BERING SEA KING CRAB INVESTIGATION

CHARTER VESSEL CRUISE PLAN

1961

by

Staff, King Crab Investigations

U.S. Bureau of Commercial Fisheries

Seattle Biological Laboratory

CONTENTS

KING CRAB CHARTER VESSEL PLAN, 1961

INTRODUCTION

The charter vessel cruise of the king crab investigation during the summer of 1961 is supported by projects related to abundance, growth, hydrography, ecology, migration, and effect of fishing. The data needed and methods to be used are set forth by projects. This plan is intended principally as a guide for the personnel responsible for the conduct of the cruise, and it is not to be considered a complete summary of research objectives and programs.

Vessel: MV Paragon; Harry Jacobson, Master

Itinerary:

May 1 to May 15	Trip to Unalaska and Adak, Alaska
May 18 to July 6	High seas salmon sampling
July 8 to August 18	King crab station pattern survey
August 19 to August 29	Return to Seattle

The above dates are tentative and subject to changes as conditions may dictate.

Scientific Personnel:

Herbert H. Shippen, Fishery Research Biologist (Cruise Chief).

Henry M. Sakuda, Fishery Research Biologist

Alan H. Hazelwood, Oceanographer

Responsibilities:

1. A ship's log is to be maintained by the captain, showing time, place, duration, and results of all operations. When traveling he will keep details on times, courses, positions and any other pertinent information. When fishing he will complete the king crab fishing information form in carbon, as well as any other information pertinent to the particular haul.

2. The cruise chief (senior biologist aboard) has top authority and is responsible for carrying out the cruise plan, the timing of the operation and making certain that the government receives the services contracted.

3. The captain of the vessel is responsible for the operation of the vessel and safety of the ship and personnel. He will determine whether conditions will permit operations and his judgment in such matters is final.

4. The senior scientist aboard is responsible for reporting promptly the completion of each fifteen day charter interval by wire, so that the owner may be paid for work completed. In the event the days occur during which the vessel does not meet the terms of the charter, the beginning and ending dates and hours of each period during which payment should not be made must be submitted, and the cause for non-payment stated.

5. At intervals of a maximum of three days or as reception and transmission may permit, the senior scientist aboard shall report by wire or telephone to Tak Miyahara, Bureau of Commercial Fisheries, Biological Laboratory, 2725 Montlake Boulevard East, Seattle 2, Washington (Phone - EAst 5-4300). The report shall include position, progress and estimated position for the next day.

6. At the end of the cruise, the senior scientist shall prepare a brief written summary of his work. This should include the period covered, work attempted, accomplishments and suggestions for improvements.

OPERATIONAL PLAN

The proposed station pattern was chosen to include the majority of commercial-sized crabs in the eastern Bering Sea. The personnel aboard should keep in mind that the intent is to sample this stock as completely as possible and thus additional stations may be required. These additional stations should be extended outward at 20-mile intervals until none or very few commercial-sized male crabs are taken in the standard trawl effort (one hour). As a specific rule for determining the limits to the station pattern, it has been decided that stations will be continued outward until 5 or fewer commercial-sized (greater than 130 mm.) males are taken in the standard trawl effort at a minimum of two adjacent stations.

Additionally, in the northwest quadrant of the station pattern where relatively large numbers of male crabs are usually encountered, supplementary stations are to be taken equidistant between those of the 20-mile grid. These supplementary stations are to serve a dual purpose: (1) to more adequately define the limits of areas of abundance than is possible with stations 20 miles apart and (2) to provide large numbers of crabs for certain tagging experiments described below. A station in the 20-mile grid where 75 or more male crabs (irrespective of shell condition or size) are taken is deemed an area of abundance under (1), above. The number of these supplementary stations, like the extent of the station pattern, is to be considered flexible.

The examination of data from past years suggests that rather drastic changes in distribution may occur rapidly in the western half of the station pattern. In order to determine as nearly as possible the actual distribution of crabs, it is desirable that the western half of the station pattern be

sampled completely at the start of the field season while the eastern half of the pattern should be sampled afterward. Three stations in the western half, Z5, A5, and B5 are to be resampled at the end of the field season.

A chart showing the location of fishing stations (fig. 1) and a table listing their positions follow.

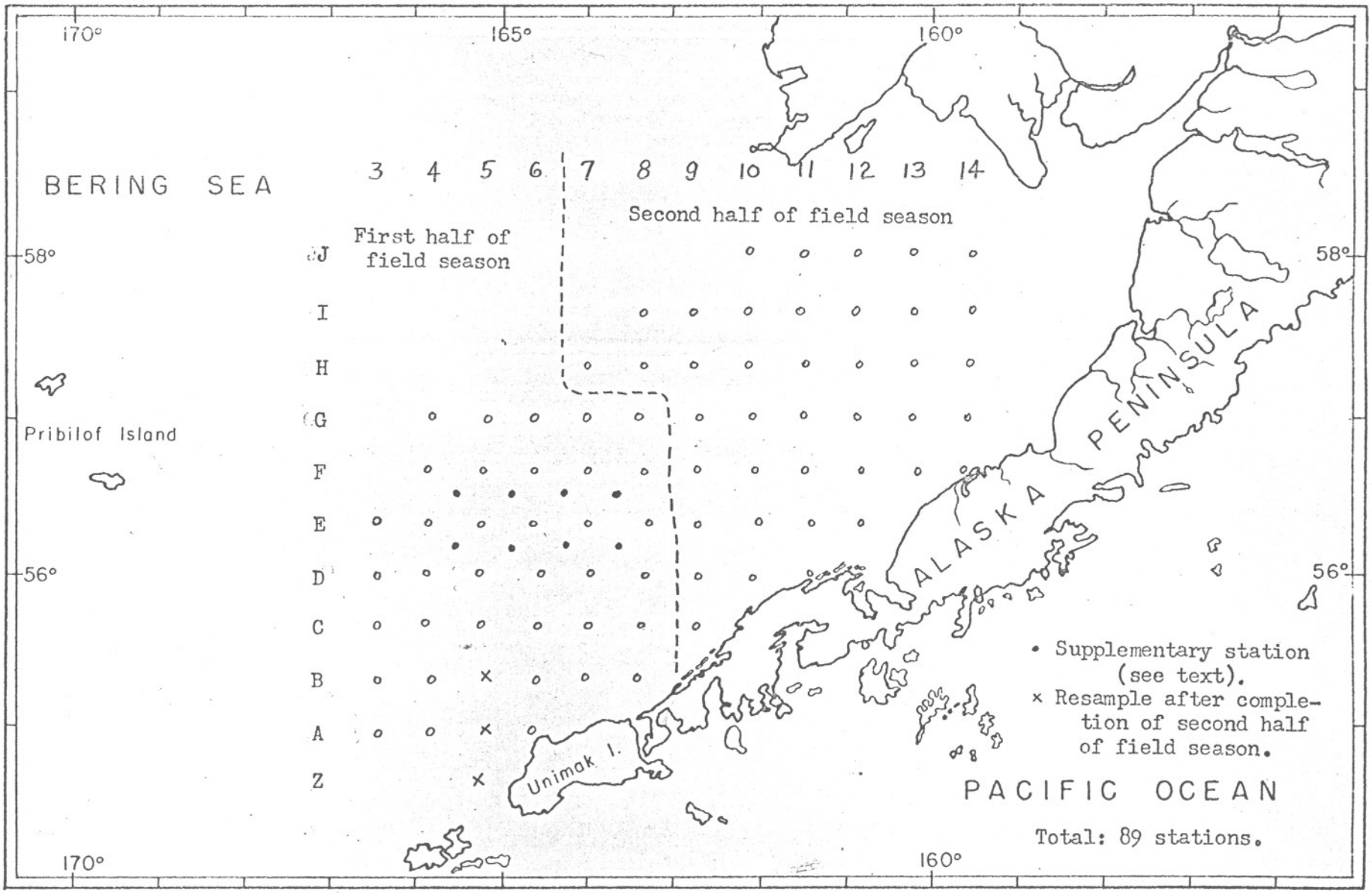


Figure 1.— Designated fishing stations for the 1961 King Crab Investigation charter cruise.

1961 CHARTER VESSEL FISHING STATION POSITIONS

Station	Latitude	Longitude
A-3	55°00' N	166°20' W
A-4	55 00	165 44
A-5	55 00	165 10
A-6	55 00	164 36
B-3	55 20	166 21
B-4	55 20	165 46
B-5	55 20	165 12
B-6	55 20	164 36
B-7	55 20	164 00
B-8	55 20	163 25
C-3	55 40	166 24
C-4	55 40	165 49
C-5	55 40	165 12
C-6	55 40	164 36
C-7	55 40	164 00
C-8	55 40	162 23
C-9	55 40	162 49
D-3	56 00	166 25
D-4	56 00	165 49
D-5	56 00	165 13
D-6	56 00	164 36
D-7	56 00	164 00
D-8	56 00	163 24
D-9	56 00	162 48
D-10	56 00	162 12
D-11	56 00	161 38
E-3	56 20	166 27
E-4	56 20	165 51
E-5	56 20	165 13
E-6	56 20	164 36
E-7	56 20	164 00
E-8	56 20	163 24
E-9	56 20	162 47
E-10	56 20	162 11
E-11	56 20	161 37
E-12	56 20	161 00
E-13	56 20	160 23
F-4	56 40	165 50
F-5	56 40	165 14
F-6	56 40	164 37
F-7	56 40	164 00
F-8	56 40	163 24
F-9	56 40	162 47
F-10	56 40	162 11
F-11	56 40	161 35
F-12	56 40	160 59
F-13	56 40	160 22
F-14	56 40	159 46
G-4	57 00	165 51
G-5	57 00	165 14
G-6	57 00	164 37
G-7	57 00' N	164 00' W
G-8	57 00	163 24
G-9	57 00	162 46
G-10	57 00	162 10
G-11	57 00	161 34
G-12	57 00	160 58
G-13	57 00	160 20
G-14	57 00	159 44
G-15	57 00	159 07
H-7	57 20	164 00
H-8	57 20	163 23
H-9	57 20	162 46
H-10	57 20	162 09
H-11	57 20	161 32
H-12	57 20	160 56
H-13	57 20	160 19
H-14	57 20	159 42
H-15	57 20	159 05
I-8	57 40	163 23
I-9	57 40	162 45
I-10	57 40	162 08
I-11	57 40	161 31
I-12	57 40	160 54
I-13	57 40	160 17
I-14	57 40	159 40
I-15	57 40	159 02
J-10	58 00	162 07
J-11	58 00	161 29
J-12	58 00	160 52
J-13	58 00	160 14
J-14	58 00	159 37
J-15	58 00	158 59
K-10	58 20	162 06
K-11	58 20	161 28
K-12	58 20	160 50
Z-5	54 40	165 10
Supplementary Stations		
DE 4.5	56 10	165 31
DE 5.5	56 10	164 55
DE 6.7	56 10	164 18
DE 7.5	56 10	163 42
EF 4.5	56 30	165 31
EF 5.5	56 30	164 55
EF 6.5	56 30	164 18
EF 7.5	56 30	163 42

GENERAL ROUTINE

The general routine to be followed during the station pattern survey is described below. Each project discussion should be read and understood.

1. Upon arrival at a station, the trawl with distance meter is set. Door spread floats are then set attached to the trawl doors by 60 fathom stainless steel wires. The captain should start filling out the fishing information form.

2. After sufficient time (10 minutes), to insure that the trawl is set properly, measure the distance between tow cables at the towing blocks on the stanchions and at a point six feet from the towing blocks. Measure also the angle to the floats with the sextant and the distance to each float with the rangefinder. Record all measurements.

Repeat the door spread floats measurements at the middle and near the end of the tow.

3. Upon recovering the trawl hydrographic observations will be made while the vessel is stopped. BT and Nansen bottle casts will be made at each station in accordance with accompanying plan.

4. The captain will estimate the total weight of the catch. The scientist will read the distance meters.

5. The king crabs will be sorted from the catch and stacked on their backs on the hatch cover.

6. All halibut will be measured (use salmon rack). When killed, otoliths will be taken and records of length, sex, and stomach contents kept. At least one sample of halibut less than 50 cm. should be collected, bagged and frozen each day. Tags may be used to identify the bags or isolated fish.

7. As outlined in the attached plan, crabs will be collected in the live tank for meat content studies and tagging experiments as necessary.

8. Molting or soft shell crabs are to be held in the live tank to observe hardening and growth.

9. Tagging will be undertaken at stations as outlined in the plans below. Data will be kept on date, position, station number, tag number, carapace length and width, sex and shell type. Tagging data sheets are provided.

10. Information on the incidental fish catch at each station will be collected and recorded as follows:

a. The captain will estimate the amounts of various fish species in each trawl sample by weight and number and record the data on the fishing information form, figure 2.

b. The scientific personnel with assistance from the fishermen will collect biological data on the fish in accordance with the detailed plans given below.

11. Information and specimens for the International Halibut Commission will be collected as prescribed below.

12. Invertebrate specimens taken from the trawl catches will be preserved as requested by staff members at the University of Washington and outlined in the accompanying plan.

Page No. _____

Date _____ Station _____ Tow No. _____

Position (Set) Lat. _____ Long. _____

Depth _____ Cable out _____

Net on Bottom _____ Begin Haul _____

Tow Direction _____ Wt. of Catch _____ lbs.

Dist. Meter Revol. _____ , _____

Wind Dir. & Vel. _____ Air Temp. _____

Barometer _____

Crab Catch _____ M _____ F

Crab Release Lat. _____ Long. _____

Underway _____ Course _____
(time)

REMARKS:

FISH WEIGHT EST. _____ LBS.

Species	Est. No.	Est. Wt.

GPO 992269

Figure 2.-- Fishing Information Form

RESEARCH PLANS

Abundance estimate from standardized trawling

General directions:

1. Take distance and door spread measurements on all trawl efforts.

2. The captain will record in the fishing information form the station number, date, depth, time when gear is first set on bottom, time when hauling begins, length of trawl cable out, number of king crabs caught and number of tagged, untagged and number of female crabs.

3. Scientists will measure the cable spread between the cable blocks and at a point 6 feet down the cable from the stanchion block. This data will be taken three times during each tow.

4. The door spread will be measured by towing a float from each door on a line about 60 fathoms long. The lines from the doors need not be exactly 60 fathoms, but must be exactly the same length. Assuming that the lines from the doors to the floats are parallel, the spread between the floats will equal the spread between the doors. This spread is to be calculated from the angle which they form with an observer on the stern of the vessel and the distance from the observer to a float. The angle is to be measured with a sextant and the distance with a range finder. Angular measures should be taken to the nearest second and linear measures to the nearest yard.

5. All measurements observed will be recorded.

Procedure for setting floats for trawl door spread measurement:

The following procedure has been found best for setting the floats for trawl door spread measurements:

1. Distance meter (roller) is secured to the purse line at the cod end of the trawl.

2. The trawl is set into the water.

3. The trawl is attached to the trawl doors and prepared to be lowered to the bottom.

4. The stainless steel float wire is clipped to a line (9 thread) that is secured through a hole at the upper forward end of the trawl door.

5. As the trawl door is slowly let out, the wire is also paid out of its winding drum.

6. The trawl door is lowered until the end of the 60 fathom wire is in sight on the winding drum.

7. Stop lowering the trawl doors at this depth, unclip the wire from the winding drum and clip on the floats. Hold on to the stainless steel wire securely, or it will be snapped overboard.

8. With both floats clipped on to their espective wires, resume lowering the trawl doors.

9. When the wires become taut, heave both floats away from both sides of the stern simultaneously.

10. The trawl doors may then be lowered to the bottom.

Procedure for recovery of floats after trawl door spread measurements:

The procedure for recovering the floats used to measure the trawl door spread is as follows:

1. As the trawl doors come up and are secured in place, the lines connecting the stainless steel wires to the trawl doors are retrieved.

2. Holding on to the wire securely, unclip it from the line and clip it on to the winding drum.

3. With both wires clipped to the winding drum, reel in the floats.

4. The trawl is not to be taken in until the floats are retrieved.

5. When the floats come in, unclip them from the wires and return to their place of storage until the next tow.

Preparation of equipment required for trawl door spread measurements:

1. Bore a hole at the upper-forward corner of the trawl doors to secure nine strand lines.

2. The nine strand lines to be about six fathoms long with a loop spliced on one end and a brass clip spliced onto the opposite end. Two lines are required.

3. The stainless steel float wire should be about 60 fathoms long for stations under 45 fathoms depth. For stations deeper than 45 fathoms an additional 30 fathom wire will be added to the 60 fathom line.

4. All stainless steel float wires will be prepared prior to the cruise with brass rings at both ends. Clips will be attached to all other parts such as floats, line from the door and securing clip on winding drum.

5. Secure a pair of brass clips on the winding drum to attach the stainless steel wires.

6. Brass clips will be attached to all floats.

The King Crab Investigation Experimental Otter Trawl for Sampling King Crabs (Paralithodes camtschatica, Tilesius) in the Eastern Bering Sea.

Net: The otter trawl, Eastern type, 400-mesh size, is constructed of medium laid cotton netting in the approved conventional manner, completely treated with copper naphthanate or copper oleate net preservative. All mesh sizes are stretched measure between knot centers.

Specifications

Net is constructed as follows:

Top Wings:	80 meshes long, 68 meshes wide tapered to 15 meshes wide on forward end, to be of 48-thread 4-$\frac{1}{4}$ inch netting.
Bottom Wings:	133 meshes long, 68 meshes wide tapered to 31 meshes wide on forward end, of 48-thread 4-$\frac{1}{4}$ inch netting.
Square:	45 meshes long, 272 meshes wide tapered to 207 meshes wide on after end, of 48-thread 4-$\frac{1}{4}$ inch netting.
Top Belly:	100 meshes long, 207 meshes wide tapered to 64 meshes wide on after end, to be of 48-thread 4-$\frac{1}{4}$ inch netting.
Bottom Belly:	100 meshes long, 207 meshes wide tapered to 64 meshes wide on after end, of 48-thread 4-$\frac{1}{4}$ inch netting. In sewing top and bottom belly to Intermediate, extra meshes on top and bottom belly are picked up at even intervals around the Intermediate.
Intermediate:	90 meshes deep, 114 meshes around of 72-thread 3$\frac{1}{2}$ inch netting. In sewing intermediate to Bag, extra meshes on intermediate are picked up at even intervals around the Bag.
Bag:	60 meshes deep, 100 meshes around of 96-thread 3$\frac{1}{2}$ inch netting, complete with 33 galvanized rings 2$\frac{1}{2}$ inches inside diameter by 5/16 inch, fastened to 18-thread manila line in the conventional manner.
Head Rope:	71 feet long plus eyes, of 3/8 inch galvanized 6x19 wire rope wrapped with 6-thread manila line.
Foot Rope:	94 feet long plus eyes, of $\frac{1}{2}$ inch galvanized 6x19 wire rope wrapped with 27-thread manila line.
Breast Lines:	7 feet long including eyes, of 3/8 inch galvanized 6x19 wire rope wrapped with 6-thread manila line.

Rib Lines: 8 each Bag, of 27-thread manila line installed in the conventional manner, one along each seam and one along the top and bottom center, and one from the corners of each bosom on top and bottom running diagonally to join the side rib lines. All rib lines are soaked in water at least 24 hours and then run before hanging.

Wing Extensions: 40 - 42 feet long, 46 meshes wide tapered slightly to fit the width of the after trawl door chains.

Wing Extension Rope: 40-42 feet long plus eyes, of 3/8 inch galvanized 6x19 wire rope wrapped with 6-thread manila line.

Cod End Liner: Last six feet, inside of cod-end lined with 1½ inch mesh netting.

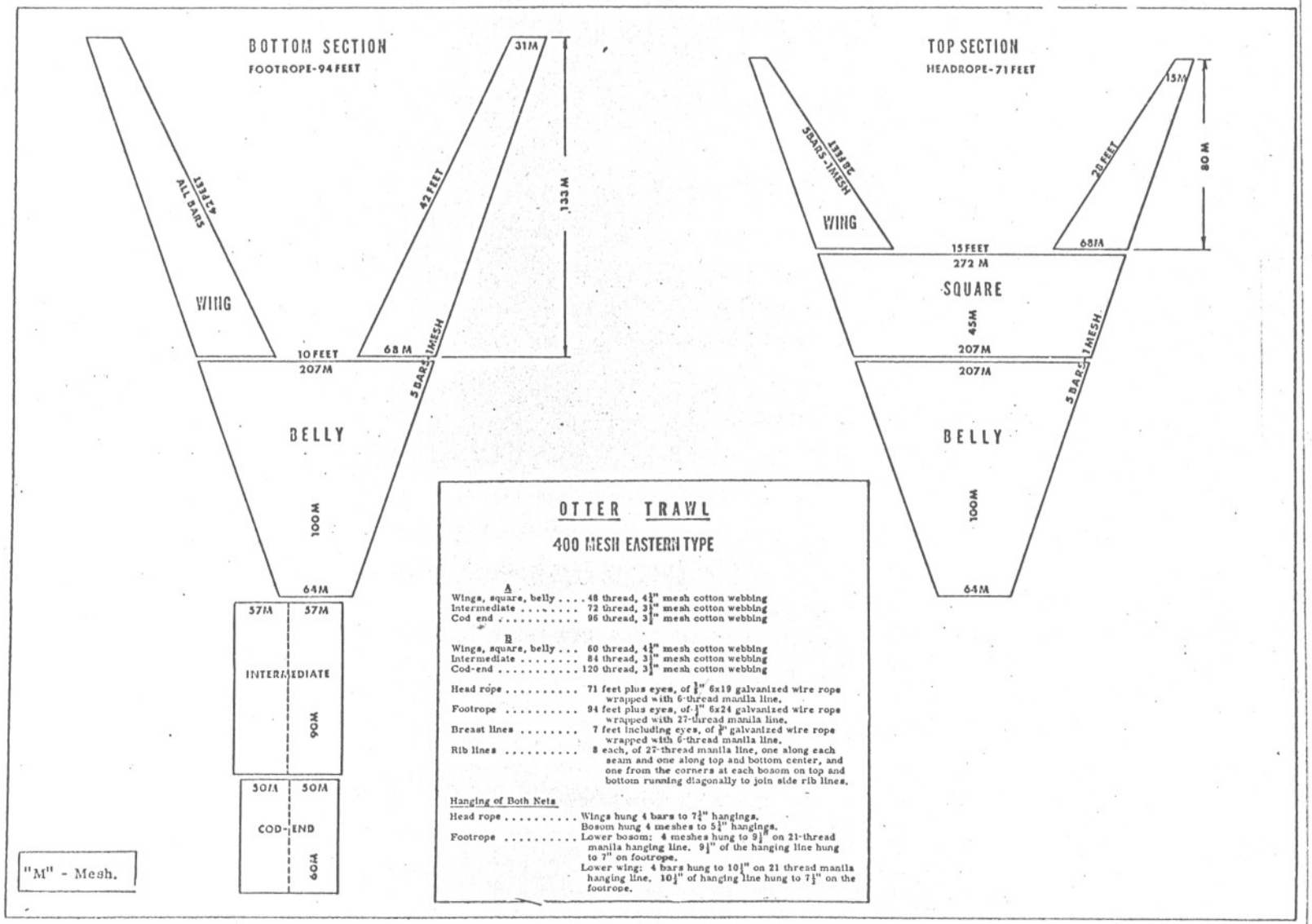
Chafing Gear: Of manila material, attached to the bottom of the cod-end to prevent wear to the bag.

Trawl Floats: 8 inches diameter, NoKalon plastic trawl floats, secured along head rope, 8-9 floats or as captain feels sufficient for proper fishing.

C-Hook w/ Link: Secured to After trawl door chains with 5/8 inch shackles.

Flat Link w/ Link: Secured to Wing extension ropes with 5/8 inch shackles.

Idler Cables: To be secured to Links on wing extension ropes and swivel link on trawl cable with 5/8 inch shackles.



OTTER TRAWL

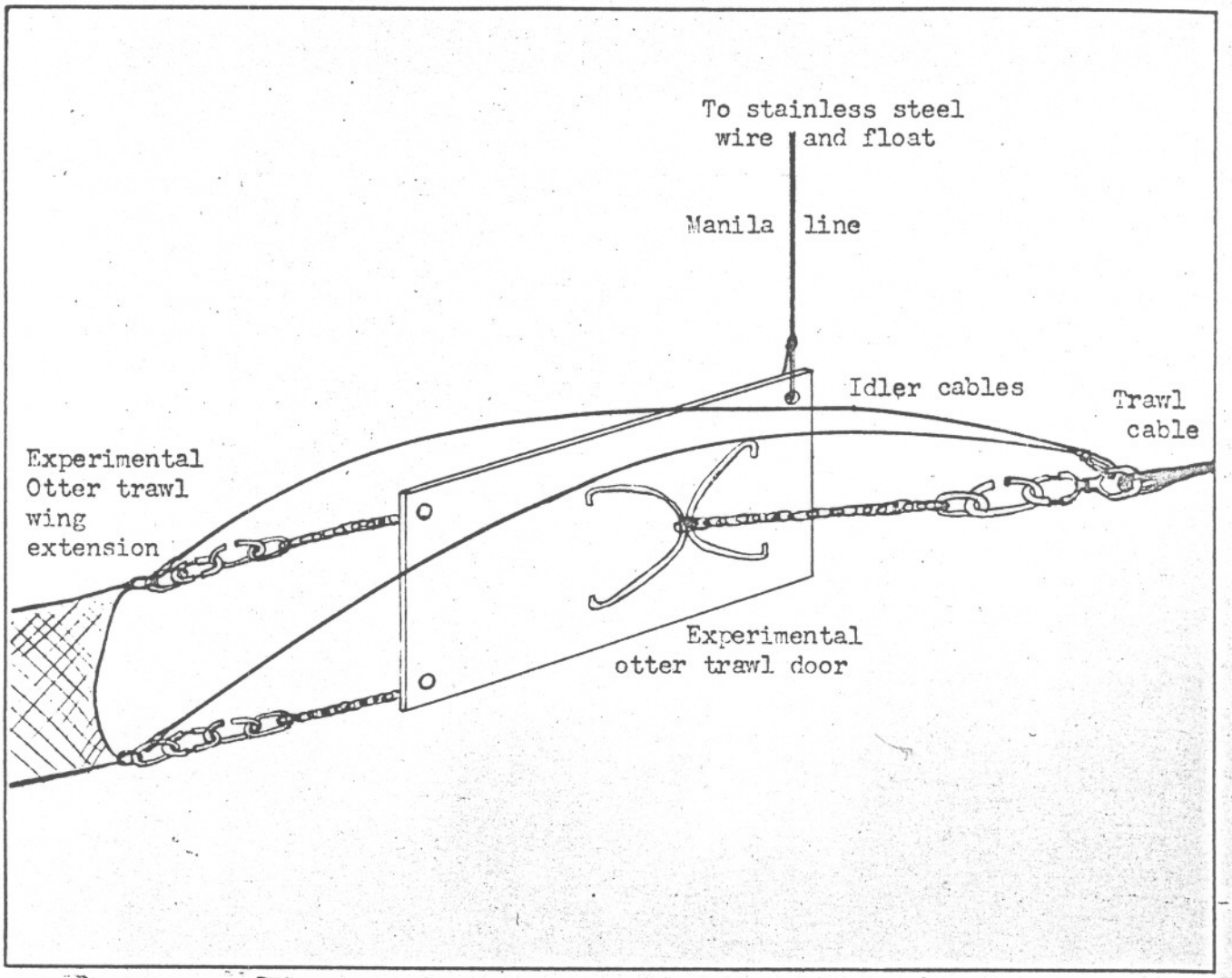
400 MESH EASTERN TYPE

A	
Wings, square, belly	48 thread, $4\frac{1}{2}$" mesh cotton webbing
Intermediate	72 thread, $3\frac{1}{2}$" mesh cotton webbing
Cod end	96 thread, $3\frac{1}{2}$" mesh cotton webbing
B	
Wings, square, belly	60 thread, $4\frac{1}{2}$" mesh cotton webbing
Intermediate	84 thread, $3\frac{1}{2}$" mesh cotton webbing
Cod-end	120 thread, $3\frac{1}{2}$" mesh cotton webbing
Head rope	71 feet plus eyes, of $\frac{3}{4}$" 6x19 galvanized wire rope wrapped with 6-thread manila line.
Footrope	94 feet plus eyes, of $\frac{1}{2}$" 6x24 galvanized wire rope wrapped with 27-thread manila line.
Breast lines	7 feet including eyes, of $\frac{3}{8}$" galvanized wire rope wrapped with 6-thread manila line.
Rib lines	8 each, of 27-thread manila line, one along each seam and one along top and bottom center, and one from the corners at each bosom on top and bottom running diagonally to join side rib lines.

Hanging of Both Nets

Head rope	Wings hung 4 bars to $7\frac{1}{2}$" hangings. Bosom hung 4 meshes to $5\frac{1}{2}$" hangings.
Footrope	Lower bosom: 4 meshes hung to $9\frac{1}{2}$" on 21-thread manila hanging line. $9\frac{1}{2}$" of the hanging line hung to 7" on footrope. Lower wing: 4 bars hung to $10\frac{1}{2}$" on 21 thread manila hanging line. $10\frac{1}{2}$" of hanging line hung to $7\frac{1}{2}$" on the footrope.

Details of a standard 400-mesh eastern-type otter trawl used for bottom-fish explorations off Southeastern Alaska.



Schematic diagram for the door assembly of the King Crab Investigation's experimental otter trawl.

Oceanographic observations

I. General procdure.

A. Oceanographic data will be collected at all stations.

B. An oceanographic station will consist of the following samples:

1. A bathythermograph lowering (use 450' BT for depths to 137 meters and the 900' BT for depths between 137 and 275 meters). DO NOT LOWER BT MORE THAN THE LOWER LIMIT GIVEN ABOVE.

2. Water bottle samples at depths depending upon depth (see table included). Surface sample to be taken with bucket and thermometer; the deepest (near bottom) bottle is to be between one and two meters above the bottom. DO NOT PLACE BOTTLE SO CLOSE TO BOTTOM THAT IT STRIKES BOTTOM UPON REVERSAL.

3. A cast will consist of the BT at the bottom of the hydro line, and Nansen bottles at depths of 0, 15, 30, 50, and 80 meters.

C. A BT cast will be made at mid-distance between stations when oceanographer aboard deems it necessary.

II. Notes and Precautions in the use of oceanographic equipment.

A. Bathythermograph:

1. Do not use 450' BT at depths greater than 75 fathoms (137 meters) or 150 fathoms (274 meters) for the 900' BT.

2. Before using a slide for the BT, write name of boat to see how easy it marks. If slide won't mark with soft pencil, don't use unless necessary.

3. Be sure to push the slide into its holder as far as possible when placing into BT.

4. When BT is again aboard, check slide for trace. If slide shows np tracing retake the cast.

B. Water Bottle Casts:

1. After attachment of bottles to line, check to be sure the mercury at top of main thermometer has drained.

2. Check to be sure the stop cocks of the bottle have been closed before lowering.

3. Attach messenger to bottle so bottles below will be tripped.

4. After bottles reach depth, allow to soak 10 minutes before tripping.

5. After bottles are back aboard, draw salinity samples before reading temperature so that thermometers can reach equilibrium.

6. Upon completing the drawing of salinity and reading the thermometers, turn the bottles rupright so mercury can be rejoined. THERMOMETERS WILL BE RUINED OR WILL BECOME INACCURATE BY LEAVING THEM IN A REVERSED POSITION ANY LONGER THAN NECESSARY.

Distribution of the King Crab Stock

Objective:

To determine the general distribution of the southeastern Bering Sea king crab stock with respect to abundance, shell condition, sex, and size during the period covered by the 1961 cruise.

Procedure:

1. At all stations measure all king crabs caught in the standard fishing effort for carapace length and width. Record sex, shell condition and state of maturity if evident.
2. Enter all data on standard forms.

Tagging for Migration, Abundance, and Mortality Studies

Procedure:

1. Except as necessary for meat content and juvenile growth studies, male king crabs will be tagged and released on all fishing stations.
2. Tagging procedure will be as follows:

   A tagging line will be set up in the following order:

   a. Crew member attaching spaghetti tags to tagging needle in tag number sequence.
   b. Crew member or biologist tagging the king crabs.
   c. Biologist measuring carapace length and width and calling tag number, sex and shell type.
   d. Biologist or crew member recording the carapace measurements, sex, tag number, and shell type.
   e. Crew member typing the loose ends of the tags and releasing the crabs.

Materials:

The equipment to be used in the tagging operation will be the following:

1. Spaghetti-type tags, Series E-0000 to E-5000.
2. Tagging needles.
3. Tagging information sheets (forms).

Growth of Juvenile Crabs

Objective:

To determine the growth rate of juvenile king crabs through analysis of size frequency distribution data.

Methods:

Analysis of size frequency distribution data requires adjustment by the molting phase of the individuals comprising the modes. Classification of the molting phase is best done in the laboratory.

Retain a sample of approximately 100-200 crabs of either sex less than 70 mm. in carapace length. Do not retain samples of isolated individuals, but retain samples where 10 or more crabs are taken in a single haul.

Procedure:

Bag and freeze crabs. Bags are to be labeled and a record kept of the date and position of capture.

Evaluation of the Effectiveness of Tagging

Objective:

To ascertain the degree to which the return of tagged male crabs is affected by the sloughing of tags and by mortality resulting from the operation of tagging through the isthmus.

Procedure:

1. The crabs used in this study will be obtained from the supplementary stations (see Operational Plan).
2. Tagging procedure will be similar to that described in the section on Tagging for Migration, Abundance, and Mortality Studies except

that all crabs will be tagged with a spaghetti-type tag through the posterior margin of the carapace, and every other one (in addition to the carapace tag) will have a second tag through the isthmus.

3. The spaghetti tag through the carapace should be well secured by drawing the knot closely against the posterior margin.

4. In order to expect a significantly large return it is estimated that a total of 2000 male crabs should be released in this experiment.

5. The male crabs tagged and released should be of a size greater than 135 mm. carapace length if new shell and greater than 150 mm. carapace length if old shell.

Materials:

1. Spaghetti-type tags, Series D-4000 through D-7999.
2. Tagging needles.
3. Tagging forms.
4. Carapace punch.

Meat Content Studies

Objective:

To determine the meat content of male king crabs for various sizes and shell conditions.

Procedures:

Meat content sampling will include meat extraction in the field and freezing of live specimens for later study in the laboratory.

1. Field sampling:

   a. Collect samples 2-3 days prior to returning to port and retain in live tank for processing ashore.

   b. Approximately 25 crabs are to be processed at each of the two anticipated returns to Unalaska.

   c. Individuals should be selected so that at the completion of the field season there is a series of approximately 25 males

of each shell type, new and old, representating the range between 100 and 200 mm. carapace length.

d. Techniques of data processing and collection are described below.

2. Frozen samples:

a. Samples will be collected, placed in cotton bags, labeled and frozen.

b. It is desirable that a minimum of 5 individuals, preferably 10, be obtained from each 10 mm. size group and shell condition, new and old, throughout the entire size range encountered.

Techniques of Data Collection:

1. Live weight measurement:

a. Pull crab out on its side to drain excess water
b. Immediately weigh crab on its back to reduce excessive water loss and standardize weighing
c. Record live weight in data book
d. Shell type, lenghth, width, crab number, and date

2. Cooking crabs:

a. Boil crabs for 30 minutes, starting with water already at boiling.

3. Cooling crabs:

a. Cool crab in running water for 10 minutes.

4. Picking and weighing meat:

a. Place the picked meat in the strainer until all meat has been picked.
b. Wash off excess non-meat particles by shaking the strainer in the pot of sea water.
c. Weight all meat on Chatillon Autopsy scale and record weight in pounds and to the tenth of an ounce.

5. Freezing: Cotton bags will be available for individual bagging of crabs.

Equipment:

1. Data collection:

a. Meat content data book
b. Calipers
c. Cotton bags

2. Crab preparation:

   a. String to tie leg sections together
   b. A pot to cook crabs
   c. Coleman three-burner stove
   d. Shears for picking meat
   e. Strainer for washing picked meat

3. Weighing crab meat:

   a. Chatillon Autopsy scale, for live and total meat weights to the nearest tenth of an ounce

4. Crab holding:

   a. Live tank - for vessel

Study of the Southeastern Bering Sea Ground and Demersal Fish Stocks

I. Background and objectives

The king crab survey of the southeastern Bering Sea provides an incidental sample of the ground and demersal fish stock of the area. Knowledge of the biology, abundance, and distribution of these species is important since in recent years they have become the object of intensive exploitation by Japanese and Russian mothership expeditions.

II. Commercial Species Considered

A. Ground fish*

Yellowfin sole	Limanda aspera
Rock sole	Lepidopsetta bilineata
Lemon sole	Pleuronectes quadrituberealatus
Turbot	Atherestes stomias
Flathead sole	Hippoglossoides elassodon and H. Robustus
Starry flounder	Platichthys stellatus

* Halibut, Hippoglossus stenolepis, is not considered in this study since information pertaining to this species is already being supplied to the International Halibut Commission.

B. Demersal fish

Cod	Gadus macrocephalus
Pollock	Theragra chalcogramma
Hake	Merluccius productus

C. Species Identification

Most of the commercial species found in the eastern Bering Sea easily identified. Of those under consideration in this survey only rock sole, pollock, hake and the two species of flathead sole may cause difficulty. The following characteristics will separate out the above species from any others likely to be encountered.

1. Rock sole Lepidopsetta bilineata:

   Rough scales on eyed side of body; lateral line with a distinct arch.

2. Flathead sole:

   a. Hippoglossoides elassodon

      15-19 gill rakers on lower arch (probably most common of the 2 species).

   b. Hippoglossoides robustus

      10-13 gill rakers on lower arch

3. Pollock or whiting Theragra chalcogramma:

   3 dorsal fins; 2 anal fins

4. Hake Merluccius productus:

   2 dorsal fins; 1 anal fin

III. Methods

A. Sampling area and position

Previous surveys of the southeastern Bering Sea indicate that the various species of ground and demersal fish are not

distributed randomly throughout the area. The distribution of the more abundant species encountered in 1958 is shown in figure . Efforts to obtain samples of a particular species should be made in the appropriate area, since it is less likely to occur in numbers outside the area. On the other hand, it is desirable to sample a widely distributed species, such as yellowfin sole, at two or three well-spaced stations.

B. Sampling procedure

1. Abundance and distribution. The basic data to be collected for each haul consists of the following:
   a. Depth, date, and position of station
   b. Area covered by trawl
   c. Estimate of number and weight by predominant species in catch (Estimates to be made by vessel captain).
   d. Temperature and salinity observations
   e. Type of bottom (to be determined from refuse in trawl)
   f. The presence and approximate numbers of minor fish species will be noted by scientific personnel.
2. Sampling for age and growth rates. In samples collected for the study of age and growth it is desirable to examine from each sex within each species approximately 5 individuals from each 1 or 2 centimeter length group (depending upon the range of sizes to be sampled). Conditions aboard the vessel may well prove to be unsatisfactory for the collection of all the data necessary, and personnel should be prepared to freeze and bag samples for processing at the laboratory. The following data on each individual should be collected:

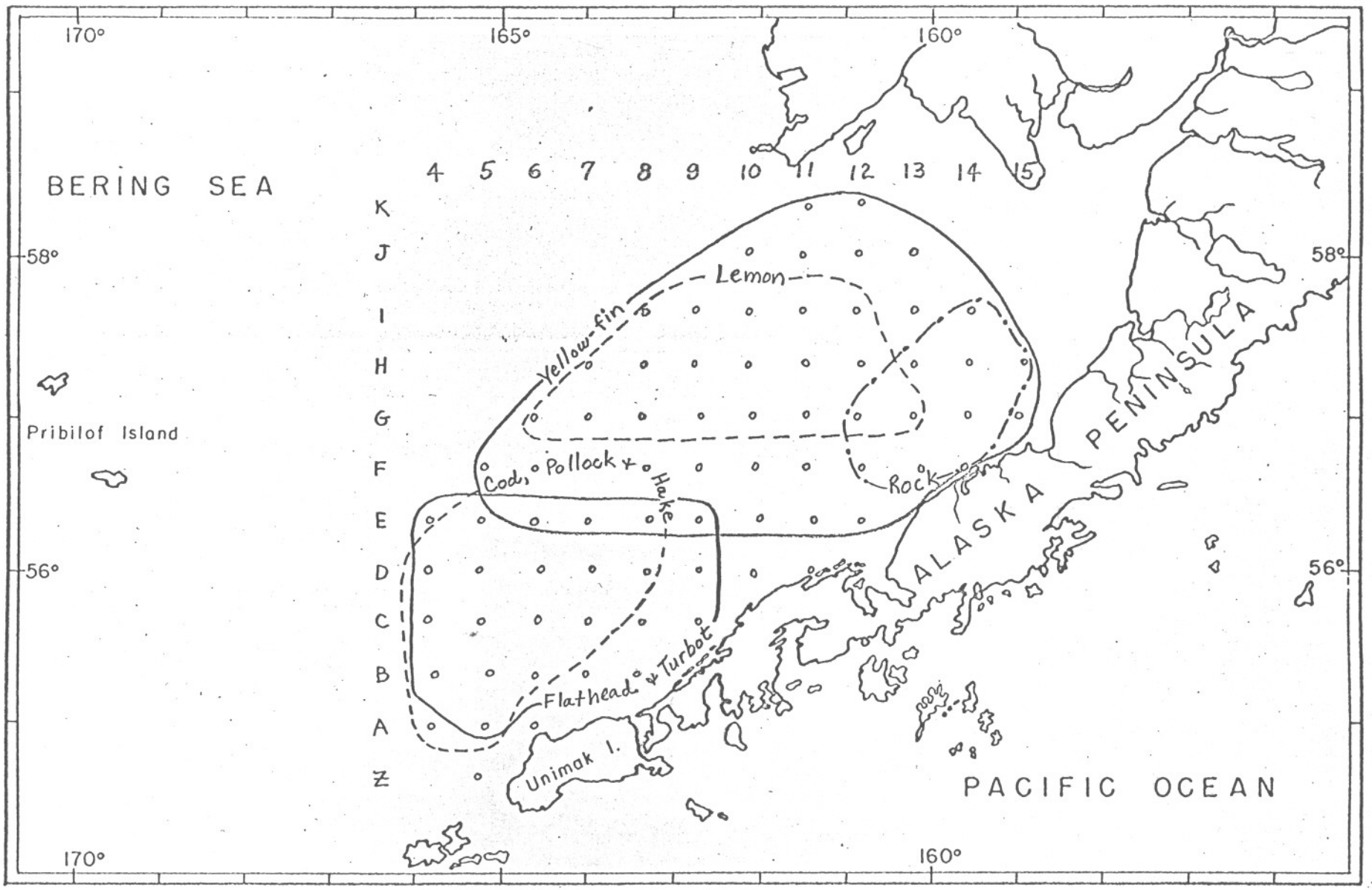


Figure 3.-- General Areas of fish distribution as determined from 1958 data.

= hake!

a. Total length (to nearest mm.)

b. Sex

c. Weight

d. Age (to be determined from otoliths or other appropriate structure)

3. Sampling for length frequency distribution. For each species and sex a random sample of length frequency data (with corresponding weights) should be collected. As with the sampling for age and growth it may be necessary to freeze and bag the samples for laboratory study.

IV. Materials required

500 coin envelopes for otoliths

1 Produce scale

50 burlap sacks (50# potato)

1 measuring board

2 notebooks for recording data

200 cattle ear tags and pliers for identifying sacks and individual fish

V. Remarks

This plan is subordinate to the king crab projects and should not be allowed to detract from their pursuit. It is entirely possible that the time available for the study of the fish catches will be quite limited so that relatively little information can be collected. If such is the case it is recommended that sampling be concentrated on the following species:

Yellowfin sole

Rock sole

Lemon sole

It is more advisable to obtain relatively complete information about fewer species than to collect insufficient data on several.

Bottom Invertebrate Sampling

At the request of Dr. Paul Illg of the University of Washington we have agreed to collect the invertebrate species listed below when they are taken in the trawl. Specimens should be bagged, labeled with date and position of the station, and frozen.

1. The large barnacle, Balanus evermanni, previously taken at Z5, E6, E7, and F5.
2. Hermit crabs, particularly from Z5 and deep water stations.
3. Sea cucumbers, particularly Psolus. This animal is egg shaped, drab brown to orange in color, with numerous dorsal plates and a broad flat ventral foot. Length, 1 to 4 inches.
4. Sea pens and ships. Collect as many as convenient.
5. Echiuroids. Collect all taken. White or olive green, sausage shaped, often with one or two rows of posterior spines. Length ½ to 6 inches.
6. Mollusks. Collect all taken except Nudibranchiata.
7. Tunicates. Collect all except Boltenia ovifera (onions).

Information for the International Halibut Commission

Halibut are caught in the otter trawl during the surveys of the king crab investigation in the eastern Bering Sea. Since they are available their collection, which is very desirable to the International Halibut Commission and does not hamper the primary operation, will be undertaken by the members aboard the 1961 cruise.

Objective:

The following are the purposes in the collection of the data:

1. Estimate of the halibut catch per unit effort.
2. Estimate of the proportion of sub-commercial sized fish in the halibut catch (those less than 66 centimeters in length).
3. Estimate of the age composition in the halibut catch.

Method:

The method for collection is as follows:

1. Data will be collected on halibut on all fishing stations.
2. All halibut caught will be either measured and released or bagged and frozen for later examination. Data will be kept on these in the Halibut data collection form.
3. Those killed will be sexed, measured and otoliths taken. Envelopes will be provided for otoliths.

Procedure:

1. Measurements will be made in millimeters with the salmon measuring rack and recorded in Halibut data collection form.
2. Bags of halibut will be tagged and tag numbers recorded with dates, and stations.
3. The captain will fill the Halibut data collection form which includes numbers of halibut frozen, halibut measurements, numbers measured and released, and number of halibut killed, as well as date, station and position.

4. At least one sample of halibut less than 50 cm. should be frozen each day.

HALIBUT DATA COLLECTION FORM

Date _____ Station No. _____ Tow No. _____ Depth _____

Position _____

Catch: Total _____ Preserved _____ Released _____

Halibut Lengths (mm.)

1	16	31
2	17	32
3	18	33
4	19	34
5	20	35
6	21	36
7	22	37
8	23	38
9	24	39
10	25	40
11	26	41
12	27	42
13	28	43
14	29	44
15	30	45

Remarks: _____

Charter Vessel Safety Precautions

This is to emphasize again the need for observing and carrying out safety precautions while conducting research in the field. We are all aware of the hazards that are present on seagoing vessels and therefore should strive to be alert and safety conscious at all times.

You have been informed periodically on the detailed safety policy of the Service. However, because of the increase in duties and its consequent increase in machinery, etc., aboard these vessels, you should be extra careful in the performance of your duties. A detailed rule of safety is not possible as each vessel differs in its construction and operation. In any event, the captain should be consulted for safety rules and precautions pertinent to the vessel. The following general precautions, however, should be observed and carried out.

1. Discuss and go over again with the captain the "Safety" section in the charter bid. It is the duty of the captain to instruct all personnel on emergency procedures and maintain emergency equipment in good working order. Each person shall be assigned a Coast Guard inspected and approved life jacket which is to be kept in an accessible place. Upon commencement of the charter period a life boat drill shall be carried out during which the boats are lowered in the water and manned. At this time all life boat equipment will be checked and personnel instructed in proper operation and use of the equipment. Additional drills shall be held after any changes in personnel or modifications to the boats or handling equipment, and at any other time deemed advisable. The life rafts should be inflated and inspected for leaks. Distress flares are to be tested by actually firing one of each type or lot number.

2. Performance of hazardous work, not related to his duties, should be left to the more experienced crew members. See also paragraph 3 of "Vessel Equipment and Personnel" in charter bid.

3. No firearms will be permitted on board the vessel during the charter period without permission of the Laboratory Director.

4. The engine room is a potential danger to anyone not familiar with such spaces. The owner is responsible for the satisfactory operation of all machinery and scientific personnel shall keep out of the engine room and well clear of vessel equipment maintained by the crew.

5. Never exceed the manufacturer's specifications on winches, motors, gear or other equipment.

6. Do not attempt to perform work alone on deck without knowledge of others. Be sure that the wheel-watch is informed, or that another person is nearby or is aware of your situation. At night be sure that a deck light is turned on before going on deck.

7. Insure that a periodic check is made by vessel personnel to see that all items are fastened or lashed securely.

8. Any hazard, or potential hazard, should be pointed out to the captain so that safety precautions may be carried out immediately. If the hazard is unavoidably one of recurrent nature, be sure that everyone aboard is informed and thereby aware of the situation.

9. Any pertinent information which will lead to accident prevention should be exchanged between vessels.

10. Report additional precautions that should be incorporated in this list.

The following are some of the accidents which have occurred, and a few of the many danger spots or conditions which may exist aboard our charter vessels.

1. A scientist injured the tip of his index finger on an exposed "U" clamp during the hauling of a BT. Injury was such that the captain decided to go into port for proper medical care to prevent infection. Result - loss of two operational days.

2. A scientist received lacerations and a large bump on his head when the heavy hook of an unattended single block and tackle struck him on the head with sufficient force to knock him to the deck. Result - his efficiency was cut down for several days.

3. A scientist nearly had his finger badly injured or torn off during gill net setting operations when he attempted to pull loose a lead line which became wedged between a pipe and the pilot house. There was sufficient strain on the outgoing nets to have caused severe injury, but luckily he was able to jerk his enmeshed finger out in time.

4. There were numerous occasions when someone has slipped on deck or in the companionway. This usually happens when a person, having spent some time on board, becomes lax or careless.

5. The loose-hanging shirt of an engineer aboard a charter vessel was caught in the belt of an auxiliary engine. He was knocked about severely but it resulted, luckily, only in painful lacerations all over his body. This shows that even an engineer, in his own element, will occasionally be involved in an accident in the engine room.

6. Firearms are occasionally carried aboard these vessels either by crew members or by scientific personnel. Most everyone is very careful when handling firearms. However, an unfortunate incident occurred when a scientist failed to check and clear his rifle while on deck. This person, upon retiring to this cabin, pulled the trigger of his rifle without any thought. The bullet, from the round which was still in the chamber, went through the headboard of a bunk, passed over a row of batteries, and lodged itself in one of the heavy beams. It was very fortunate indeed that the bullet did not richochet, nor hit the engineer who happened to be nearby, nor hit the batteries. The skipper, upon being informed of this accident, severely reprimanded the person. An accident of this nature should never have happed, but it did!

7. A scientists was accidentally locked in the ship's freezer when the door (with a snap-lock) slammed shut with the pitch of the vessel. He was able to get out an hour later only when a crew member, by chance, happened to go down to the freezer for some frozen food. The type of freezer and the type of door lock aboard our charter vessels this year prevents recurrence of this type of accident. However, all personnel should make certain that others are informed at all times of his (their) presence in the freezer.

8. In the past a potentially dangerous condition existed near the winches during hydrographic observations. When the free-falling method was used for lowering the wire, there was a tendency for the wire to slack and occasionally form a loop on the deck, then suddenly snap taut when the vessel surged. Accidents caused by this situation may be very serious. The winch operator should be alerted therefore, to prevent any slacking of wire.

In general, the skippers and crew members of all the charter vessels are safety conscious and will point out the many dangers which we may not be aware of, or tend to overlook, such as not standing in the bight of a line, etc. However, it is also our responsibility to be prepared for and be aware of most of the hazards which we may encounter aboard the charter vessels. To reiterate, accident prevention is an inherent responsibility of each individual, so be alert, and seek out and correct any unsafe condition.

Special SAFETY precautions for vessels using Trawl Gear

1. All scientific personnel shall acquaint themselves with the operations of the trawl during preparation for a cruise. The captain should be consulted at any time if there occurs any doubt of vessel or personnel safety regarding the trawl.

2. The crew shall handle all trawl and trawl door and winch operations.

3. All blocks or whatever is used, through which trawl cables are led shall have a safety device. In the event the block stem should break, the device should be able to hold the pressure of the trawl cables.

   Example: When the swivel of a trawl cable block on the rail of a vessel broke, a safety chain through the block saved the lives of three men working in the bight of the trawl cable.

4. All personnel will be especially careful with the trawl cables and alert during instances in the bight of the trawl cables. If possible, stay out of the bight.

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