November 2-3, 1978

AGENDA ITEM: 24

ACTION REQUIRED: Informational

SUBJECT: Results of Joint Industry/Government venture on surf clams in the S.E. Bering Sea - 1978

SUMMARY: ~~Two~~ One documents are attached:

(a) A report by Hughes & Nelson, NWAFC/NMFS

~~(b) A memo from Branson~~

A presentation by Steve Hughes, NMFS is also expected

COMMENTS: There is a slight possibility of a commercial clam fishery for 1979. Objections have been raised because of the incomple environmental assessment and impacts study and an unfinished FMP.

APPENDIX B

Agenda 24 HUTTON
Nov. 2-3, '78 10/17/78
Seattle

PRELIMINARY RESULTS OF JOINT INDUSTRY-GOVERNMENT VENTURE ON SURF CLAMS IN THE S. E. BERING SEA - 1978

by

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and

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INTRODUCTION

A second season of field research aimed at assessing the potentials of a surf-clam fishery in the S. E. Bering Sea was concluded in August 1978. Following the 1977 survey, which resulted in delineation of a surf-clam resource estimated at over 286,000 metric tons of whole clams near the Alaska Peninsula (Fig. 1), efforts in 1978 emphasized production fishing and environmental impact studies. Additional aspects of the overall study initiated in 1977 and continued in 1978 included analyses for paralytic shellfish poison (PSP), collection of biological data required for resource-management decisions, and expanded studies to determine processing and product quality.

Production-fishing studies using a commercial-size hydraulic clam harvester were emphasized in 1978 to determine if the resource discovered in 1977 occurred in concentrations sufficiently dense to support a viable fishery. The commercial-scale clam removals also afforded an opportunity to assess ecological changes to the environment resulting from the fishing effort. Ecological studies were conducted under private contract by the North Pacific Management Council to provide data for the development of an environmental impact statement. While results of that study will be summarized here, this report deals primarily with production-fishing studies, tests for PSP, size composition of the resource, and a financial feasibility study of a surf-clam fishery in the S. E. Bering Sea.

As in 1977, financial support for and participation in the 1978 surf-clam research involved private industry and both Federal and State of Alaska agencies. Over $80,000 was contributed by eight fishing/processing

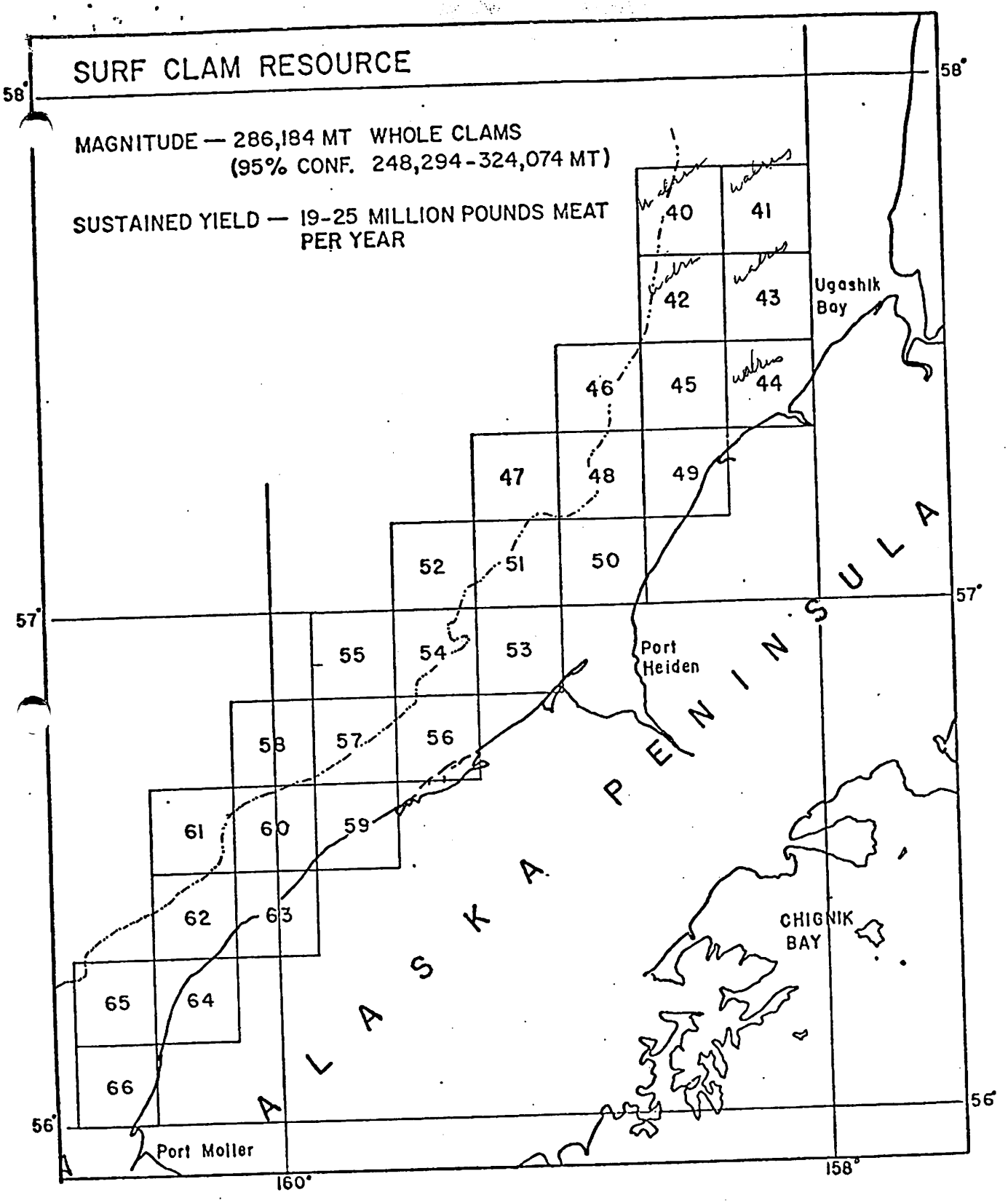

Fig. 1.--Location of survey blocks 40-65 along the Bering Sea side of the Alaskan Peninsula where an estimated 286,000 metric-ton, surf-clam resource was identified during the 1977 joint Industry-Government clam survey.

companies: New England Fish Co., Seattle; Peter Pan Seafoods, Seattle; Snow Foods Division of Borden, Inc., Columbus, OH; Gorton Division of General Mills, Gloucester, MA; Campbell Soup Company, Camden, NJ; Guilford Packing Co., Inc., Port Townsend, WA; Pacific Seapro, Tacoma, WA; and Dutch Harbor Seafoods, Redmond, WA. The State of Alaska Economic Development Division contributed $60,000. Alaska Department of Fish and Game served as administrator of research funds and provided scientific personnel during the field work. The North Pacific Management Council provided $20,000 in addition to supporting a $107,000 contract for the ecological studies, and the National Marine Fisheries Service provided $80,000, scientific leadership for the research venture, analytical facilities and personnel for PSP analysis, and the use of the R/V Oregon for conducting ecological studies.

VESSELS AND GEAR

Operations were conducted from the 102' trawler/crabber F/V Sea Hawk as the clam survey vessel, and the 100' NOAA R/V Oregon, which served as the base for most ecological studies.

The F/V Sea Hawk was powered by two V·12·71 GM diesels, each producing 330 hp at 1800 rpm. Electronic fishing and navigation aids included dual radars, loran C with a loran C plotter, automatic pilot, echosounders, and radios. The vessel was equipped with both freezer and live-tank holds. Fishing gear consisted of an East Coast-style commercial hydraulic clam harvester with a 72-inch (fishing width) knife. A concaved steel guard, designed to divert crab and other epibenthic organisms from the harvester's

path, was constructed on the forward section of the gear. A deck-mounted, engine-pump package supplied water to the harvester's manifold. This unit consisted of a 4,000 gpm Deming pump with a 20-inch impeller driven by a 6-cylinder, Allis Chalmers model 25000, Mark II, turbo-charged diesel, delivering 360 hp at 1800 rpm. The on-deck water supply was carried to the harvester via a 6-inch-diameter rubber hose rated at 150 psi. The 5500-pound harvester was set and retrieved from the port side by a trawl winch and boom system and towed with 3-inch-diameter polypropylene line.

The vessel was captained by her owner, John Roberts, a veteran East Coast surf-clam skipper who recently relocated to the West Coast. Captain Roberts and his experienced clamming crew made numerous gear adjustments during production fishing trials in an attempt to "tune the gear" to various fishing conditions encountered.

The R/V Oregon was stationed on and near three sites where the Sea Hawk conducted production clam-harvesting trials. Gear deployed to determine epibenthic and inbenthic fauna and ecological conditions before and after clam harvesting, included an underwater TV system, a VanVeen grab capable of obtaining a 1/10 square-meter-substrate sample to a depth of 10 inches, and a small trawl.

METHODS

Survey Design

A major portion of the survey effort was devoted to a series of intensive production fishing/ecological studies in blocks 57 and 59. Within these adjacent blocks (Fig. 1), three 1/2-x-1/4-mile plots and a

control site were marked with buoys.

Grab sampling of substrate in the three plots and the control site was done prior to, during, and after harvesting to provide baseline information on benthic species composition, population densities, and sediment profiles to provide the basis for determining changes over time as a result of harvesting. An underwater TV system was employed to position the VanVeen grab within the clam harvester tracks immediately after fishing and epibenthic organisms were collected by trawl to identify stomach contents of predators.

Surf-clam harvesting in the three 1/2-x-1/4-mile plots was conducted at high-, medium-, and low-fishing densities, respectively, to investigate the degree of ecological change resulting from these different fishing efforts.

Further studies of production fishing were conducted in 10 other locations along the Alaskan Peninsula. These locations, like the three production-fishing/ecological study sites, were discovered through exploratory fishing and results of the 1977 survey. When apparent commercial clam concentrations were encountered, a marker buoy was set and at least 10 tows completed to establish catch rates. Harvesting was conducted as it would be during a commercial fishery. Tow durations ranged from 10-30 minutes but were usually 10-15 minutes.

Clams obtained daily were sampled and retained for analysis of PSP; however, two separate extensive collections for PSP samples from the entire resource area were completed. These collections were made on the first three and the last three days of the July 4 - August 10 cruise period and consisted of representative clams from one tow within each sampling block

along the Peninsula.

Collection of Biological Data

Clams from each catch were sorted by species and weighed to determine species composition and catch rates. Crab were also carefully enumerated; however, other minor invertebrate catch components were not as carefully enumerated as during the 1977 survey. At each production-fishing site, surf-clam catches were subsampled from representative tows and size composition determined by measuring shell length of 200-300 individuals. Other clam species were measured as time permitted.

Two stratified samples of surf clams (25 individuals per 5-mm-length interval) were collected to determine length at age relationships for later development of age-length keys, age composition, growth, and mortality studies. Clams exceeding 70 mm in length were shucked and the shells frozen for annual ring counts, while those measuring less than 70 mm were frozen whole.

Surf clams were also preserved for later studies to determine size at maturity and reproductive activity.

Collection of Samples for PSP Determination

Clams were frozen at sea for later use in analysis for PSP. During each day of production fishing, samples for PSP analysis were taken from at least 7 tows. Each sample consisted of all clam species represented. For the larger species (surf clams and cockles), 12 individuals were shucked, the meat frozen, and identified by code number. For the smaller species (tellins and macomas), 20-25 individuals were frozen whole. Samples obtained during the extensive PSP surveys at the beginning and end of the

cruise period were handled in an identical manner.

All PSP samples collected were analyzed by NMFS for PSP by the mouse bioassay method. In the laboratory, clams were thawed, shucked when necessary, then separated into edible portion and viscera. Edible portions and viscera were analyzed separately. If a test for PSP was positive, it was repeated.

Samples for Product Evaluation Studies

Whole surf clams were packed in 80- to 120-pound-capacity burlap bags and frozen aboard the Sea Hawk. Shucked surf-clam meats were also frozen aboard ship in 5-pound boxes. All frozen samples were identified by codes corresponding to the PSP sample codes and shipped to Seattle for distribution to industry participants for quality studies.

RESULTS

Clamming operations conducted by the Sea Hawk were effective. Vessel and gear worked well, and no break downs or gear damage were experienced. A total of 488 tows with the clam harvester were completed; over 60,000 pounds of whole surf clams, 1,100 pounds of tellins, and 3,100 pounds of surf-clam meat were frozen aboard ship and freighted to Seattle. All biological data requirements were completed, and 370 clam samples for PSP analysis were collected and returned to the Seattle NWAFC laboratory for analysis.

Ecological studies were conducted primarily from the R/V Oregon but completed by the Sea Hawk as planned. Tetra Tech personnel experienced some problems with their underwater TV system and attempts to visually

locate the VanVeen grab directly into clam-harvester tracks met with limited success. However, the 1/10-square-meter VanVeen grab proved to be an excellent sampling tool, and all other aspects of their study went well.

Fishing Conditions

In addition to general weather conditions, both current velocity and substrate conditions affected fishing success in the Bering Sea survey area.

Current velocity averages about 1.5 knots and often exeeds 2 knots, which is considerably greater than currents over the clam grounds fished in the Atlantic. The strong current velocities affected the ability of the vessel to maintain tow direction and desired tow speed and significantly reduced catch rates during peak tidal flow relative to slack water periods.

The black sand substrate in blocks 54-65 (Fig. 1) was generally good for fishing. Substrates in blocks 40-53 were varied: streaks of black sand, gravel, peat, and rocky areas. This made fishing more difficult, increased scouting time to locate clam concentrations, and yielded reduced catch rates.

Production Fishing Studies

Thirteen production sites in the survey area were located and fished to establish catch rates applicable to evaluating the feasibility of a commercial fishery. During this portion of the survey, 52.14 hours of actual fishing time with the 6-ft.-wide clam harvester resulted in a catch of 87,750 pounds of surf clams.

The location of these production sites within the survey area is shown

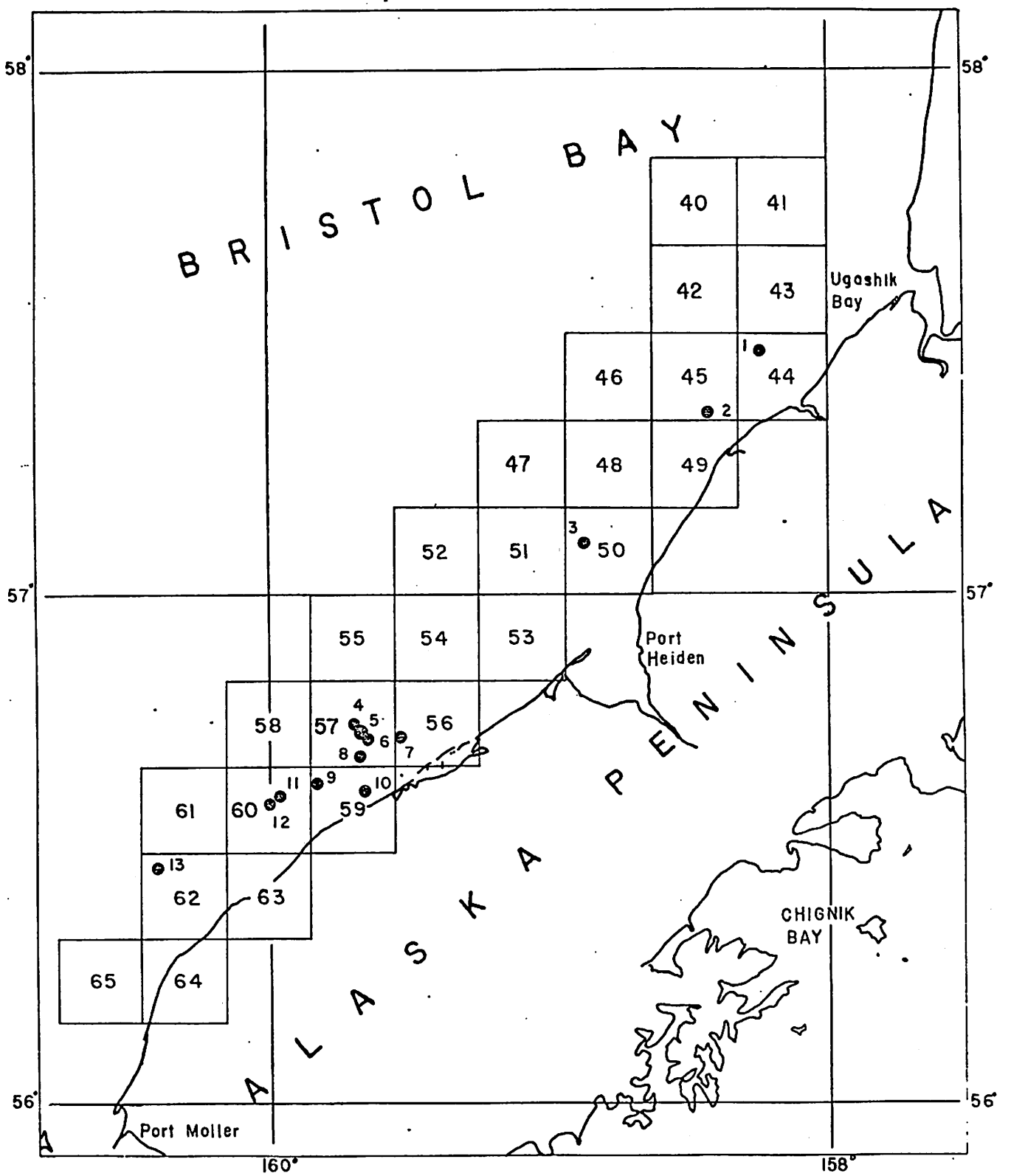

Figure 2. Location of 13 sites in the Alaskan Peninsula survey area (blocks 40-65) where production-fishing studies on Alaskan surf clams were completed.

Table 1. Surf clam catch information obtained with a 6 ft. wide hydraulic clam harvester at 13 production fishing sites along the Alaskan peninsula survey area in the S.E. Bering Sea.

Production Site No.	Survey Block No.	Fishing Effort (hrs.)	Total Catch (lb.)	Catch/Hour lb.	Catch/Hour bu.	Average Clam Length in.	Average Clam Length mm.
1	44	1.67	1,511	907	11.3	4.5	115
2	45	1.40	1,882	1,344	16.8	4.5	115
3	50	2.47	3,669	1,487	18.6	3.9	98
4	57	11.08	17,820	1,608	20.1	3.9	99
5	57	2.60	5,118	1,968	24.6	4.1	103
6	57	9.15	16,120	1,762	22.0	4.3	110
7	56	1.83	3,503	1,911	23.9	4.1	103
8	57	1.67	4,740	2,844	35.5	4.3	109
9	59	1.50	3,033	2,022	25.3	4.5	115
10	59	13.05	18,237	1,397	17.5	4.0	101
11	60	1.02	1,595	1,569	19.6	4.4	111
12	60	2.53	5,054	1,995	24.9	4.5	114
13	62	2.17	5,468	2,524	31.9	3.9	99
All sites		52.14	87,750	1,683	21.0		

in Figure 2 with associated catch data from each site given in Table 1. Environmental impact studies were conducted at production sites 4, 6, and 10.

Data presented indicate the overall surf-clam catch rate with the 6-ft.-wide harvester was 1,683 lbs. or 21 bushels per hour (at 80 pounds per bushel). Catch rates at production sites 1-3 were considerably lower (11.3-18.6 bu/hr) than other sites due to variable and hard substrates encountered in survey blocks 44, 45, and 50. At production site 10 in block 59, harder than average substrate was encountered and lower production rates were experienced. In such hard substrate areas, catch rates dropped considerably if tows exceeded 15-minute durations. For example, while the site 10 production rate was 17.5 bushel/hr, tows of less than 15-minute duration produced a catch rate of 31.5 bushel/hr. In areas of normal black-sand substrate, tows of less than 15-minute duration produced essentially the same catch rates as those produced in tows of 15- to 30-minute duration.

During production-fishing trials, few "clean" catches of surf clams were obtained. Most areas produced high incidental catches of starfish and old surf-clam shells, indicating that automated catch-sorting deck gear would be essential in a Bering Sea surf-clam fishery. As an example, a typical 15-minute tow would produce 400-600 pounds of surf clams, 100-200 pounds of starfish, and 100 pounds of old surf-clam shells. The second, most abundant clam species obtained was the Alaska tellin, which normally did not exceed 20-30 pounds in a typical catch. Cockles, macoma clams, and razor clams were obtained in quantities normally not exceeding 5 pounds per species per tow in most areas.

King crab were rare in catches, and no tanner crab were taken.

More precise species catch-composition information will be available after completion of analysis.

Biological Data

Two extensive samples of surf clams were collected for analysis of age composition, age-length relationships, growth studies, and mortality studies. Additional samples were collected to determine state of reproductive activity and size and age at first maturity. The above samples have not been analyzed to date.

Results of PSP Analyses

Between July 4 and August 8, 1978, 370 clam samples were collected to determine the incidence of PSP in the 1,900-square-mile, resource-study area. Collected were: 185 surf clam (Spisula sp.), 132 tellin clam (Tellina sp.), and 53 miscellaneous clam samples.

In the laboratory, the edible portion of the clam was separated from the viscera. These two portions were analyzed separately for PSP using the AOAC standard mouse-bioassay procedure. To date: 185 edible portions of surf clam, 48 surf-clam viscera, 72 tellin clam edible portions, 7 tellin viscera, and 12 miscellaneous clam-edible-portion samples have been analyzed for PSP. The results are shown in Tables 2, 3, and 4.

Surf-Clam Results.--A small percentage of both the edible portions and viscera of surf-clam samples tested to date were found to contain toxin.

The edible portion of four samples were toxic. The samples from which these portions were taken came from 3 blocks: 50, 51, and 57. The average level of PSP in each of these samples was below the level of

Table 2. Paralytic Shellfish Poison Results - Surf Clam (Spisula)

Block No.	EDIBLE PORTION			VISCERA		
	No. of samples	No. positive	Range of Means (µg PSP/100 g)	No. of samples	No. positive	Range of Means (µg PSP/100 g)
40	2	0	--	2	0	--
41	2	0	--	1	0	--
42	4	0	--	1	0	--
43	6	0	--	3	0	--
44	10	0	--	2	0	--
45	11	0	--	2	0	--
46	2	0	--	2	0	--
48	4	0	--	2	0	--
49	2	0	--	2	0	--
50	14	1	39	5	4	49-271
51	2	1	53	2	1	234
53	-	-	--	-	-	--
54	1	0	--	1	1	137
56	13	0	--	2	0	--
57	54	2	56-69	7	2	42-53
59	25	0	--	7	3	31-41
60	19	0	--	3	0	--
62	10	0	--	1	0	--
63	2	0	--	1	0	--
65	2	0	--	1	0	--
Totals	185	4		47	11	

Table 3. Paralytic Shellfish Poison Results - Tellins (Tellina)

Block No.	EDIBLE PORTION			VISCERA		
	No. of samples	No. positive	Range of Means (µg PSP/100 g)	No. of samples	No. positive	Range of Means (µg PSP/100 g)
40	1	0	--	1	1	43
41	1	0	--	-	-	--
42	2	0	--	-	-	--
43	2	0	--	-	-	--
44	1	0	--	1	0	--
45	5	0	--	-	-	--
46	1	1	35	1	1	130
48	2	0	--	-	-	--
49	2	0	--	-	-	--
50	8	3	27-47	-	-	--
51	2	2	43-65	1	1	400
53	1	1	52	-	-	--
54	1	0	--	1	1	289
56	2	0	--	-	-	--
57	29	1	65	1	1	149
59	9	1	65	1	1	223
60	2	0	--	-	-	--
62	-	-	--	-	-	--
63	-	-	--	-	-	--
65	1	0	--	-	-	--
TOTALS	72	9		7	6	

Table 4. Paralytic Shellfish Poison Results - Miscellaneous Clams

Block No.	Species	EDIBLE PORTION No. of samples	EDIBLE PORTION No. positive	EDIBLE PORTION Range of Means (µg PSP/100 g)
54	S. groenlandicus	1	0	--
57	Macoma	1	1	77
	S. Groenlandicus	1	0	--
	Siliqua alta	1	1	92
59	Macoma	1	0	--
60	Macoma	2	2	80-127
	S. groenlandicus	1	0	--
	S. laperousii	1	0	--
62	Macoma	2	2	60-61
63	Macoma	1	0	--
Totals		12	6	

80 µg PSP/100 g meat limit set by FDA. The toxic samples were all collected in the first half of the sampling period and from hauls made close to each other in time and distance in each block. The positive samples represent 2% of the total surf-clam samples taken for PSP analyses. Seven bags of whole clams were frozen from these lots. These will be retained for further PSP analysis.

The positive edible samples showed an interesting relationship to their visceral components. The edible samples from block 50 and 51 had levels of ≃ 250 µg PSP in their corresponding visceral portion, whereas both positive edible samples in block 57 showed no detectable toxin in their visceral portions. Although more testing is necessary to verify this, the samples from block 57 may indicate that small amounts of toxin can be retained in the edible portion of the clam after the viscera have been freed of toxin. The time retention and anatomical location of the toxin have yet to be determined.

Twenty-six percent of the 185 surf-clam viscera samples have been analyzed. These include at least one sample from each block and all samples of edible portions found to be positive. Eleven samples have shown the presence of toxin. Positive samples have been found in blocks 50, 51, 54, 57, and 59. They represent 23% of the viscera samples analyzed to date. Toxicity levels range from 31 to 234 µg PSP/100 g of viscera; the majority (73%) being below 60 µg PSP. In block 54, a viscera sample contained 137 µg/100 g, but no toxin was detected in the corresponding edible portion. PSP levels of 270 µg and 234 µg in the viscera of samples from blocks 50 and 51 corresponded with low levels of toxin in the edible portions. These characteristics may indicate a "threshold-level" relationship between

toxin levels in the viscera and edible portions; however, further investigation is necessary to eliminate the possibility of the phenomena being a result of poor physical separation and cleaning technique during the preparation of samples for analysis.

Tellin-Clam Results.--Only 54% of the edible portions and 5% of the viscera portions of the 132 tellin-clam samples have been analyzed for PSP. The edible portion of at least one sample from each block has been analyzed.

Toxicity levels in the nine positive samples of edible portions ranged from 27 to 65 µg PSP/100 g meat. They represent 12% of the total number of samples tested to date. All levels are below the 80 µg/100 g limit set by FDA.

The viscera of tellins exhibited higher PSP levels than any other group tested. Levels primarily occurred between 130 µg and 300 µg PSP, with one sample each at 43 µg and 400 µg PSP. The 400 µg and 289 µg PSP levels in tellin viscera of samples from block 51 and 54 coincide with the 234 µg and 137 µg PSP levels found in surf-clam viscera in the same blocks and hauls. The higher toxicity levels in some of these viscera could be responsible for false positive results in their respective edible portions since complete dissection of tellin clams is more difficult to accomplish than for surf clams.

Toxic edible-portion tellin samples were found in the same blocks as were toxic surf-clam samples (50, 51, 57, and 59) and also in blocks 46 and 53. Toxic tellin viscera was found in block 40, where none previously had been found by surf-clam analyses.

Miscellaneous Clam Results.--The edible portions of 12 clams of various species have been analyzed to date: 7 Macoma, 3 Serripes groenlandicus, 1 Siliqua alta, and 1 S. laperousii. This comprises 23% of the 53 miscellaneous clam samples collected.

None of the S. groenlandicus or S. laperousii samples were toxic, but the single Siliqua and 5 Macoma samples were found to be toxic. All positive samples ranged between 60 µg to 127 µg PSP/100 g meat. The Macoma species give indication of the presence of PSP in blocks 60 and 62 not found by analyses of the surf- and tellin-clam samples.

Product Evaluation Studies

No product evaluation studies have been completed to date as all clams remain in freezer storage in Seattle. It is expected that lots of both frozen whole clams and shucked meat will be released soon pending completion of the PSP tests. Clams in storage will meet or exceed all specific industry requests for product evaluation studies.

Environmental Impact Studies

FINANCIAL FEASIBILITY STUDY PURVIEW

Information on vessel-operating costs, which are expected to occur, and income resulting from landings have been compiled to aid in evaluating the feasiblity of conducting a Bering Sea surf fishery. A number of assumptions and generalizations are incorporated in this analysis; while each are identified, not all may prove true or be the most economical approach.

The hypothetical prototype vessel chosen for this analysis is a 108' crabber/trawler steel vessel with an 850 hp main engine. The vessel would be equipped with twin 150 hp auxiliary engines, hydraulic power on deck, and three circulating sea water live tanks below deck with an 8,000 cubic foot capacity. Cost of such a vessel was set at $1.5 million; however, replacement cost would approach $2.2 million. To enter the fishery, the vessel would have to purchase and install twin 450 hp pump engines with 6,000 gpm pumps, at a cost of about $30,000 each (deck mounted), trawl winches, twin stiff arms (costs would vary considerably by vessel), and clam-sorting deck gear at a cost of $10-15,000.

The prototype gear would consist of twin 10-ft.-wide hydraulic clam harvesters at a cost of $10,000 each.

In this analysis, it is assumed the vessel would operate 24 hours a day with a six-man crew. During the 24-hour day, the harvesters would be fished 17 hours per day, and the catch would be placed directly in live tanks.

Vessel-operating costs and income have been computed on a daily basis, a trip basis, and a monthly basis. It is assumed the vessel would

unload live clams by pump at Port Moller. A five-day trip time has been calculated to consist of 3 day's fishing, 1 day running and unloading and 1 day scouting and/or weather loss. Thus, 6 trips per month are projected.

The following calculations are offered:

Operating Cost Per Fishing Day

Fuel @ 7 gal/hr/100 hp	=	2667 gal/fishing day
@ 60¢/gal	=	$1600 /fishing day
Lub costs	=	$ 30 /fishing day
Vessel hull Ins. @1.5%/yr	=	$ 62 /day
Personnel Injury Ins.	=	$ 33 /day for 6 men
Vessel & gear maintenance	=	$ 100 /day
Total		$1825 /day

Operating Costs Per Non-Fishing Day

Fuel @ 7 gal/hr/100 hp	=	1333 gal/day
@ 60¢/gal	=	$ 800 /day
Lub costs	=	$ 15 /day
Vessel hull Ins. @ 1.5%/yr	=	$ 62 /day
Personnel Injury Ins.	=	$ 33 /day
Vessel & gear maintenance	=	$ 100 /day
Total		$1010 /day

Operating Costs Per Trip - 3 days fishing, 2 days non-fishing =$ 7,675

Reasonable crew share @ $300/manday + $500/skipper day = 10,000

$17,675

Operating Costs Per Month - 6 trips per month

$17,675/trip = $106,050/month

Vessel Landings @ 21 bushel/hr with 6' harvester

Twin 10' harvesters	=	70 bushel/hr
@ 17hrs/day	=	1,190 bushel/day
@ 3 fishing days/trip	=	3,570 bushel/trip
@ 80 pounds/bushel	=	285,600 lbs/trip
@ 6 trips/month	=	21,420 bushel/month
	=	1,713,600 lbs/month

Vessel Income from Landings

3,570 bushel/trip @ $8.00/bushel	= $ 28,560/trip
21,420 bushel/month @ $8.00/bushel	= $171,360/month

Vessel Income Less Operating Costs

$ 28,560/trip less $17,675/trip	= $10,885/trip
$171,360/month less $106,050/month	= $65,310/month*

*This figure is not profit. Vessel depreciation and construction loan costs (interest and principle) have not been figured in operating expenses.

CONCLUSIONS

During 1977 and 1978 surveys, a substantial data base has been developed for industry to evalaute the desirability of initiating a surf-clam fishery in the S. E. Bering Sea and for government agencies to regulate its utilization.

While the surf-clam resource along the Port Moller-Ugashik Bay area of the Alaska Peninsula is large, 248,294 - 324,074 metric tons of whole clams, the clam concentrations are not as dense as those known in the Atlantic surf-clam fishery. The production-fishing rates obtained with the 6-ft. clam harvester (average 21.0 bushel/hr) are lower than anticipated. The high incidental catch of starfish in most areas may be a clue to the low densities as starfish are the surf clam's primary predator. If a fishery does develop, it would be wise management to require vessels to grind starfish catches before returning them to the sea.

Starfish and old clam shells were continuously present in catches, which makes hand sorting of clams impractical. Mechanical catch sorters like those used in some areas of the Atlantic fishery would be highly desirable along the Alaskan Peninsula.

The presence of PSP in the areas surveyed in 1977 and 1978 indicates that some degree of PSP can be expected in the future. The fact that only 4 of 185 samples of surf-clam meats contained detectable amounts of toxin this year and none were found with toxin in 1977 suggests that the surf clam may not be seriously affected by PSP. Apparently, there is a differential up-take of the toxin among clam species. Since surf clams are filter feeders and tellins are detritus feeders, one can speculate that

feeding habits have an effect on toxin intake. Further investigation to clarify this would be useful.

None of the 4 surf-clam meat samples that had detectable toxin contained more than 80 µg/100 g. Thus, the entire experimental pack of 1978 is assumed to be safe. However, viscera from those lots (numbers 70550, 70551, and 70554) that contained toxin in the viscera at levels above 80 µg/100 g; viscera will be retained and resampled as a precautionary measure.

The data on PSP in the tellin clams are incomplete as only part of the samples have been tested. The results so far indicate that significant numbers of the tellin samples will show detectable PSP in ~~only~~ the viscera-free portion. It appears from the data on the 54% completed so far that the "meat" portion of the tellins will contain PSP levels less than the 80 µg/100 g level. The viscera portion of the tellins will frequently have PSP levels significantly over 80 µg/100 g.

The PSP potential must be recognized and dealt with before any commercial harvesting can proceed. The surf clam will likely be safe to use but should be tested routinely. A lot-by-lot monitoring program would be a reasonable approach to PSP testing.

The financial feasibility study indicates that a 108' prototype vessel equipped with twin 10' clam harvesters can expect to operate at a reasonable profit level. The study also indicates that vessels of this size could not operate at a reasonable profit if significantly smaller gear were employed. Furthermore, production rates in this study were obtained by experienced surf-clam fishermen who were continually "tuning" the harvester to variable substrate conditions encountered. Thus, as with

any new fishery, initial catch rates will probably be less than reported here until proficiency is perfected and knowledge of the grounds expanded.

Little can be concluded in this preliminary report of biological studies conducted as most samples have not been processed to date. A similar situation exists with Tetra Tech's environmental studies; however, their report will be concluded in the near future.

ACKNOWLEDGEMENTS

The cooperation by all participants was again excellent in 1978. Special thanks are extended to Pete Harris of New England Fish Company for his extra efforts in assisting Captain Roberts' preparation of the Sea Hawk for the cruise. Dale Dwight, superintendent of Peter Pan, Port Moller plant, was extremely helpful during the survey and assisted the joint venture in many ways. Captain Roberts and his crew on the Sea Hawk must be thanked for their 110% efforts which prevailed throughout the survey.