times the retail value. Column 1 assumes a 5 % dry biomass, therefore ,875 kilograms of dry material are harvested per hour. This is related back to Column D for the total dollar value harvested relative to the shelf item.

as a seasoning. It is doubtful that scuba harvesting could be used to produce the dry product. Consulting Table 18 shows that the dollar value of the dry weight is extremely high, if you relate it to the value of the wet cucumber. Equivalent to Chicken Breasts, the cost would be $168.20 per kilogram and this would represent approximately 400 sea cucumbers averaging 2.5 grams dry biomass.

The shelf life of the dried sea-cucumber is unlimited. Material from the summer of 1984 is still the same high quality in the spring of 1986. The dark brown outer skin and dark orange inner skin still retain their colour.

Processing Sea Urchins

Dr. Paul Ke reported that fresh sea urchins have been shipped to markets in New York City from the maritimes (personal communication). He also reports that the gonads are frozen and shipped to markets in the Orient.

There is one plant in Quebec that processes the gonads and markets in bottles. Unfortunately the addressess have not been reported in time for this present report.

This study has determined that the sea urchins can not be frozen for extended periods without a loss in flavour, either in the test or extracted, (Appendix 17)

Processing Sea Cucumbers

The only known location in Canada processing sea cucumbers is the experimental project sponsored by the Dept. of Regional Industrial

Processing Mussels

The commercial market in Canada and the U.S.A. consists primarily in marketing fresh produce.

On the east coast, mussels of 5 to 7 cm lengths are brought from the harvest area in small boats to a washing and sorting station. They are usually held in seawater on rafts for several days before shipping, enabling bulk shipments. In additon, the mussels reaquire shellliquor lost during the trauma of harvesting (Lutz,1977), and cleanse themselves of foreign particles in their intestines.

In Canada, the mussels, in polypropylene hags, are shipped by air in fish boxes packed with ice. Maximum weight for Air Canada is 35 kilograms.

An industry rule is that shelf life is 3-4 days (Lutz,1977), although proper packing with ice can extend life to 17 days.

For local consumption in Sanikiluaq, storage on rafts in the harbour would allow the produce to remain fresh and the villagers could sort their own specimens, placing them into 7 litre containers for sale. Produce could easily be bulked for shipment to Great Whale River in Quebec, with a flight time of 45 minutes.

Public Health

A problem with bivalves, mussels in particular, and sea cucumbers, is the presence of a dinoflagellate, Gonyaulax tamarensis, which causes Paralytic Shellfish Poisoning (PSP). These microscopic organisms are concentrated by the filter feeding mussel s and sea cucumbers, resulting in the accumulation of toxin. The illness results ts in a tingling sensation on the hands and feet, followed by loss of equilibrium and vomiting. in extreme cases there is respiratory arrest and death (Lutz, 1977).

PSP is a problem found on the east coast of Canada (Dr. Paul Ke, personal communication), forcing the inspection of produce on a weekly basis for signs of an impending loom of dinoflagallates.

There is no record PSP exists in Hudosn Bay. Roger Gelinas (personal communication), Chief of Techni cal Services, Dept. of fisheries and Oceans, Gare Maritime, Champlain, thinks that. the low water temperature may exclude Gonyaulax sp. from Hudson Bay. (Appendix 15)

Specimens of mussels, sea cucumber-s and sea urchins were. sent to the Freshwater Inst itu te for biochemical and heavy metals analysis (appendix 13). They are safe for human consumpti on.

Dr. Paul Ke, Dept. of Fisheries and Oceans has been intimately involved in processing sea cucumbers and sea urchins and has agreed to forward all his procedures to our project.

Health and Welfare Canada located in Churchill have been notified (Appendix 14).

The Dep. of Economic Development and Tourism has scheduled a new community freezer to be constructed during the summer of 1985. This may provide a processing facility which can be used to store and process produce. It may also allow local villagers to harvest produce from the surface and store for possible resale to the Co-Op. Hopefully the unit will have these design features. The possession of a processing plant is the ONLY way that material can be packed for shipment out of the community. The regulations require the use of a "fish packing plant" for even the most simple harvesting packing and shipping. This has been a major disappointment during the project-the inability to have the facilities to conform to regulations.

Employment Potential

This study has focused on trying to determine if quantities of produce exist in the water and if it can be harvested and marketed profitable by divers and the Mitiq Co-Op.

At present it is not known if local villagers can be trained in underwater harvesting. The theory has certainly been grasped, and some initial water activity without scuba equipment has been initiated. It will not be known if it is possible to teach local people diving until a certifying instructor is obtained from the south in a future project.

The marketing of sea urchins in town was highly successful. It can be reasonably assumed that sales of harvested produce can be marketed locally at a competitive price with store-bought items. Since land-based foods are more desirable, they could be priced on the higher side of selected items from the Co-Op, insuring a good price for the harvesters. There of severs] tables in this report that make comparsions. The nutritive value of fresh produce will justify the higher price.

Although discussions with Dr. Paul Ke seem to indicate a market in the south of Canada, it should not reassumed that it can be exploited in the near future. Therefore, the focus of marketing should be on the self-sufficency in the hamlet of Sanikiluaq. indeed, due to the higher cost of food in Sanikiluaq and the community acceptance of land-based foods, there may not be any benefits to shipping produce to the south.

The underwater harvesting season could begin in early June at Katapik. This area breaks up before other areas. This area stays open until the end of November. Harvesting at both ends of the seasons would require a small shack with a Kerosene heater enabling the divers to suit-up. Effectively, the season would begin in mid-June and last until mid-October.

Any jobs generated from this project will be limited to 4 or 5 months. The jobs will have an additional appeal to local villagers because it involves being on the land. This will allow them the freedom to vary their activities.

The initial presentation of this project to the Board of the Mitiq Co-Op brought several interesting questions. The Board members wanted to know if they could sell produce to the Mitiq Co-tip. This project may result in a more concentrated effort to harvest for profit using surface methods. One member of the community, Charlie Kudluarok, has surface harvested mussels and sold them to the Co-Op in Great Whale River.

Limits to the. Sustainability of the Resource

This project has sampled limited areas and no attempt has been made to quantify the amount of produce found around the Belcher Islands. Due to the unusual shape of the islands it can he reasonable speculated that the amount of produce available is related to the amount of shoreline. The transects possess a wealth of information, and the Appendix could be use to further study the organisms. It may be possible for a mathematician to design a model to quantify the species present, but the data is not complete to attempt this. Hopefully someone will take the transect data and combine this with a statistical overview of the islands. The island quantification is not within the scope of this limited study.

The local population harvest-s primarily from Katapik using long poles. An underwater visual survey showed that their harvesting has practically no impact, only a few bottom scrapings could be found. Thus their removal of produce is quickly replaced by migration and/or planktonic settlement.

The only other predator of the edible invertebrates is the eider ducks. During the underwater survey done by trolling, sever-al "graveyards" of mussels and sea chins were discovered. It is assumed hate eiders were the predators because there was a neat hole in the shells and the locations were in areas not frequented by villagers.

If commercial hat-vesting takes place, it. probably would not have any impact on the villagers harvesting by hand, providing the channel at Katapik is monitored carefully, or declared off limits to large scale harvesting. The villagers harvest in the shallow parts of Katapik, usually 2-3 metres deep. Just outside the channel, on the east side, the water deepens and villagers cannot reach the bottom wit. poles. This area is extreme ly rich with sea cucumbers and should be used for commercial harvesting on large scale.

If commercial harvesting is limited to hand gathering, then there will not be devastation harvesting, since only the larger specimens will be gathered. This will allow all beds to continue in existence, although regeneration time is not known. It was commonplace for the diver to find many small "button" sea urchins in the early summer, but they were never found in the fall. This suggests that the urchins may achieve maturity in ones season, or perhaps they burrow under the rocks and not available for harvesting.

At present, growth curves for the 4 edible species is not known or available for this report. Empty mussel shells were sent to the Dept. of Fisheries in Frobisher Bay for furtherance to a student studying aging of mussels in Pangnirtung, but no results have been forthcoming.

Approximately 40 kilometres of shoreline were observed during the summer. This represents a fraction of the shoreline around the islands. It is unknown if many "Falkland islands" arid Katapiks exist. It is only with this knowledge that a reasonable guess could be made about the amount of produce and the limits of harvesting.

Scuba Instruction

Unfortunately, no scuba equipment arrived until the last week in March, 1985. Thus no water acclimitization could be done during the summer of 1984. The dry suits did not arrive until the end of September 1985. This severely limited the exposure of new students., although most managed to don the suit and snorkle in the Bay.

Classroom theory classes commenced in April, 1985. There were 12 enrolled students, of which 5 have the potential to endure the rigours of the theory and possibly become candidates for water work. Although I was approached by many young men in the summer of 1984, about learning how to dive, none of them participated in the classroom theory. No reason is suggested for the lack of interest by these young people. Three of the participants had permanent jobs in town: David Mikiyuk, Jimmy Takatak, Peter Katuk, one was a hunter, Jimmy Iqaluk, and one was an unemployed young female, Lucy Appaqaq. Although the 3 employed participants have the potential to succeed, it is very unlikely that they would change their jobs to accept part time employment as divers.

Video

There is a Beta Max video showing the processing of sea urchins and sea cucumbers in Sanikiluaq. Although elementary, it may help people unfamiliar with our specimens become more knowledgable.

It. is available upon request from the Hamlet Office in Sanikiluaq, NWT

SCIENTIFIC	Attempted	Unsuccessful	Partially Successful	Successful
1. approximate the factors involved in the distribution of the 4 main species around the hamlet of San Kiluaq	yes		Page 8-9	
2. estimate the kilograms/hectare from the shoreline to a depth of 4-5 metres in 3 selected areas (Sanikiluaq, Katapik and Coates Bays)	no		(1)	
3. denude selected quadrants to establish long term regeneration and/or migration	yes		Page 10-14	
4. determine edible biomass/kilogram of harvested material	yes			Appendix 4-12
5. identify edible invertebrates to species	yes			Page 1
6. determine availability of species during the day (diurnal)	yes			yes
HARVESTING				
1. determine the most efficient method of harvesting, including use of assistants	yes		(2)	
2. establish kilogram hectare/man hours harvesting	no	(3)		
3. determine preparation time and clean up time	yes		Table 10	
4. determine manhours required to prepare species for marketing	no	(4)		
5. determine fatigue of diver, number of dives possible.'day,' individual	yes		page 24	
6. estimate kilograms of edible material/individual/day	yes		Tables 14-19	
MARKETING				
1. determine local acceptance	yes		page 17A	
2. establish quality control, time between harvesting and sale	yes	(5)		
3. compare cost/kilogram of edible material from the ocean compared to meat obtained from the south	yes		Table 11-13	
4. estimate profitability	yes		Table 14-17	

TRAINING

1. during the summer of 1984 local villagers will be acclimitized to the activity of scuba diving	yes	page 38
2. during the fall, winter and spring classroom instruction will occur to prepare local villagers to receive instruction from a certifying instructor	yes	page 38

(1) Limited areas were sampled by transects but variability in substrate prevented any large scale evaluation. The information in the Appenix could be used to form the basis if a powerful method of statistical evaluation was to be used in the future: but this is not a necessity under the present recommendations and the small quantities that could he harvested, The amount of produce/3 square metres has been determined for different locations, this can be extrapolated to hectares very easily if more was known of the substrate composition around the island. A very large task.

(2) Many ways of gathering using scuba gear was tried. Unfortunately time did not permit the attempt at new ways of surface harvesting or comparing surface harvesting versus scuba harvesting. The recommendation to open the Co-Op to receive marine invertebrate produce could show the effectiveness of both methods when money is the incentive. All variables being equal, there is no question that scuba harvesting easily out produces surface harvesting using long poles.

(3) Kilograms man hour harvesting was determined, but no attempt was made to involve large areas such as hectares.

(4) In the experimental community marketing through the Co-Op, no preparation was necessary. The sea urchins were clean when picked from the bottom. The aim of this objective was to prepare material for shipping outside of the community. Unfortunately a permit could be obtained since the community does not have a fish packing plant.

(5) This was only done for the community marketing.

Summar,

The major disappointments and shortfalls of the Mitiq Co-Op Seafood Project were a lack of estimating the amount of produce/hectare and thus around the islands and the inability to ship produce to markets in the south. During the summer of 1984 the government required only inspecton of the produce by the Freshwater Institute. This took 4 months, but it was completed. In the summer of 1985 they required a fish packing plant with chlorinated water, washrooms, washdown facilities and several add-ons. This is excessive for an operation that will pack produce In ice boxes and shipped directly south, with no storage,.

The major successes was the marketing of the produce in the community, The population will purchase local land foods if they are fresh, It was suggested that the community would not buy country foods, This study has disproved this fact, and it may now be possible for the Co-Op to start marketing various country foods. Fish would especially be desired by the people who have no source of fish through netting.

The second success was the harvesting of quantities of produce which could be marketed, Scuba harvesting is faster than surface long pole harvesting, but it is much slower than other types of harvesting such as dredges; but the advantage of scuba harvesting is the selectivity of picking produce and the high quality of the produce. Scuba harvesting could never devastate an area because the harvester would never try to remove all the produce; only the large specimens are removed, the small produce are not worthy of the time. Therefore, quality is always assured.

FUTURE RECOMMENDATIONS

It is most important that local people be trained to dive and/or trained to hat-vest produce from the sea. There is not a lot of money to be made from the sea which would entice southern harvesters to the Belcher Islands, such as fish roe on algae that brings scores of divers to Alaskan waters, but there is a local market that has been shown to be very receptive to purchasing local produce. The season from mid-June to mid-November could produce an income from harvesting for several unemployed, but trained divers.

With the accent on tourism becoming a force in the north, it is to be expected that the next few years will see many recreational activities formerly the domain of the south, slowly creeping into the north. There is no reason to expect recreational scuba diving to he any different. In fact, the fact that the Co-Op now possesses an air compressor and equipment is an attraction without having trained local divers. Divers require airbills, and it is impossible for them to drag heavy tanks and compressors around during excursions. The Co-Op is ready to service divers right now.

RECOMMENDATION 1

The Community Economic Development Officer(s) should assume responsibility for the continuing thrust of future endeavours. They possess the bureaucratic experti se and the mandate to develop skills in the local population to increase income. Being closely related to the Dept. of Economic Development and Tourism in Frobisher Bay allows them access to the correct bureaucratic channels to advance community desires.

This project should be evaluated and decisions made according to the

RECOMMENDATION 3

If there is a demand for diver training, then existing funds approximating $3500 remaining from the initial allot-merit should be applied to the summer of 1986 and a further application for funds made to bring a certifying scuba instructor from the south in 1986.

RECOMMENDATION 4

The Co-Op should encourage local people to bring fresh produce to the store for marketing to the community. A known rate should be established for the marketable invertebrates. This study has shown that the limited availability of seafood produce will produce a strong demand for it. It ensures the continued demand for country foods at competitive rates and with more nutritional value.

RECOMMENDATION 5

The Co-Op should seek funding to promote the fact that the community can now supply diving support equipment to southern recreational divers. The investment of $10,000 in equipment can pay dividends both in rental and in the use of the hotel to billet divers. An agreement between the Co-Op and the local Hunters' and Trappers' Association could produce a reliable supply of divers to be escorted to different dive locations around the island.

RECOMMENDATION 6

Attempt to secure Ministerial permission to short circuit some of the bureaucratic regulations and allow some experimental marketing outside of the community. It seems futile to have Federal inspection of seafood for contaminants and similar Northwest Territories inspection for contaminants, especially when the inspections are done at the same lab of the Dept. of Fisheries and Oceans in Winnipeg or Montreal.

RECOMMENDATION 7

The freezer plant in Sanikiluaq should be declared a fish packing plant., This would allow packaging of the seafood for sale out of the community.

RECOMMENDATION 8

Secure equipment that could be installed in the freezer plant that could generate ice suitable for packing produce.

The following are long and short term objectives that might he considered if local people decide to continue the endeavour of harvesting seafood.

Long Term

It is very important that our research in Sanikiluaq be tapped into the reseach conducted by Dr. Paul Ke, Dept. of Fisheries and Oceans in Halifax. He is doing a similar experiment. He has the vast resources of an experienced technical support team.

It would be beneficial if their processing of produce could be visited during the summer. They have access to a plant processing and bottling sea urchins in Quebec, and they have an experimental harvesting project gathering and drying sea cucumbers.

Dr. Ke has invited representatives from Sanikiluaq to visit their staff of biologists, technicians and harvesters.

A visit to their facilities would open new avenues of harvesting and processing, allowing us to build upon their experience. This would allow us to more constructively channel our energies in the future. Perhaps a member of the Dept. of Fisheries and Oceans in Frobisher Bay could drop in and visit the east coast. on their way to Sanikiluaq. This might be combined with a tour of a mussel fat-men the east coast.

Short Term

Although there are some scientific aspects which could be investigated, the study should proceed to strictly harvesting and marketing. The following objectives should be attempted and additional funding sought to bring them into operation in the near future.

Objectives

1. supply 20 boxes of fresh sea cucumbers and sea urchins to Toronto and Montreal markets and restaurants

2. supply 10 boxes of produce to Great Whale River, Quebec

3. supply 10 boxes of produce to settlements along the Quebec coast

4. supply large volume of produce to hamlet picnic through sale from the Co-Op

5. obtain 50 kg of dried sea cucumber

6. test market dried sea cucumber in cellophane bags of approximately 32 g each in Sanikiluaq

7. construct holding tanks in the harbour

8. develop surface harvesting techniques

9. sell produce directly to customers in Sanikiluaq

10. develop self-sufficiency of produce in Sanikiluaq

11. produce electrically and sun dried sea cucumber

SUMMARY

This project has sampled 5 shallow sublittoral areas extending 30 metres from shore using a transect 1 metre wide, in various locations around the Belcher islands, N.W.T., using scuba equipment. Other areas have been inspected by surface trolling with mask and snorkle, noting concentrations of the 4 edible invertebrates: Mytilus edulis, the blue mussel; Strongylocentrotus droebachiensis, the green sea urchin; Cucumaria frondosa, the brown sea cucumber; and Leptasterias polaris, the 6 rayed sea starfish.

Harvesting times have been determined fur the mussel, sea cucumber and sea urchin, and a profit scenario has been forwarded to include an assistant and 2 divers working for the Co-Op.

Future recommendations are made, focusing on harvesting for market purposes., and developing an incipient business to serve recreational divers.

ACKNOWLEDGEMENTS

The Author would like to thank the Dept. of Indian and Northern Affairs for their financial support of this project. This project involved many risks since it opened up an entirely new concept for the community. Bernie Perleman of the Yellowknife office assisted the project during his first few weeks in the office and assisted in processing the bureaucratic necessities.

Although this project was supervised by personnel outside thedornain of the Co-Op's expertise, they assisted when asked. Bob MacClean, the Co-Op manager, was supportive and saw future benefits that could possibly accrue to the Co-Op.

Shawn Shea and Larry Simpson, employees of the Dept. of Economic [development were very helpful in questioning the economic base of the study and their expertise when they critiqued the 1st draft forced the author to think more strongly about their concerns. Their-professional committment to offer assistance to welt-k outside their-department is appreciated.

Special thanks is given to Allan Hunt, formerly of the Dept. of Economic Development in Yellowknife. He assisted in having the project accepted and he strongly supported the view of building upon community self-sufficiency before seeking external markets. His suggestions were germain to developing northern based operations,

Finally, this project would not have been possible without the strong leadership shown by Angus MacDonald, formerly with the Department of Economic Development and Tourism in Frobisher Bay. Angus helped to formulate the study and offered suggestions onst.lengthening the future possibilities.

Thanks is given to Johnny Meeko, Jimmy Meeko and Tyler Appaqaq for their labour. Johnny Meeko, always reliable, provided the expertise to continue the work when difficulties arose.

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APPENDIX

Takesushi brings a gourmet fad to the masses

BY JOANNE KATES

ON THE MENU

SUSHI FOR the masses. Think of it as an election platform. It's the logical extension of lifestyle advertising. If drinking a certain beer can get you in with the right crowd, then foods can also be endowed with desirable qualities. If it were not so, gourmania would have gone the way of pet rocks long ago. This is not to imply that gourmet food is without intrinsic endearing qualities, but rather to speculate that if eating high on the hog did not confer social status, fewer of us would be doing it, and with a good deal less of the fervor we now exhibit.

In the semiotics of food world status, sushi is this year's pasta. Anyone urban having to admit ignorance of the subject of sushi is in bad shape, socially speaking, Thinking raw fish is yucky is an attitude that resembles the belief that marriage is forever: cute but outdated.

One of the factors that normally confers status on a food or a fad is the restricted nature of its availability: if everybody's got it then nobody wants it very badly any mom. Things that are hard to get, by virtue of either rarity or ex. pense, are the most desirable. Take pasta as an example. The working class has long been forced, through economic necessity, to make a fairly steady diet of macaroni and cheese. But if fettucine alfredo and ravioli with four cheeses had filtered down the socioeconomic ladder, you can bet your Holt's booties that the upper middle class would have jettisoned them faster than you can say extra virgin olive oil.

Hence the splendor of sushi as a gourmet fad. We're virtually guaranteed that the masses won't be able to play this game. Not at $20 a person as the basic coat of a sushi dinner for one person with just a few extras, At least we were sure, until Takesushi came along.

My first impression was the "Burger King of the sushi world. In the ads they say "Specializing in Beginner Sushi" and on the menu they rush to soothe the squeamish, assuring them that those who haven't yet been converted to the pleasures of raw fish have nothing to fear. Beginner Sushi is a plate of sushi made from salmon which has been marinated so long in vinegar and salt that it is effectively cooked, ebi (cooked shrimp sushi) and tamago (the sugary layered omelet that is peculiarly Japanese). As if that were not enough to make it safe for the untutored, it costs a mere $6.

It also includes California sushi, a wonderful aberration on the real thing. California sushi is a seaweed roll containing cucumber, flying fish roe. avocado and what they call crab and I call Sea Shells (crab copy).

The chain restaurant (with branches in Tokyo, New York and Washington) that brings sushi to the masses cart hardly be expected to wow sushi sophisticates. When they bring your pre-sushi hot towel hermetically sealed in plastic, you know that's true. But what's this? In the soup there are fresh Japanese mushrooms and tantalizing little bites of octopus. The deep-fried crab was alive when it hit hot oil. A brutal practice perhaps, but anyone who tastes the Takesushi soft shell crab, dipped only in flour and salt before frying, will know the sweetness of certain brutalities.

They sell a chef's special sushi plate for $16 to $19 (Beginners watch out: this is where you're headed.) and it exemplifies the exquisiteness of the Japanese approach to food. Each piece of sushi is superb, each one a dream. But the plate may not be enough to satisfy North American appetites.

Takesushi offers certain sushi not easily found elsewhere on the Toronto sushi circuit. Toro is from the belly of the bluefin tuna, the belly being the fattest and most expensive part of the fish. Toro costs. It is lighter pink than other raw tuna, a delicate coral color marbled with fat. Really you inhale rather than eat it. Melts in your mouth, not in your hand. Toro, like all raw tuna, is at its beat in the winter.

There is sweet young yellowtail (a fish similar to tuna whose proper name is amberjack), fine fresh raw whitefish and Japanese red clam, a shellfish that resembles our east coast quahog. There is also salmon roe, which transmutes from fish bait to fine flavor when you marry it to sushi rice and seaweed instead of pretending it's caviar. There is tamago and California roll.

[redacted]

Kazunoko is equally off-putting to the eye. It looks like yellow Astroturf. In Japan they eat herring roe to celebrate the New Year and they pay so dearly for it that it's called "yellow diamonds." It may look like Astroturf, but it goes down like extraterrestrial caviar. If this be food for the masses, on with the revolution.

Takesushi. 22 Front St. W. 862-1891. No *non-smoking section. Accessible to people in wheelchairs.*

pg. 13 GLOBE + MAIL 25/01/85

APPENDIX 1

Scollu-FI/tidy

Pisces Vol. 5, no. 6, 1984
Dept. of Fisheries and Oceans

Dried sea cukes go abroad

Canada's first 'bona fide' commercial shipment of dried sea cucumbers should reach Singapore before the 1985 Chinese New Year in February, according to Dr. Paul Ke, from the Fisheries Development Branch, who has been studying the creatures for a number of years.

A 15 kg sample order was drummed up earlier this year by representatives of the Department of Regional Industrial Expansion as part of their job to sell Canadian products abroad.

"Sea cucumbers are not a commercial commodity in North America, but they are a rare delicacy in the Orient, " said Dr. Ke. "In Japan, for example, the most highly-sought parts — the intestines and gonads — sell on the retail market for as high as $400 per kg. "

Because dried sea cucumbers — the form in which they are usually sold — had never been commercially harvested in Canada, there were no processing plants rigged to produce them. Feelers were putout, Seacrest Fisheries Ltd., in Saunierville, Nova Scotia responded, and work was started to install the necessary equipment.

"-Al first, we weren't sure how the potential buyer would rate our sea cucumbers, " said plant owner Nelson Saunier. "After all, Singapore was already importing sea cukes from Bangladesh and Korea. "

But, shortly after the sea cucumbers were sampled, a telex arrived at Seacrest. Not only did the Singaporeans prefer the superior quality of Canadian sea cukes, they also offered the Digby County plant up to $8 per kg for as many containers of the delicacy as it could produce.

Sea cucumbers are plentiful in the Scotia-Fundy area. They area by-catch of many commercial fisheries, particularly scallops. At present, most are thrown back into the ocean but, said Dr. Ke, they could be a good cottage industry.

In addition to being captured incidentally in most types of gear, they can also be harvested easily by hand as they are slow-moving and prefer shallow water. The only impediment might be sticky white threads which they exude when disturbed that can irritate the eyes but which are harmless to humans.

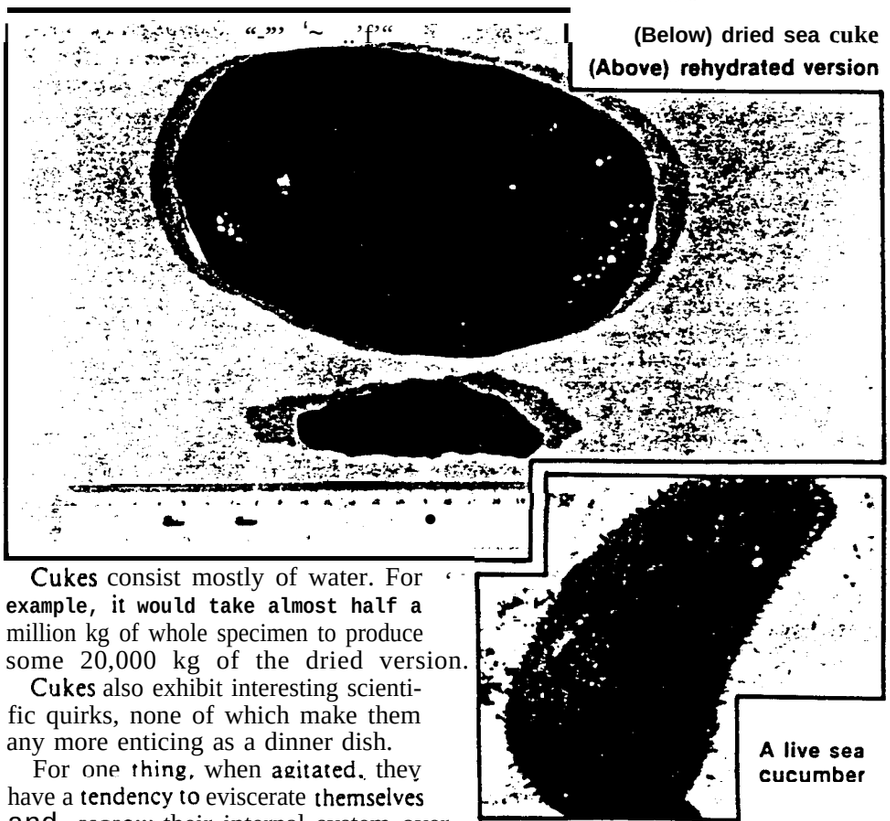
Sea cucumbers are also cheap to produce. "We have been studying the technology behind catching, handling and storing sea cucumbers for three years, and have set up a pilot project, all for less than S15,000, " said Dr. Ke.

Part of the reason sea cucumbers are not popular in North America is their lack of a definable taste and texture, both of which are important to western appetites. Their unfortunate appearance does nothing to help — even Dr. Ke who has worked closely with the miniature monsters for many years agrees they are unpleasant to look at.

So, except for a small ethnic market in large centres like New York City and Toronto (they sell for about $3 per kg here), their gastronomical destiny seems confined to Asian markets.

All about them

Sea cucumbers, known affectionately as cukes or scientifically as holothurians, look just like they sound except for a spray of tentacles around the mouth and unattractive lumps on their soft flesh. (It is said that they were originally named by ancient Greek philosopher Aristotle.)



(Below) dried sea cuke
(Above) rehydrated version

A live sea cucumber

Cukes consist mostly of water. For example, it would take almost half a million kg of whole specimen to produce some 20,000 kg of the dried version.

Cukes also exhibit interesting scientific quirks, none of which make them any more enticing as a dinner dish.

For one thing, when agitated, they have a tendency to eviscerate themselves and regrow their internal system over the next several weeks. And, 'if that isn't repulsive enough, they also serve as unwilling landlords to a small fish called carapus which enters the cukes backward through the anus (the young make it in frontwards) and therein reside, munching on their environs.

Perhaps the cuke's only redeeming quality by North American standards — and this is as dubious as other similar claims — is that it is supposed to be an aphrodisiac. However, this might have more to do with its rarity in some cultures than to scientific fact.

Cuke returns promising

Still, for Norman Saunier, there seems to be a future in sea cukes. Recently, Seacrest Fisheries Ltd. hired three people for eight weeks — thanks to a federal work-incentive program — to help fill the Singapore order.

Yet, the sea cuke business is not without its problems. "Our customer likes sun-dried cukes, " said Mr. Saunier. "And, when the sun doesn't shine, it puts a damper 'on production. "

Although the plant owner is considering the purchase of a mechanical dryer, he wants to be sure the drying method won't alter the sea cuke taste.

"Once the drying problem is solved, we should be able to supply Singapore with between 100,000 and 200,000 kg of dried sea cucumber by 1987 . . . and, at $8 per kg, that's not a bad return, on something that used to be thrown back into the sea, " Mr. Saunier said.

Dale Callingham Lynda Cameron
Communications. HQ

The following is the proposal passed by the Mitiq Co-Op in June 1984.

This proposal will outline the establishment of a feasibility study to harvest invertebrate marine species for local consumption. There are 3 foci for this initial proposal: scientific sampling, harvesting and Co-Op marketing.

The following objectives will be attempted.

Scientific

1. approximate the factors involved in the distribution of the 4 main species around the hamlet of Sanikiluaq.

2. estimate the kilograms/hectare from the shoreline to a depth of 4-5 metres in 3 selected areas (Sanikiluaq Harbour, Katapik and Coates Bay)

3. denude selected quadrats to establish long term regeneration and/or migration

4. determine edible biomass/kilogram of harvested material

5. identify edible invertebrates to species

6. determine availability of species during the day (diurnal)

Harvesting

1. determine the most efficient method of harvesting including use of assistants

2. establish kilogram/hectare/man nours of harvesting

3. determine preparation time and clean-up time

4. determine manhours required to prepare species for marketing

5. determine fatigue of diver, number of dives possible/day/individual

6. estimate kilograms of edible material/individual/day

Marketing

1. determine local acceptance

2. establish quality control, time between harvesting and sale

3. compare cost/kilogram of edible material from the ocean compared to meat obtained from the sleuth

4. estimate profit ability

Training

1. during the summer of 1984 local villagers will be acclimitized to the activity of scuba diving

2. during the fall, winter and spring, classroom instruction will occur to prepare local villagers to receive instruction from a certifying instructor from the south

APPENDIX 4

Record of measurements taken from Breakwall

Rectangle 1 (1 m x 3 m)

MUSSELS

Number	Length cm	Whole Shell Wt. grams	Edible wt. grams
1	4.3	5.6	2.0
2	6.0	10.4	3.2
3	4.5	5.9	1.9
4	3*9	3.6	1.4
5	6.8	21.6	7.5
6	5.1	7.9	2.3
7	5.3	8.0	2.5
8	5.8	8.3	1.8
9	4.2	3.6	102
10	4.9	9.1	3.2
11	4.6	4.9	1.3
12	4.8	5.2	1.7
13	5*5	8.6	2.9
14	6.3	14.3	3.6
15	3.1	1.8	0.6
16	4.8	6.3	2.2
17	7.4	27.8	7.0
18	4.6	5.2	1.7
19	4.6	5.7	200
20	4.4	4.7	1.7
21	5.9	12.4	2.5
22	5.3	797	2.0
23	4.6	6.1	1.9
24	5.7	8.2	2.5
25	5.4	8.6	2.5
26	4.6	5.6	1.4
27	7.0	15.6	3*7
2$	4.4	4.3	1.2
29	5.6	7.4	2.4
30	5.2	6.5	2.1
31	5.4	6.5	2*0
32	4.4	5.1	1.6
33	797	19.0	3.7
34	4.5	5.0	1.6
35	3.5	3.2	1.0
36	4.7	6.4	1.6
37	5.4	7.8	2.4
38	4.6	4.9	1.8

Number	Length cm	Whole Shell Wt. grams	Edible wt. grams
39	3.7	3.3	1.2
Lo	5.7	8.6	2.2
41	4.1	3.1	0.9
42	4.6	5.4	1.3
43	3.0	1.6	0.5
44	5.8	6.7	2.2
45	4.5	5.4	1.7
46	4.5	4.4	1.5
47	5.2	7.2	2.0
48	6.6	14.7	3.0
49	5.2	6.6	2.2
50	5.4	8.4	2.3
51	4.8	6.4	1.3
52	3.6	2.4	0.7
53	4.0	4.0	1.2
54	3.5	3.0	0.9
55	5.2	7.2	1.8
56	3.4	2.8	0.8
57	5.6	7.7	1.9
58	4.0	3.8	1.1
59	3*5	2.$	0.$
60	4.7	6.4	1.8
61	5.6	8.8	2.6
62	5.1	7.6	2.4
63	6.7	11.7	4.0
64	4.6	4.9	1.3
65	4.5	4.7	1.5
66	4.5	5.5	1.5
67	4*1	4.0	1.1
68	4.4	4.6	1.3
69	5.0	8.9	2.2
70	5.0	6.8	2.1
71	5.0	8.9	2.8
72	3.6	2.5	1.0
73	6.5	12.3	3.2
74	5.7	10.1	2.5
75	5.4	6.8	1.9
76	4.3	5.4	1.5
77	5.1	7.9	2.2
78	5.3	7.6	2.5
79	4.8	6.1	2.0
80	4.4	5.0	1.2
81	4.7	5.5	1.8
82	4.4	4.1	1.4
83	4.4	4.8	1.4
84	6.1	12.5	3.0
85	5.3	7.1	2.3
86	4.5	5.9	1.$

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
87	6.4	13.7	3.2
88	7.0	13.9	3.1
89	4.0	2.8	0.8
90	3.9	400	1.5
91	4.5	5.2	1.6
92	4.8	5.5	1.5
93	4.3	4.3	1.3
94	5.1	7.5	2.2
95	3.6	3.1	1.1
96	6.3	10.6	3.0
97	4.3	4.3	1.1
98	6.0	11.7	3.6
99	4.1	3.9	1.1
100	4.6	5.1	1.1
101	5.2	7.1	2.2
102	597	8.5	2.5
103	5.3	7.6	2.2
104	4.7	6.8	2.2
105	4.9	7.1	2*2
106	6.0	1000	3.2
107	4.0	3.7	1.1
108	4.8	6.9	1.9
109	5.0	6.5	2.2
110	4.4	4.4	1.4
111	4.7	5.6	2.0
112	5.1	7.9	2.0
113	7.5	26.5	5.4
114	3.5	2.5	0.7
115	4.3	5.0	1.5
116	5.4	7.4	2.4
117	3.7	2.3	0.7
118	5*4	7.5	1.9
119	4.8	5*9	1*7
120	6.0	10.1	2.3
121	4.3	5.5	1.8
122	4.9	7.2	2.4
123	6.3	14.5	2.7
124	4.5	6.2	2.0
125	4.5	5.2	1.6
126	5.1	6.4	1.7
127	4.1	3.4	0.7
128	5.3	10.3	3.3
129	4.1	4.5	1.4
130	4.8	5.1	1.3
131	3.4	2.2	0.6
132	5.9	11.0	3*3
133	4.2	4.2	1.2

Number	Length cm	Whole Shell Wt. grams	Edible Wt. prams
134	5.5	8.8	2.6
135	6.2	13.5	2.8
136	4.0	4.1	1.4
137	3.9	3.4	1.4
138	4.3	4.2	1.0
139	4.4	4.9	1.3
140	5.0	6.1	1.7
141	5.6	10.0	2.9
142	4.8	5.0	1.2
143	5.7	10.8	3.4
144	3.8	3*5	1.2
145	4.0	- 3*5	1 . 1
146	3.4	2.9	0.7
147	3.1	1.8	0.5
148	5.0	7.3	2.5
149	4.5	4.6	1.3
150	3*9	3.7	1.1
151	4.1	3.9	1.0
152	5.3	8.3	2.4
153	4.0	4.3	1.3
154	4.7	6.2	1.9
155	4.1	4.4	1.6
156	4.3	3.$	1.0
1s7	4.1	3.8	1.1
158	5.1	8.9	2.6
159	5*5	9.3	2.7
160	4.9	5.3	1.5
161	4.9	6.7	2.2
162	4.4	4.7	1.6
163	3.6	3.9	0.9
164	3.1	1.7	0.3
165	5.4	6.2	1.7
166	3.7	4.0	1.1
167	5.0	6.7	1.5
168	4.7	6.6	1.8
169	4.2	3.3	1*0
170	4.1	3.8	1.2
171	3.5	2.2	0.8
172	4.0	4.4	1.1
173	4.1	3.9	0.7
174	3.8	3.0	1.0
175	3.2	2.0	0.5
176	4.0	3.5	1*0
177	6.2	12.3	2.7
178	5.0	6.3	2.1
179	5.0	8.2	3.1
180	5.8	10.8	3.9
181	4.7	5.6	1.5
182	5.0	7.8	3.2

Number	Length cm	Whole Shell Wt. grams	Edible Wt. reams
183	3*5	2.1	0.4
184	5.4	8.2	2.3
185	5.3	7.3	2.0
186	4.0	4.4	1.6
187	5.7	10.1	2.5
188	5.1	7.5	2.1
189	4.2	4.2	1.2
190	5.0	6.1	1.8
191	5.5	8.5	2.5
192	4.9	5.$	2.1
193	4.7	499	1.5
194	3.7	-305	1.2
195	3.7	3.4	0.9
196	4.7	4.8	1.4
197	4.6	4.7	1.5
198	3.6	2.8	0.8
199	4.1	3.6	1.0
200	4.3	5.0	1.3
201	4.4	4.3	1.5
202	5.1	6.2	1.9
203	2.8	1.6	0.3
204	3.1	1.5	0.4
205	5.3	7.1	2.3
206	5.3	7.4	1.9
20'7	5.6	11.6	3.6
208	5.5	9.3	2.6
209	5.6	9.0	3*4
210	4.1	3.5	1.2
211	5.6	8.3	2.6
212	5.6	8.2	2.5
213	4.5	4.4	1.4
214	4.4	4.4	1.5
215	4,2	5.2	1.1
216	4.4	4.5	1.2
217	3.5	3.0	0.7
218	3.4	2.8	0.8
218	6.2	12.6	2.7
219	5.7	10.0	2.7
220	4.8	6.o	1.9
221	5.1	9.0	2.0
222	5.0	6.3	1.6
223	4.3	6.3	1.6
224	3.7	3.0	0.6
225	3.8	3.3	1.1
226	4.1	3.5	1.1
227	397	3*5	1.0
228	5*5	7.4	1.6

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
229	5*5	9.7	2.6
230	5.1	7.6	2.5
231	4.5	6.2	1.9
232	5.6	9.0	2.6
233	5.1	6.5	2.0
234	4.4	3.6	1.1
235	4.3	399	1.0
236	5.8	11.6	2.6
237	5.7	7.0	2.1
238	3.2	2.2	0.5
239	3.8	3.2	0.7
240	5.6	8.3	3.0
241	5.2	7.0	1.$
242	4.7	6.0	1.6
243	4.6	4.2	0.9
244	5.6	9.4	3.8
245	4.0	3.8	1.2
246	6.0	12.5	2.9
247	5.0	5.6	2.1
248	4.9	6.2	2.0
249	4.4	5*1	1.8
250	5.0	5.8	1.7
251	4.2	3*5	1.3
252	4.3	4.5	1.3
253	4.9	5.2	1.3
254	3.5	3.6	1.3
255	4.1	3.7	1.1
256	4*5	5.3	1.7
257	3.8	3.1	0.$
258	4.2	4.2	1.3
259	3.9	3.7	0.9
260	4.0	3.3	0.9
261	4.3	5.2	1.4
262	4.9	6.3	2.3
263	5.4	6.9	2.1
264	4.8	4.8	1.2
265	4.1	4.0	0.8
266	3.6	3.6	0.9
267	5.7	10.0	2.6
268	4.0	3.2	1.0
269	4.0	4.2	1.3
270	4.6	5.1	1.2
271	3.8	3.2	0.9
272	3.4	2.0	0.5
273	5.3	797	2.4
274	3.7	3.1	0.8
275	494	5.3	1.7
276	4.3	4.4	1.4

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
277	4.4	4.5	1.6
278	4.2	4.4	1.4
279	4.0	4.0	1.1
280	3.4	2.6	0.6
281	4.7	5.0	1.6
282	5.8	6.7	2.2
283	4.9	5.9	1.8
284	3.7	2.9	0.8
285	3.8	2.7	0.7
286	5.2	9.2	2.3
287	3.9	3 9 7	1.2
288	3.6	3.0	0.8
289	4.3	4.9	1.6
290	4.7	4.7	1.3
291	4.0	3.1	1.0
292	3.9	3*7	1.2
293	4.0	3.2	0.8
294	3.9	2.8	0.7
295	3.1	2.0	0.5
296	3*9	3.1	0.7
297	3.2	1.8	0.6
298	5.8	9.3	2.5
299	"5.1	$.1	2.2
300	5.1	6.1	1.7
301	5.4	10.0	2.9
302	4.8	5.7	2.1
303	4.9	6.2	1.7
304	5.1	10.0	2.9
305	4.6	4.5	1.5
306	4.7	4.7	1.4
307	5.1	8.6	2.4
308	4.4	4.4	1.3
309	4.1	3.8	1.0
310	4.2	4.7	1.3
311	5.1	5.8	1.4
312	5.6	8.2	2.0
313	597	8.9	2.4
314	4.4	4.5	1.6
315	4.8	6.5	1.6
316	5.2	7.8	2.2
317	4.6	4.6	1.5
318	4.1	3.5	1.1
319	4.6	5.1	1.1
320	5.6	8.5	1.6
321	397	2.7	1.0
322	3*5	2.6	0.5
323	4.8	6.2	1.8

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
324	4.1	4.5	1.5
325	4.6	5*3	1.6
326	3.9	4.0	0.8
327	3.6	2.9	0.7
328	3.6	4.3	1.3
329	5.2	7.9	2.0
330	3.5	2.5	0.8
331	4.5	5.0	1.4
332	4.1	3.9	1.2
333	4.3	4.1	1.0
334	4.3	4.5	1.2
335	4.0	3.1	1.0
336	5.1	6.2	1.8
337	4.2	4.4	1.4
338	4.0	2.6	0.9
339	4.0	4.0	1.1
340	4*3	3.$	1.1
341	3*9	3.2	0.7
342	5.5	9.3	2.8
342	4.0	3.1	1.1
343	4.1	4.1	1.8
344	.3*3	2.1	0.6
345	3*3	1.$	0.5
346	5.1	7.8	2.4
347	4.9	4.8	1.6
348	4.7	6.2	1,8
349	4.1	3.7	0.5
350	4.4	4.2	1.3
351	4.6	7.2	2*0
352	5.1	6.8	1,8
353	4.8	6.1	2.3
354	4.4	5.2	1.3
355	5.0	6.2	2.2
356	5.0	6.5	1.6
357	3.6	2.8	0.7
358	4.5	4.4	1.3
359	3.4	1.9	0.3
360	3*3	2.3	1.0
361	4.6	4.6	1.4
362	4.6	7.0	2.0
363	4.1	4.0	0.8
364	3.3	2.2	0.6
365	5.1	7.9	2.8
366	4.4	5.1	1.4
367	3.1	2.0	0.6
368	3.9	3.0	0.7
369	3.6	2.7	0.9

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
370	3*7	3.9	0.8
371	3.3	2.5	0.7
372	4.6	5.7	1.5
373	3.6	2.5	0.6
374	3.7	2.$	1.0
375	3.6	3.1	1.0
376	3.0	1.9	0.5
377	3.2	1.9	0.6
378	3.4	2.9	0.$
379	3.5	2.5	0.7
380	4.0	2.9	0.9
381	3.2	1.9	0.6
382	3*5	2.3	0.6
383	3*5	2.6	0.6
384	3.4	2.8	1.0
385	2.$	1.3	0.6
386	3.0	1.5	0.5
387	3.5	2.9	0.6
388	3.2	201	0.6
389	3.1	1.5	0.5
390	3.2	2.1	0.6
391	3.1	2.0	0.4
392	3.2	1.8	0.6
393	2.$	1.1	0.4
394	3.2	2.4	0.5
395	2.7	1.2	0.3
396	2.8	1.7	0.3
397	2.8	1.6	0.3
398	2.2	1.0 4	0.2
399	2.8	1.5	0.4
400	7.6	33.8	3.9
401	5*5	8.5	2.5
402	7.0	17.4	2.9
403	5.1	8.0	2.6
404	4.9	6.3	1.$
405	6.4	13.9	3.0
406	4.5	4.5	1.1
407	5*3	9.0	2.4
408	4.7	6.4	2.2
409	5.4	8.5	3.1
410	4.9	6.2	1.8
411	4.4	5.2	1.5
412	5.2	6.7	2.0
413	6.3	14.4	4.5
414	4.5	5.4	1.5
415	3.7	3.4	1.1
416	5.6	9.2	2.4
417	3.4	2.6	0.7
418	6.0	11.4	3.4

Number	Length cm	Whole Shell Wt. grams	Edible Wt. grams
419	7.0	17.0	5.4
420	5.0	8.5	2.4
421	5.7	9.9	2.5
422	5.0	8.0	2.2
423	5.1	7.3	2.3
424	4.1	3.8	1*2
425	6.3	13.2	3 . 3
426	5.3	$.4	2.8
427	5*3	9.4	3.0
428	5.2	8.9	2.2
429	5*3	9.0	2.8
430	5.3	8.4	2.7
431	4.3	5.2	1.$
432	3.2	2.2	0.8
433	6.7	16.6	6.1
434	4.9	6.7	1.6
435	4.6	6.1	2.0
436	4.9	8.8	2.5
437	4.8	6.1	1.7
438	3.9	4.0	1.2
439	3.2	3.2	1.0
440	4.5	4.8	1.5
441	6.4	14.0	2.2
442	595	7.5	1.8
443	4.3	4.1	1.4
444	4.4	5*5	1.7
445	5.5	7.1	2.5
446	5.3	10.4	3.1
447	5.3	7.4	2.2
448	4.9	7.0	2.0
449	4.6	5*1	1.7
450	4.9	3.4	1.2
451	6.1	11.4	2.7
452	5.1	7*5	2.2
453	5.1	8.7	2.6

Due to the large remaining amounts of mussels, only lengths and total edible material was determined.

Number	Length	Number	Length
454	4.9	455	5.2
456	4.9	457	4.4
458	4.4	459	5.2
460	3.9	461	4.0
462	5.1	463	6.6
464	5.6	465	4*3