4K92-31

PROJECT OPERATIONAL PLAN FOR THE 1991 BRISTOL BAY RED KING CRAB TEST FISHERY PROJECT

By

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and
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ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

PROJECT OPERATIONAL PLAN

Title:	Bristol Bay Red King Crab Test Fishery Project	
Yellow Book Project No(s):	TF-960	
Project Leader:	Leslie J. Watson	**PCN:** *11-1857*
Biometrician:	Douglas Pengilly	**PCN:** *11-1227*
Date Submitted:	October 3, 1991	
Region:	Westward	
Fishery Unit:	Bering Sea/Aleutians Crab	
Fishery:	Bristol Bay Red King Crab	
Fishery Management Plan:	Fishery Management Plan for the Commercial King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands	
File Name:	G:\bbpop91	

APPROVALS

Level	Signature	Date
Project Leader:	_____	_____
Biometrician:	_____	_____
Research Supervisor:	_____	_____
Regional Supervisor:	_____	_____
Headquarter's Receipt:	_____	_____
Headquarter's Recommendation:		
Further Review:	_____	_____
Approval:	_____	_____

Note: Other approvals, such as Biometric Supervisor and Fisheries Manager, may be added at the discretion of the Regional Supervisor.

FOREWORD

This project is a continuation of a study initiated in 1990 and documented in Regional Information Report 4K91-21, A Pilot Mark-Recapture Study Using External Tags and Implantable Passive Integrated Transponder (PIT) Tags on Red King Crab in Bristol Bay, Alaska, completed in October, 1991. The total budget ($661,800) for the Westward shellfish test fishery project TF-960 is described in the FY 92 yellow book (Appendix A). The TF-960 budget covers both the Bristol Bay project and the Adak Brown (Golden) King Crab Test Fishery project (described in a separate POP; RIR 4K92-29). The Bristol Bay survey will conduct a cost recovery program to fund both projects.

INTRODUCTION

An intensive mark-recapture project utilizing non-visible, injected tags (Passive Integrated Transponder or PIT tags) in conjunction with external tags (Floy tags) was initiated by the Alaska Department of Fish and Game (ADF&G) in 1990 on legal and pre-recruit male red king crabs, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. The primary objectives of the study were to determine the feasibility of using PIT tags in a large-scale, commercial crab fishery application and to improve the accuracy of the estimated exploitation rate of legal male red king crab in Bristol Bay during the summer of 1990 through tag recovery analysis. Secondary objectives included collection of biological data such as lengths, shell condition, and fecundity. Data gathered from the 1991 tagging survey will be used to refine annual population estimates from trawl survey data and to provide information on natural mortality, growth, migration, and the effects of fishing mortality on the Bristol Bay red king crab population.

The Bristol Bay red king crab fishery has historically been one of Alaska's most valuable shellfish fisheries, with a record landed catch in 1980 of 129.9 million pounds (58.9 million tonnes) worth an estimated 117 million dollars ex-vessel (ADF&G 1990). The abundance of Bristol Bay red king crab has been assessed annually since 1969 from trawl surveys conducted in the eastern Bering Sea by the National Marine Fisheries Service (Stevens and MacIntosh 1990). Over the course of the fishery and its assessment, many unanswered questions concerning stock status and the dynamics of the Bristol Bay red king crab population have arisen. For example, trawl surveys in recent years have shown major differences in legal population numbers while the catch-per-unit-effort (CPUE) from the fishery has been relatively constant. Low precision and unknown biases in the trawl survey may be contributing factors in this apparent discrepancy. Ultimately, disruption of industry planning (based on pre-season stock assessments) results when adjustments to the guideline harvest level are precipitated by in-season fisheries performance.

To-date, attempts to address these questions through supplemental tagging efforts by NMFS has yielded little additional information due to insufficient and inconsistent tag returns (R.S. Otto, National Marine Fisheries Service, Kodiak, personal communication). Further, tagging studies conducted on Kodiak Island red king crab populations during the early 1980s were compromised by a high degree of non-cooperation from fishermen in returning externally-marked crabs, which also resulted in deficiencies in collected tag data (ADF&G 1982). High loss rates of Floy-tagged juvenile red king crab in the Kodiak area suggests at-sea tag losses may be a significant factor in the rate of visible tags recovered from the fishery (B. Dew, National Marine Fisheries Service, Kodiak, personal communications). The need for a tagging program capable of providing tag returns unbiased by factors associated with visible tags is clearly evident.

Implantable tags have been field-tested in several commercially-important crustaceans. The use of injected ferromagnetic or coded-wire tags in the snow crab, *Chionoecetes opilio* by Bailey and Dufour (1987) and the spot prawn, *Pandalus platyceros* by Prentice and Rensel (1977) have been tested with some success. Preliminary testing of PIT tags on small numbers of several other crustaceans, the dungeness crab, *Cancer magister* (Prentice 1986) and red king crab (W.E. Donaldson, Alaska Department of Fish and Game, Kodiak, personal communication) indicated that these tags were retained through molting and could be detected without sacrificing the tagged animal. Results from the 1990 red king crab tagging project demonstrated that PIT tags were retained in crabs at a high level (95.2%) and were durable and recoverable over the 90 day length of the project (Watson, et. al. 1991). This POP describes proposed testing and implementation of a tagging study using both traditional external tags and advanced PIT tag technologies with red king crabs on a large scale, in situ study.

OBJECTIVES

1. Conduct a cost recovery program by catching and selling red king crab from the Bristol Bay area to fund the TF-960 project in the amount of $661,800.

2. Determine an estimate of the minimum harvest rate for red king crabs inhabiting the Bristol Bay study area during the 1991 November commercial fishery using external (Floy) tag returns.

3. Determine if present-day PIT tag technologies can be used to reliably estimate the harvest rates on red king crabs in the Bristol Bay study area.

    a. Determine tag loss and retention of external (Floy) tags and large (20-mm) internal (PIT) tags.

    b. Test automated PIT tag detectors through seeding experiments conducted on commercially-caught red king crabs during active processing.

- Determine the acceptability of two brands of automated detectors.
- Determine the rates of detection for the two automated detectors.
- Characterize ease of automated detector installation, operation, and maintenance over the duration of active processing during the November 1991 red king crab fishery.

4. Compare performance of PIT tags to Floy tags in determining an estimate of the 1991 harvest rate of red king crabs. Additionally, the relative benefits and disadvantages of using PIT tags versus Floy tags will be characterized.

   a. Determine the 15 month retention rate for PIT tags by examining (scanning) all returned 1990 dual-tagged crabs for presence/absence of PIT tags.

   b. Compare external tag returns from catcher-processors monitored by mandatory shellfish observers, catcher boats monitored by ADF&G, and catcher boats not monitored by ADF&G.

5. Determine size frequencies for red king crabs and *C. bairdi* Tanner crabs caught on the 1991 tagging survey.

METHODS

This project will be conducted in four phases: 1) tagging survey and cost recovery, 2) PIT tag automated recovery system demonstration, 3) tag recovery, and 4) analysis - report writing.

Tagging Survey and Cost Recovery

Phase 1 of this project will be conducted from September 1 - October 6, 1991 in Bristol Bay. The FV *Kristen Gail* has been contracted using the test fish account (TF-960). The charter will be conducted in two 17-18 day legs, with tagging to be accomplished during the first 10 days of each leg and cost recovery to be accomplished in the last 7-8 days of each leg. Tagging will commence in the area of greatest legal crab concentrations (as ascertained from last year's tagging survey and the 1991 NMFS eastern Bering Sea trawl survey) to afford maximum ability to support an intense tagging effort and to find legal crab for the cost recovery portions of the survey.

Sample Design

The Bristol Bay red king crab management area (Area T) is too large to cover in a 20 day survey. Tagging effort must therefore be restricted to a smaller study area within Area T that supports a significant portion of the harvestable population. The study area, encompassing approximately 2,400 nm^2, and the orientation of stations within it, are based on results from last

year's tagging study and the 1991 NMFS trawl survey (Appendix B.1.). The goal of the study area selection and design was to maximize, under the logistic constraints of the charter contract, the sampling of high density concentrations of legal red king crabs.

One hundred twenty-eight sampling stations of four pots each (512 pots total) have been identified and are arrayed in a grid-like pattern over the study area (Appendices B.2 and B.3). Each station is made of four pots, set in a 1.0 nm northeast to southwest line with a spacing of 1/3 nm between pots (Appendix B.4.). The location identified for a station is the northern-most point of the string of four pots. The north-south distance between strings is 2 3/4 nm; the east-west distance between strings is 7 1/2 nm. An itinerary for setting and picking pots in a station is given in Appendix B.5. Following the first set day, 32 pots will be set and picked each day. Under the itinerary shown in Appendix B.5., the pots will soak two nights before picking them except for those in stations 1 through 8 and stations 65 through 72, which will soak for one night before picking. Gear set and retrieval location data will be recorded as shown in the pilot house log form (Appendix C.1.).

Catch Sampling

The contents of each sampled pot will be unloaded onto a sorting table where the catch of king and Tanner crabs are sorted by species and sex and then transferred to a tagging/measuring table. Each sampled crab (including all tagged crabs) will be measured to the nearest mm (carapace length or CL for red king crab; carapace width or CW for Tanner crab) and checked for shell condition. An additional, commercial measure of carapace width outside the lateral spines will be made for males of both species to classify them as either legal or sub-legal size crab. Crab referred to as legal or sub-legal will be defined by the commercial measurement. In instances where large numbers of Tanner crabs, immature male red king crabs and female red king crabs are encountered, the catch will be sub-sampled to allow additional deck time for tagging. Only healthy, non-injured crabs will be tagged; tagged crabs will be handled in a gentle manner and returned on station to the sea as quickly as possible. The data form to be used for catch sampling is shown in Appendix C.2.

All male red king crab $\geq$ 120 mm CL will be Floy-tagged, measured and examined for shell condition. Using CPUE data from last year's survey, approximately 5,000 -7,000 crabs will be tagged. To ensure maximum deck time to accomplish external tagging of mature male red king crabs, all other crabs will be sampled and measured as follows. For immature male red king crabs < 120 mm CL, mature females < 90 mm CL, and immature females $\geq$ 90 mm CL, the maximum number of measurements per pot will be 20 animals. For Tanner and snow crabs, the maximum number of measurements per pot will be 5 males and/or 5 females.

PIT Tag Automated Recovery System

This phase will involve testing of two prototype automated PIT tag detecting units, one from Biosonics and one from Infopet. Testing will occur in mid-September and again in early

November. The unit from Biosonics will be piloted at the end of the second leg of the FV *Kristen Gail* survey (~September 18, 1991). Red king crabs caught for sale will be dual-tagged using external tags and internal tags prior to the delivery. We will be testing the retention of a new, larger (20-mm) PIT tag. Additionally, we will install the automated detector and evaluate its effectiveness in tag detection and the durability of the unit itself.

Tag Loss and Retention Experiments (September)

The purpose of these experiments is to monitor the fate of each tagged crab from the time of tagging through delivery, processing and ultimately, through the Biosonics automated detector. Each crab will be individually tracked through these processes by conducting three experiments to determine:

1. the short term (approximately 6 days) loss/retention of Floy tags and 20-mm PIT tags on legal male crabs in a commercial vessel's holding tank;
2. the loss of 20-mm PIT tags through the butchering process and the detection of PIT tags by the automated detector;
3. the detection rate of double PIT-tagged carapace tail assemblies.

Experiment I: Short term Floy and PIT tag retention. At the beginning of the first leg of commercial fishing on the FV *Kristen Gail*, 300 legal-size male crabs will be triple tagged with a Floy tag placed in the isthmus muscle, a 20-mm PIT tag placed in the proximal segment of the right fifth leg, and a carapace dart (or disc) tag. These crabs should all be tagged within the first 12 hours of commercial fishing so that the time between tagging and delivery to the processor is maximized. At the discretion of the onboard biological crew, tagging may be spread throughout the first 12 hours <u>if</u> it appears that concentrated tagging would result in an unrepresentative sample of size/shell types.

At the time of tagging, the following data will be recorded for each tagged crab: Floy tag number, disc tag number, PIT tag number, carapace length, and shell age. All data but the PIT tag number will be recorded onto a 'hard copy' data form (Appendix D.1.) during the process of tagging. The PIT tag number will be added to the form after the PIT reader file is dumped to a file on the onboard computer but **prior** to the delivery of crabs to the processor.

At the time of the first delivery, at least two ADF&G personnel will thoroughly monitor the offloading of crabs for external tags and externally-marked crabs. The objective is to recover and set aside **all** externally tagged crabs from the landing **prior to butchering**. To minimize the chances of tagged crabs slipping by unnoticed, everyone involved in the processing of this delivery should be clearly instructed to return all externally-tagged crabs they encounter -- intact and with tags attached -- to the ADF&G crew. Likewise, everyone involved in the processing should be clearly instructed to deliver all loose external tags to the ADF&G crew.

Crabs recovered with external tags (Floy and/or disc) will be checked for the presence of all three tag types: Floy, disc and PIT tags. Crabs that are recovered alive and intact with PIT tag present

and detectable will be set aside in a tote for inclusion in Experiment II (see below). Crabs that have either or both external tags (Floy and/or disc) but no detectable PIT tag present will have their external tags removed and safely stored; these crab can then be returned for processing with the rest of the delivery. If a crab is recovered with a detectable PIT tag but has no disc tag, it will receive a new, replacement disc tag before being set aside for Experiment II. If a crab is recovered with a detectable PIT tag but is not suitable for use in Experiment II, e.g. it is dead, or is crushed, the external tags and PIT tag will be removed and safely stored before discarding or butchering.

For each externally-tagged crab that is recovered, the following information is to be recorded, with the hard copy immediately available (Form I, Appendix D.1.):

1. original disc tag number ("0" = missing; "1" = present)
2. replacement disc tag number ("0" = doesn't exist; "1" = present)
3. Floy tag number ("0" = missing; "1" = present)
4. PIT tag detected/not detected ("0" = missing; "1" = detected; "2" = not detected)
5. PIT tag number (added later by merging data files)
6. Fate of crab ("0" = crab not recovered; "1" = crab recovered and used in Experiment II; "2" = dead on arrival; "3" = other). A "0" would result if a Floy tag was found loose on the vessel or processing deck and not matched with any disc-tagged crab that was missing its Floy tag. A "3" would result if there was no PIT tag present in a recovered crab, or if a crab was so badly damaged it could not be used in Experiment II. A "3" should be explained in the Comments section on the data form.

From data collected in Experiment I, short term loss/retention rates for Floy and 20-mm PIT tags will be estimated. Procedures in this phase also prepare crabs for use in Experiment II.

Note: During processing of the delivery, ADF&G personnel should set aside approximately 300 intact carapace-tail assemblies for use in the November 1991 automated detector trials. Each tail section should be bagged individually, frozen and stored at the processor.

Experiment II: Effects of butchering and PIT tag automated detection. After all the processing of untagged crabs is completed, the processing plant crew can take a short break. After the break, a reduced crew will return to handle the work produced by a single butcher. During this break, the Biosonics automated detector can be tuned up by ADF&G personnel for maximum detection and operation.

When the automated detector is ready for operation, the automated detector's memory should be cleared or a 'marker' put in the data file to note the beginning of Experiment II data. The crabs that were set aside in Experiment I will now be butchered at a rate controlled by ADF&G personnel. This rate will probably not need to be slower than 15 seconds per crab. Aside from control of the butchering rate, the butcher should strive to simulate normal butchering and **should not pull the tail from the carapace** during disposal of the waste. Note that each crab being

butchered at this time should have a disc tag and a detectable PIT tag present; the PIT tag is the original tag implanted during commercial crab fishing.

Each crab carapace that passes through the automated detector will be inspected and data recorded for each of the following conditions (Form II, Appendix D.2.):

1. disc tag number
2. tail fate ("0" = missing; "1" = attached to carapace; "2" = unattached to carapace but present on waste conveyor)
3. right, fifth leg ("0" = missing; "1" = attached to tail; "2" = unattached to tail but present on waste conveyor)
4. left, fifth leg ("0" = missing; "1" = attached to tail; "2" = unattached to tail but present on waste conveyor)
5. PIT tag ("0" = missing; "1" = in right, fifth leg; "2" = loose but present on waste conveyor)
6. PIT tag detectable by hand scanner ("1" = yes; "2" = no)
7. PIT tag detectable by automated detector ("1" = yes; "2" = no); Note: ADF&G personnel may be able to monitor automated detector reader box to determine this, but detection will be stored in, and can be recovered from, the automated detectors memory.

All tails still attached to the carapace that have both fifth legs attached and a detectable PIT tag in the right, fifth leg will be set aside with their carapaces still attached for Experiment III. The condition requiring carapace attachment assures that the tail section is still attached to an identifiable marker -- the disc tag. The waste remains of the other crabs will have their external and PIT tags removed and stored safely before discarding. These tails could be frozen for the November trials.

After the last crab is passed through the automated detector, a 'marker' is put into the memory of the automated detector to denote the end of Experiment II.

By the end of Experiment II, we should be able to estimate:

1. the effects of butchering on the integrity of the crab wastes, particularly with regard to the appendages which hold PIT tags (the fifth, right leg);
2. the probability of loss or functional loss of the PIT tag in the fifth, right leg after butchering;
3. the probability that a PIT tag present and functioning in a live crab will be detected by the automated detector after butchering;
4. relationships among 1-3 above.

Also, by the end of Experiment II, a large sample of crab remains will have been set aside for Experiment III. Each of the remains in this sample have both fifth legs attached to tails and the tail attached to the carapace with disc tag present and the PIT tag still functioning in the right, fifth leg.

Experiment III: Detection of PIT tags from double PIT-tagged carapace-tail assemblies. The automated detector's memory should be cleared or have a "marker" put into the data file to note the beginning of Experiment III data. The carapaces with tails and both fifth legs attached (carapace tail assemblies) that remain from Experiment II will be used in this experiment. The following procedure will be applied to the remaining carapace-tail assemblies. A 20-mm PIT tag will be injected into the proximal segment of the left, fifth leg. Using the hand-held reader, scan/store both legs (right leg first, left leg second) to confirm presence and function of both tags. Place carapace-tail assemblies on the waste conveyor at 15 second intervals to pass through the automated detector panels. Record disc tag number and PIT tag number as each carapace-tail assembly comes down the conveyor (Form III, Appendix D.3.). If, within the first 50 carapace-tail assemblies, 31 of those carapace-tail assemblies are not detected by the automated detector (i.e., for 31 carapace-tail assemblies, the PIT tags in both legs are not detected by the automated detector) the experiment may be abandoned. Otherwise, the experiment will continue for all carapace-tail assemblies remaining from Experiment II. The stopping rule is adopted because 31 failures in the first 50 trials is sufficient to indicate interference in detection between the two PIT tags in the same tail. Under this stopping rule, the probability of continuing Experiment III is less than 5% if the true detection rate is 30% or less, while the probability of stopping Expermiment III is less than 1% if the true detection rate is 60%.

From these data we should be able to determine if double-tagging crabs with PIT tags (one in the left, fifth leg and another in the right, fifth leg) would increase the probability of detection of a tagged crab by the automated detector, or if it would decrease this probability to interference between the two PIT tags.

Afternote: This experiment was not conducted due to inadvertent damage to the Biosonics automated detector unit at the conclusion of Experiment II.

Acceptance Trial for Two Automated Recovery Systems (November)

Concomitant with the November 1 opening of the red king crab fishery, both the Biosonics and the Infopet units will be installed at Dutch Harbor processing facilities and a formal acceptance trial for each unit will be performed as described below. If the units are acceptable, they will remain installed on active processing lines for the duration of processing to assess tag detection (and tag loss) capabilities along with the durability of the units themselves.

Vendors will have from 8 AM 1 November through 4:30 PM 7 November 1991 to install and demonstrate the acceptable performance of the waste disposal system scanner assembly in a processing plant located in Dutch Harbor, Alaska. ADF&G will choose the processing plant and make necessary arrangements for installation with the plant management. After the vendor has installed the unit and notified ADF&G that the unit is ready to be tested for acceptance, ADF&G will have 48 hours to accept or reject the unit. To remain within the set time limits, ADF&G must be notified by the vendor that the unit is ready to be tested by 4:30 PM 5 November.

ADF&G will accept or reject the unit according to the sequential acceptance sampling procedure shown in Appendixes E.1. and E.2. The acceptance sampling procedure leading to acceptance or rejection will be performed only once. The vendor may, of course, perform preliminary test procedures at its own expense to assure itself of the proper functioning of the unit if so desired.

In the acceptance sampling procedure, each trial consists of a transponder-injected red king crab tail section passing the waste disposal system scanner antenna assembly. An ADF&G employee will inject a red king crab tail section with the transponder and, in the manner of a crab butcher, toss the tail section into the waste chute from the vicinity of the butcher blades. A hand held reader will be used to check for the functionality of the transponder and to record the transponder's ID code prior to tossing the tail section into the waste chute; if the transponder is not functioning correctly (e.g., cannot be detected by the hand held reader) it will not used for a trial. A different transponder will be used for each trial. Except for unavailability, a different tail section will be used for each trial. Timing between each trial will be determined by ADF&G and will be constrained only by the 48 hour limit to accept or reject the unit after notification of readiness by the vendor. A "failure" in the acceptance sampling procedure occurs when the scanner antenna assembly fails to detect the transponder (as indicated by the assembly's external visual indicator) or if it fails to store the transponder's correct ID code in the assembly's memory or if it fails to correctly upload the stored transponder ID code to a portable computer supplied by ADF&G.

Afternote: The Biosonics automated detector was not installed and tested during November, 1991. Results from the September Biosonics experiments were used to fulfill acceptance testing as described in the November trials.

Tag Recovery

Tag recovery will involve an intensive dock-side interview program coupled with tag returns from mandatory at-sea shellfish observers for the return of external tags during the November 1991 red king crab fishery. The majority of dockside sampling will occur in Dutch Harbor with additional staff in Akutan and King Cove if feasible. Mandatory shellfish observers will receive forms and instructions for the receipt of tagged animals onboard catcher-processors or floating processors prior to the start of the commercial fishery. Recovered tagged animals from the 1990 survey will be measured for growth and will also be examined for the presence of PIT tags to determine the 15 month tag retention rate. Note: Only crabs tagged in 1990 have both Floy tags and PIT tags. Instruction for sampling tagged crabs and completing the tag recovery form are given in Appendixes F.1. and F.2.

A news release detailing the tag recovery effort was issued in mid-October and will also be distributed at the time of tank inspections prior to the November fishery. The news release also contains a form for capture information to be recorded by fishing vessel crews (Appendix F.3.). In addition to the tag recovery program, a tag reward program will be implemented to enhance tag returns. The tag reward poster is shown in Appendix F.4.

Report Writing and Analysis

In contrast to last year's all-encompassing report, there will be three reports documenting the 1991 Bristol Bay red king crab tagging project. The first report will document the survey itself and will include a summary of the biological and catch data collected on the survey. The second report will present results from the automated PIT tag detection trials and tag retention rates of Floy tags and PIT tags. The third report will be an analysis of 1991 Floy tag returns with possible reference to 1990 Floy tag recovery rates. If time permits, a professional paper may be prepared on the automated PIT tag detector trials for journal publication.

SCHEDULES

DATE(s)	Personnel (optional)	Activity
01/15/91-08/15/91	Watson	Secure vessel charter.
07/01/91-08/25/91	Watson/Pengilly	Project Operational Plan prep.
07/01/91-08/25/91	Watson, et al.	Logistics for charter.
08/25/91-09/30/91	Watson, et al.	Conduct survey.
10/01/91-11/15/91	Watson, et al.	Conduct tag recovery effort.
11/15/91-11/15/92	Watson/Pengilly	Analysis and report preparation.

REPORTS

DATE	Author(s)	Report
08/01/92	Pengilly/Watson	Automated Detector RIR (completed: 4K92-28).
09/01/92	Byersdorfer/Watson	1991 Bristol Bay Red King Crab Survey TFR (draft completed).
10/01/92	Watson/Pengilly	Analysis of 1991 Floy tag returns.
12/01/92	???	Journal paper on automated detectors.

OTHER NECESSARY RESOURCES

An at-sea data entry system using acoustic headsets and an onboard computer will be piloted. Data will be entered as it is taken on deck. The purpose of the project is to speed up data analysis following completion of the survey. If the system works, CPUE and length frequency data will be available at the time the survey is done.

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APPENDICES

Appendix A. FY92 Yellowbook for TF-960, Bering Sea Crab Test Fishery Project.

PROJECT TITLE: Bering Sea Crab Test Fishing
FISHERY UNIT: Bering Sea/Aleutians Crab
COMPONENT: Commercial Fish BPS# 3800
LOCATION: Kodiak
SUBCOMPONENT: Test Fish Funds
LEGISLATIVE DISTRICTS : 27

PROJECT NUMBER: TF-960
LEDGER: 74119751
PRINTORD: No order
REGION: 4
PRIORITY: 1.00

PROGRAM ELEMENT: Test Fish Survey
FISHERIES AFFECTED: Bering Sea Crab

USER GROUPS AFFECTED: Commercial

SPECIES AFFECTED: King Crab and Tanner Crab

PROJECT DESCRIPTION

Funding from this project will support the State's direct expenses for conducting shellfish tagging projects in the Bristol Bay and Aleutian Islands areas. The Bristol Bay red king crab harvest was valued recently in excess of $100 million. Error in estimating natural mortality rates and population abundances can jointly provide major errors in development of Guideline Harvest Levels. The Adak and Dutch Harbor Brown crab stocks are valued at over $30 million annually. These stocks have not been surveyed and the current harvest rate may surpass the Federal overfishing definition. Without survey data, the fishery may be closed for conservation purposes, because of stock abundance uncertainty.

PROJECT OBJECTIVES

Aleutian red and brown king crab populations are assessed to provide information for development of guideline harvest levels. Data will be collected on all crab captured during the surveys. Long term tag recovery data should provide information on natural mortality rates to be used in estimating harvest rates designed to meet conservation and economic objectives established by the BOF.

BUDGET MANAGER: 1857 - Leslie J. Watson - Marine Fisheries Biologist

BUDGET DETAIL: CODE/LINE ITEM	PRIOR YEAR ALLOCATIONS FY89	FY90	FY91	SUMMARY	
					13.0 PFT
100 PERSONAL SERV	0.0	0.0	0.0	98.5	85.4 Other
200 TRAVEL	0.0	0.0	0.0	25.4	
300 CONTRACTUAL	116.0	0.0	28.9	393.7	
400 COMMODITIES	0.0	0.0	0.0	21.0	
500 EQUIPMENT	0.0	0.0	0.0	125.5	
700 GRANTS	***	***		0.0	
PROJECT TOTALS:	0.0	0.0	28.9	664.1	
FEDERAL RECEIPTS	0.0	0.0	0.0	0.0	
GENERAL FUND	0.0	0.0	0.0	-0.1	
INTERAGENCY RECPTS	***	***	0.0	0.0	
PROGRAM RECIEPTS	116.0	0.0	28.9	664.2	
GENERAL FUND MATCH	***	***	0.0	0.0	
STAFF MONTHS	0.0	0.0	0.0	13.2	

PROJECT TITLE: Bering Sea Crab Test Fishing
UNIT: Bering Sea/Aleutians Crab
COMPONENT: Commercial Fish BPS# 3800

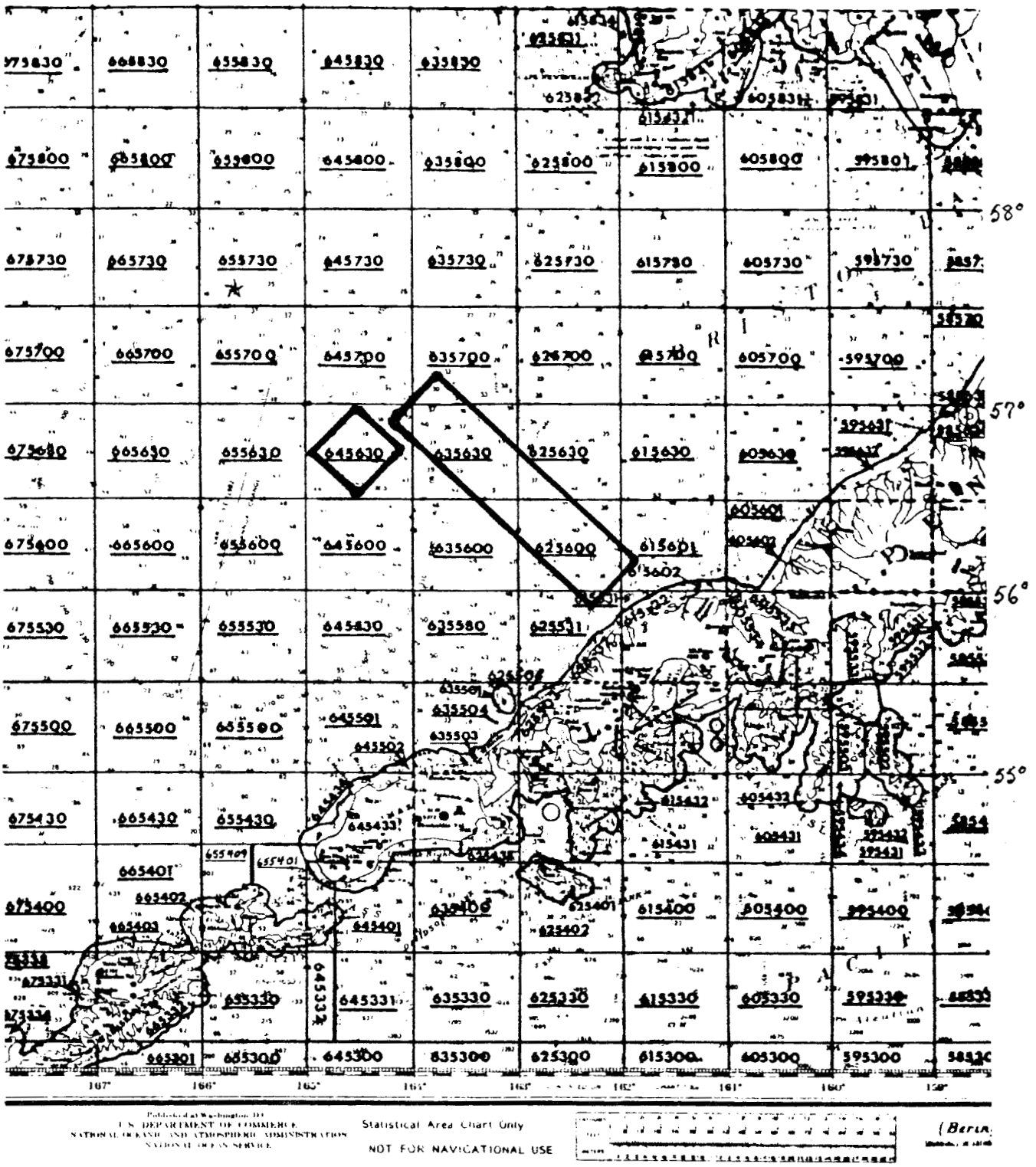
PROJECT NUMBER: TF-960
LEDGER CODE: 74119751
PRINT ORDER: No order
REGION: 4

PERSONAL SERVICES DATA

PCN	TITLE & NAME	Range R S LOC	Premium Pay Hours 92	MM	OT	SEA	HAZ	SWING	GRAVE	TOTAL COST
1006	FB II -Blau, S Forres	P F CAA 16K	16K	0.0	0.	425.	0.	0.	0.	4709.73
1117	FB I - Byersdorfer, Su	A S CAA 14B	14B	6.0	0.	1100.	0.	0.	0.	34135.45
1202	FB IV - Schmidt, Dana	P F CAA 20F	20F	0.0	0.	330.	0.	0.	0.	4504.28
1351	FB II - Beers, Dean	A S CAA 16A	16A	0.0	0.	825.	0.	0.	0.	7164.19
1825	FT III - Phillips, Kim	P S CAA 11D	11D	0.5	0.	0.	0.	0.	0.	1889.86
1843	FT III - Rudge, Kimber	P S CAA 11E	11E	0.5	0.	0.	0.	0.	0.	1964.77
1857	FB III - Watson, Lesli	P F CAA 18D	18E	0.0	0.	330.	0.	0.	0.	3819.67
N932	FT III - Vacant,	A N BKB 11A	11A	1.3	0.	725.	0.	0.	0.	8459.09
N933	FT III - Vacant,	A N BKB 11A	11A	1.3	0.	725.	0.	0.	0.	8459.09
N934	FT III - Vacant,	A N BKB 11A	11A	1.8	0.	1000.	0.	0.	0.	11688.28
N935	FT III - Vacant,	A N BKB 11A	11A	1.8	0.	1000.	0.	0.	0.	11688.28
				13.2						98482.69

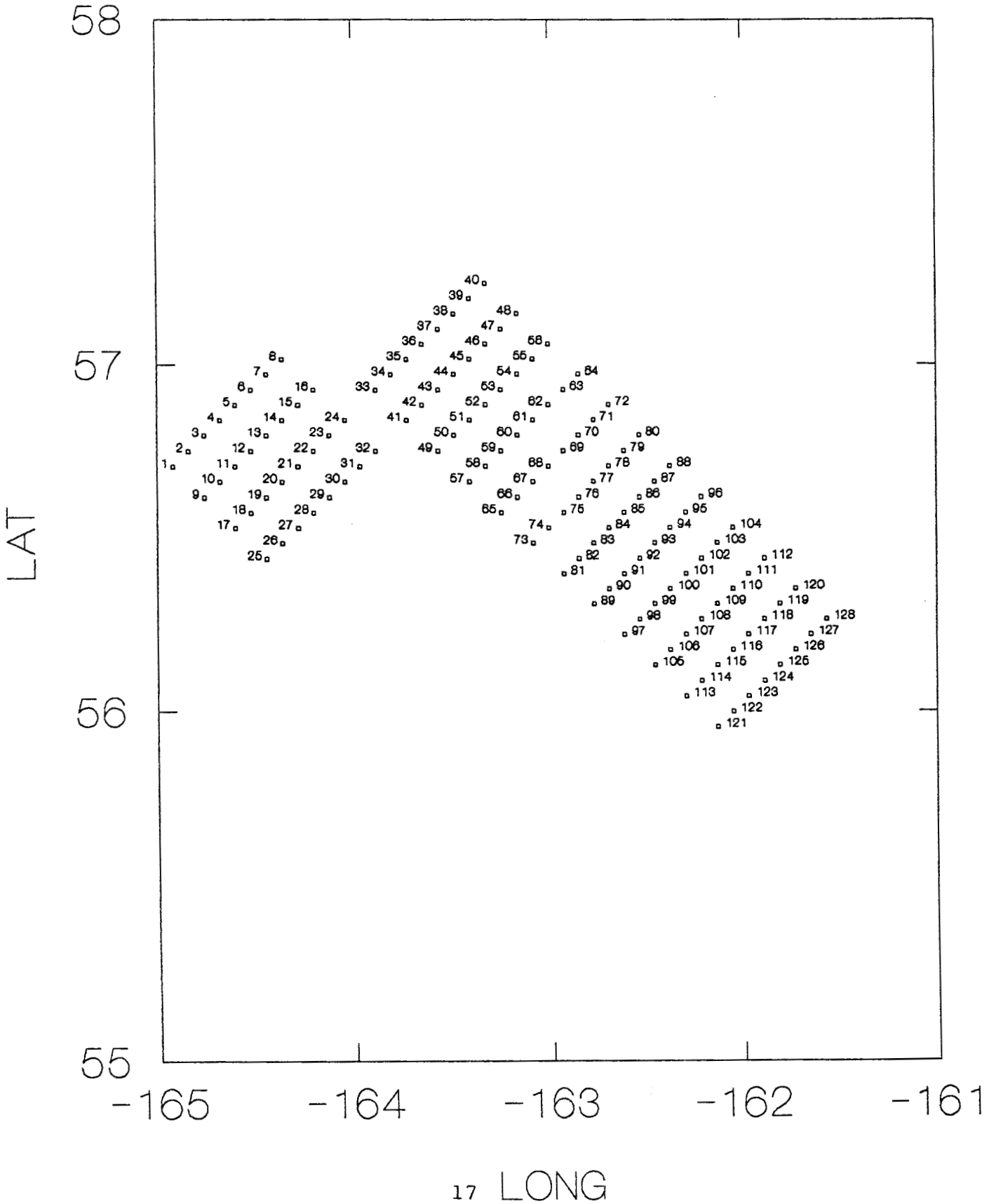
PROJECT LINE ITEM DETAIL

LINE#	DESCRIPTION	AMOUNT	COMMENT
72240	Field Travel	21.2	Travel
72500	Per Diem	4.3	Per Diem expences.
73100	Professional Services	0.6	Photo processing.
73400	Transportation	0.6	Excess baggage
73500	Advertising, Printing & Bind	0.3	Printing
73860	Rental Machinery & Equipment	2.0	Truck Rental
73860	Rental Machinery & Equipment	390.0	Test Fish Charters.
73900	Other Expenditures & Services	0.2	Freight
74220	Office & Library Supplies	13.5	Tag rewards
74220	Office & Library Supplies	0.9	Office Supplies
74480	Household & Institutional	1.0	Groceries
74480	Household & Institutional	1.5	Gloves, hardware, (etc).
74600	Other Operating Supplies	3.6	Survival Suits
74650	Repair & Maintenance Supply	0.5	Misc Electrical
75870	Laboratory & Scientific Eqip	62.4	PIT Tags
75870	Laboratory & Scientific Eqip	0.3	Floy Tags
75870	Laboratory & Scientific Eqip	53.0	Auto Detectors
75870	Laboratory & Scientific Eqip	9.8	Misc Tagging Equipment
	TOTAL LINES 200 - 700	565.6	DATE PRINTED 07/18/1991
	TOTAL PROJECT COST	664.1	



Appendix B.1. Location of the 1991 Bristol Bay red king crab tagging study.

Appendix B.2. Layout of the 128 tagging stations for the 1991 Bristol Bay red king crab tagging survey.



Appendix B.3. **Location of the 128, 4 pot tagging stations for the 1991 Bristol Bay red king crab tagging survey.**

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
1	1	56	42.35	164	55.21
1	2	56	42.58	164	54.79
1	3	56	42.82	164	54.36
1	4	56	43.06	164	53.94
2	1	56	45.00	164	50.43
2	2	56	45.24	164	50.00
2	3	56	45.47	164	49.58
2	4	56	45.71	164	49.15
3	1	56	47.65	164	45.64
3	2	56	47.89	164	45.22
3	3	56	48.12	164	44.79
3	4	56	48.36	164	44.37
4	1	56	50.30	164	40.86
4	2	56	50.54	164	40.43
4	3	56	50.77	164	40.01
4	4	56	51.01	164	39.58
5	1	56	52.95	164	36.07
5	2	56	53.19	164	35.65
5	3	56	53.43	164	35.22
5	4	56	53.66	164	34.80
6	1	56	55.61	164	31.29
6	2	56	55.84	164	30.86
6	3	56	56.08	164	30.44
6	4	56	56.31	164	30.01
7	1	56	58.26	164	26.50
7	2	56	58.49	164	26.08
7	3	56	58.73	164	25.65
7	4	56	58.97	164	25.23
8	1	57	0.91	164	21.72
8	2	57	1.15	164	21.29
8	3	57	1.38	164	20.87
8	4	57	1.62	164	20.44
9	1	56	37.05	164	45.64
9	2	56	37.28	164	45.22
9	3	56	37.52	164	44.79
9	4	56	37.75	164	44.37
10	1	56	39.70	164	40.86
10	2	56	39.93	164	40.43
10	3	56	40.17	164	40.01
10	4	56	40.40	164	39.58
11	1	56	42.35	164	36.07
11	2	56	42.58	164	35.65
11	3	56	42.82	164	35.22
11	4	56	43.06	164	34.80
12	1	56	45.00	164	31.29
12	2	56	45.24	164	30.86
12	3	56	45.47	164	30.44
12	4	56	45.71	164	30.01
13	1	56	47.65	164	26.50
13	2	56	47.89	164	26.08
13	3	56	48.12	164	25.65
13	4	56	48.36	164	25.23
14	1	56	50.30	164	21.72

Appendix B.3. (page 2 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
14	2	56	50.54	164	21.29
14	3	56	50.77	164	20.87
14	4	56	51.01	164	20.44
15	1	56	52.95	164	16.93
15	2	56	53.19	164	16.50
15	3	56	53.43	164	16.08
15	4	56	53.66	164	15.65
16	1	56	55.61	164	12.14
16	2	56	55.84	164	11.72
16	3	56	56.08	164	11.29
16	4	56	56.31	164	10.87
17	1	56	31.74	164	36.07
17	2	56	31.98	164	35.65
17	3	56	32.21	164	35.22
17	4	56	32.45	164	34.80
18	1	56	34.39	164	31.29
18	2	56	34.63	164	30.86
18	3	56	34.86	164	30.44
18	4	56	35.10	164	30.01
19	1	56	37.05	164	26.50
19	2	56	37.28	164	26.08
19	3	56	37.52	164	25.65
19	4	56	37.75	164	25.23
20	1	56	39.70	164	21.72
20	2	56	39.93	164	21.29
20	3	56	40.17	164	20.87
20	4	56	40.40	164	20.44
21	1	56	42.35	164	16.93
21	2	56	42.58	164	16.50
21	3	56	42.82	164	16.08
21	4	56	43.06	164	15.65
22	1	56	45.00	164	12.14
22	2	56	45.24	164	11.72
22	3	56	45.47	164	11.29
22	4	56	45.71	164	10.87
23	1	56	47.65	164	7.36
23	2	56	47.89	164	6.93
23	3	56	48.12	164	6.51
23	4	56	48.36	164	6.08
24	1	56	50.30	164	2.57
24	2	56	50.54	164	2.15
24	3	56	50.77	164	1.72
24	4	56	51.01	164	1.30
25	1	56	26.44	164	26.50
25	2	56	26.67	164	26.08
25	3	56	26.91	164	25.65
25	4	56	27.15	164	25.23
26	1	56	29.09	164	21.72
26	2	56	29.33	164	21.29
26	3	56	29.56	164	20.87
26	4	56	29.80	164	20.44
27	1	56	31.74	164	16.93
27	2	56	31.98	164	16.50

Appendix B.3. (page 3 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
27	3	56	32.21	164	16.08
27	4	56	32.45	164	15.65
28	1	56	34.39	164	12.14
28	2	56	34.63	164	11.72
28	3	56	34.86	164	11.29
28	4	56	35.10	164	10.87
29	1	56	37.05	164	7.36
29	2	56	37.28	164	6.93
29	3	56	37.52	164	6.51
29	4	56	37.75	164	6.08
30	1	56	39.70	164	2.57
30	2	56	39.93	164	2.15
30	3	56	40.17	164	1.72
30	4	56	40.40	164	1.30
31	1	56	42.35	163	57.79
31	2	56	42.58	163	57.36
31	3	56	42.82	163	56.94
31	4	56	43.06	163	56.51
32	1	56	45.00	163	53.00
32	2	56	45.24	163	52.58
32	3	56	45.47	163	52.15
32	4	56	45.71	163	51.73
33	1	56	55.61	163	53.00
33	2	56	55.84	163	52.58
33	3	56	56.08	163	52.15
33	4	56	56.31	163	51.73
34	1	56	58.26	163	48.22
34	2	56	58.49	163	47.79
34	3	56	58.73	163	47.37
34	4	56	58.97	163	46.94
35	1	57	0.91	163	43.43
35	2	57	1.15	163	43.01
35	3	57	1.38	163	42.58
35	4	57	1.62	163	42.16
36	1	57	3.56	163	38.65
36	2	57	3.80	163	38.22
36	3	57	4.03	163	37.80
36	4	57	4.27	163	37.37
37	1	57	6.21	163	33.86
37	2	57	6.45	163	33.44
37	3	57	6.68	163	33.01
37	4	57	6.92	163	32.58
38	1	57	8.86	163	29.08
38	2	57	9.10	163	28.65
38	3	57	9.34	163	28.22
38	4	57	9.57	163	27.80
39	1	57	11.52	163	24.29
39	2	57	11.75	163	23.86
39	3	57	11.99	163	23.44
39	4	57	12.22	163	23.01
40	1	57	14.17	163	19.50
40	2	57	14.40	163	19.08
40	3	57	14.64	163	18.65

Appendix B.3. (page 4 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
40	4	57	14.88	163	18.23
41	1	56	50.30	163	43.43
41	2	56	50.54	163	43.01
41	3	56	50.77	163	42.58
41	4	56	51.01	163	42.16
42	1	56	52.95	163	38.65
42	2	56	53.19	163	38.22
42	3	56	53.43	163	37.80
42	4	56	53.66	163	37.37
43	1	56	55.61	163	33.86
43	2	56	55.84	163	33.44
43	3	56	56.08	163	33.01
43	4	56	56.31	163	32.58
44	1	56	58.26	163	29.08
44	2	56	58.49	163	28.65
44	3	56	58.73	163	28.22
44	4	56	58.97	163	27.80
45	1	57	0.91	163	24.29
45	2	57	1.15	163	23.86
45	3	57	1.38	163	23.44
45	4	57	1.62	163	23.01
46	1	57	3.56	163	19.50
46	2	57	3.80	163	19.08
46	3	57	4.03	163	18.65
46	4	57	4.27	163	18.23
47	1	57	6.21	163	14.72
47	2	57	6.45	163	14.29
47	3	57	6.68	163	13.87
47	4	57	6.92	163	13.44
48	1	57	8.86	163	9.93
48	2	57	9.10	163	9.51
48	3	57	9.34	163	9.08
48	4	57	9.57	163	8.66
49	1	56	45.00	163	33.86
49	2	56	45.24	163	33.44
49	3	56	45.47	163	33.01
49	4	56	45.71	163	32.58
50	1	56	47.65	163	29.08
50	2	56	47.89	163	28.65
50	3	56	48.12	163	28.22
50	4	56	48.36	163	27.80
51	1	56	50.30	163	24.29
51	2	56	50.54	163	23.86
51	3	56	50.77	163	23.44
51	4	56	51.01	163	23.01
52	1	56	52.95	163	19.50
52	2	56	53.19	163	19.08
52	3	56	53.43	163	18.65
52	4	56	53.66	163	18.23
53	1	56	55.61	163	14.72
53	2	56	55.84	163	14.29
53	3	56	56.08	163	13.87
53	4	56	56.31	163	13.44

Appendix B.3. (page 5 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
54	1	56	58.26	163	9.93
54	2	56	58.49	163	9.51
54	3	56	58.73	163	9.08
54	4	56	58.97	163	8.66
55	1	56	60.91	163	5.15
55	2	56	61.15	163	4.72
55	3	56	61.38	163	4.30
55	4	56	61.62	163	3.87
56	1	57	3.56	163	0.36
56	2	57	3.80	163	-0.06
56	3	57	4.03	163	-0.49
56	4	57	4.27	163	-0.91
57	1	56	39.70	163	24.29
57	2	56	39.93	163	23.86
57	3	56	40.17	163	23.44
57	4	56	40.40	163	23.01
58	1	56	42.35	163	19.50
58	2	56	42.58	163	19.08
58	3	56	42.82	163	18.65
58	4	56	43.06	163	18.23
59	1	56	45.00	163	14.72
59	2	56	45.24	163	14.29
59	3	56	45.47	163	13.87
59	4	56	45.71	163	13.44
60	1	56	47.65	163	9.93
60	2	56	47.89	163	9.51
60	3	56	48.12	163	9.08
60	4	56	48.36	163	8.66
61	1	56	50.30	163	5.15
61	2	56	50.54	163	4.72
61	3	56	50.77	163	4.30
61	4	56	51.01	163	3.87
62	1	56	52.95	163	0.36
62	2	56	53.19	163	-0.06
62	3	56	53.43	163	-0.49
62	4	56	53.66	163	-0.91
63	1	56	55.61	162	55.58
63	2	56	55.84	162	55.15
63	3	56	56.08	162	54.73
63	4	56	56.31	162	54.30
64	1	56	58.26	162	50.79
64	2	56	58.49	162	50.37
64	3	56	58.73	162	49.94
64	4	56	58.97	162	49.51
65	1	56	0.57	163	0.25
65	2	56	0.58	163	0.24
65	3	56	0.58	163	0.23
65	4	56	0.59	163	0.22
66	1	56	0.62	163	0.17
66	2	56	0.62	163	0.16
66	3	56	0.63	163	0.15
66	4	56	0.63	163	0.14
67	1	56	0.66	163	0.09

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STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
67	2	56	0.67	163	0.08
67	3	56	0.67	163	0.07
67	4	56	0.67	163	0.06
68	1	56	0.71	163	0.01
68	2	56	0.71	162	1.00
68	3	56	0.71	162	0.99
68	4	56	0.72	162	0.98
69	1	56	0.75	162	0.93
69	2	56	0.75	162	0.92
69	3	56	0.76	162	0.91
69	4	56	0.76	162	0.91
70	1	56	0.79	162	0.85
70	2	56	0.80	162	0.84
70	3	56	0.80	162	0.83
70	4	56	0.81	162	0.83
71	1	56	0.84	162	0.77
71	2	56	0.84	162	0.76
71	3	56	0.85	162	0.75
71	4	56	0.85	162	0.75
72	1	56	0.88	162	0.69
72	2	56	0.89	162	0.68
72	3	56	0.89	162	0.67
72	4	56	0.89	162	0.67
73	1	56	0.48	163	0.09
73	2	56	0.49	163	0.08
73	3	56	0.49	163	0.07
73	4	56	0.50	163	0.06
74	1	56	0.53	163	0.01
74	2	56	0.53	162	1.00
74	3	56	0.54	162	0.99
74	4	56	0.54	162	0.98
75	1	56	0.57	162	0.93
75	2	56	0.58	162	0.92
75	3	56	0.58	162	0.91
75	4	56	0.59	162	0.91
76	1	56	0.62	162	0.85
76	2	56	0.62	162	0.84
76	3	56	0.63	162	0.83
76	4	56	0.63	162	0.83
77	1	56	0.66	162	0.77
77	2	56	0.67	162	0.76
77	3	56	0.67	162	0.75
77	4	56	0.67	162	0.75
78	1	56	0.71	162	0.69
78	2	56	0.71	162	0.68
78	3	56	0.71	162	0.67
78	4	56	0.72	162	0.67
79	1	56	0.75	162	0.61
79	2	56	0.75	162	0.60
79	3	56	0.76	162	0.59
79	4	56	0.76	162	0.59
80	1	56	0.79	162	0.53
80	2	56	0.80	162	0.52

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STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
80	3	56	0.80	162	0.51
80	4	56	0.81	162	0.51
81	1	56	0.40	162	0.93
81	2	56	0.40	162	0.92
81	3	56	0.40	162	0.91
81	4	56	0.41	162	0.91
82	1	56	0.44	162	0.85
82	2	56	0.44	162	0.84
82	3	56	0.45	162	0.83
82	4	56	0.45	162	0.83
83	1	56	0.48	162	0.77
83	2	56	0.49	162	0.76
83	3	56	0.49	162	0.75
83	4	56	0.50	162	0.75
84	1	56	0.53	162	0.69
84	2	56	0.53	162	0.68
84	3	56	0.54	162	0.67
84	4	56	0.54	162	0.67
85	1	56	0.57	162	0.61
85	2	56	0.58	162	0.60
85	3	56	0.58	162	0.59
85	4	56	0.59	162	0.59
86	1	56	0.62	162	0.53
86	2	56	0.62	162	0.52
86	3	56	0.63	162	0.51
86	4	56	0.63	162	0.51
87	1	56	0.66	162	0.45
87	2	56	0.67	162	0.44
87	3	56	0.67	162	0.43
87	4	56	0.67	162	0.43
88	1	56	0.71	162	0.37
88	2	56	0.71	162	0.36
88	3	56	0.71	162	0.35
88	4	56	0.72	162	0.35
89	1	56	0.31	162	0.77
89	2	56	0.31	162	0.76
89	3	56	0.32	162	0.75
89	4	56	0.32	162	0.75
90	1	56	0.35	162	0.69
90	2	56	0.36	162	0.68
90	3	56	0.36	162	0.67
90	4	56	0.36	162	0.67
91	1	56	0.40	162	0.61
91	2	56	0.40	162	0.60
91	3	56	0.40	162	0.59
91	4	56	0.41	162	0.59
92	1	56	0.44	162	0.53
92	2	56	0.44	162	0.52
92	3	56	0.45	162	0.51
92	4	56	0.45	162	0.51
93	1	56	0.48	162	0.45
93	2	56	0.49	162	0.44
93	3	56	0.49	162	0.43

Appendix B.3. (page 8 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
93	4	56	0.50	162	0.43
94	1	56	0.53	162	0.37
94	2	56	0.53	162	0.36
94	3	56	0.54	162	0.35
94	4	56	0.54	162	0.35
95	1	56	0.57	162	0.29
95	2	56	0.58	162	0.28
95	3	56	0.58	162	0.27
95	4	56	0.59	162	0.27
96	1	56	0.62	162	0.21
96	2	56	0.62	162	0.20
96	3	56	0.63	162	0.19
96	4	56	0.63	162	0.19
97	1	56	0.22	162	0.61
97	2	56	0.22	162	0.60
97	3	56	0.23	162	0.59
97	4	56	0.23	162	0.59
98	1	56	0.26	162	0.53
98	2	56	0.27	162	0.52
98	3	56	0.27	162	0.51
98	4	56	0.28	162	0.51
99	1	56	0.31	162	0.45
99	2	56	0.31	162	0.44
99	3	56	0.32	162	0.43
99	4	56	0.32	162	0.43
100	1	56	0.35	162	0.37
100	2	56	0.36	162	0.36
100	3	56	0.36	162	0.35
100	4	56	0.36	162	0.35
101	1	56	0.40	162	0.29
101	2	56	0.40	162	0.28
101	3	56	0.40	162	0.27
101	4	56	0.41	162	0.27
102	1	56	0.44	162	0.21
102	2	56	0.44	162	0.20
102	3	56	0.45	162	0.19
102	4	56	0.45	162	0.19
103	1	56	0.48	162	0.13
103	2	56	0.49	162	0.12
103	3	56	0.49	162	0.11
103	4	56	0.50	162	0.11
104	1	56	0.53	162	0.05
104	2	56	0.53	162	0.04
104	3	56	0.54	162	0.03
104	4	56	0.54	162	0.03
105	1	56	0.13	162	0.45
105	2	56	0.14	162	0.44
105	3	56	0.14	162	0.43
105	4	56	0.14	162	0.43
106	1	56	0.18	162	0.37
106	2	56	0.18	162	0.36
106	3	56	0.18	162	0.35
106	4	56	0.19	162	0.35

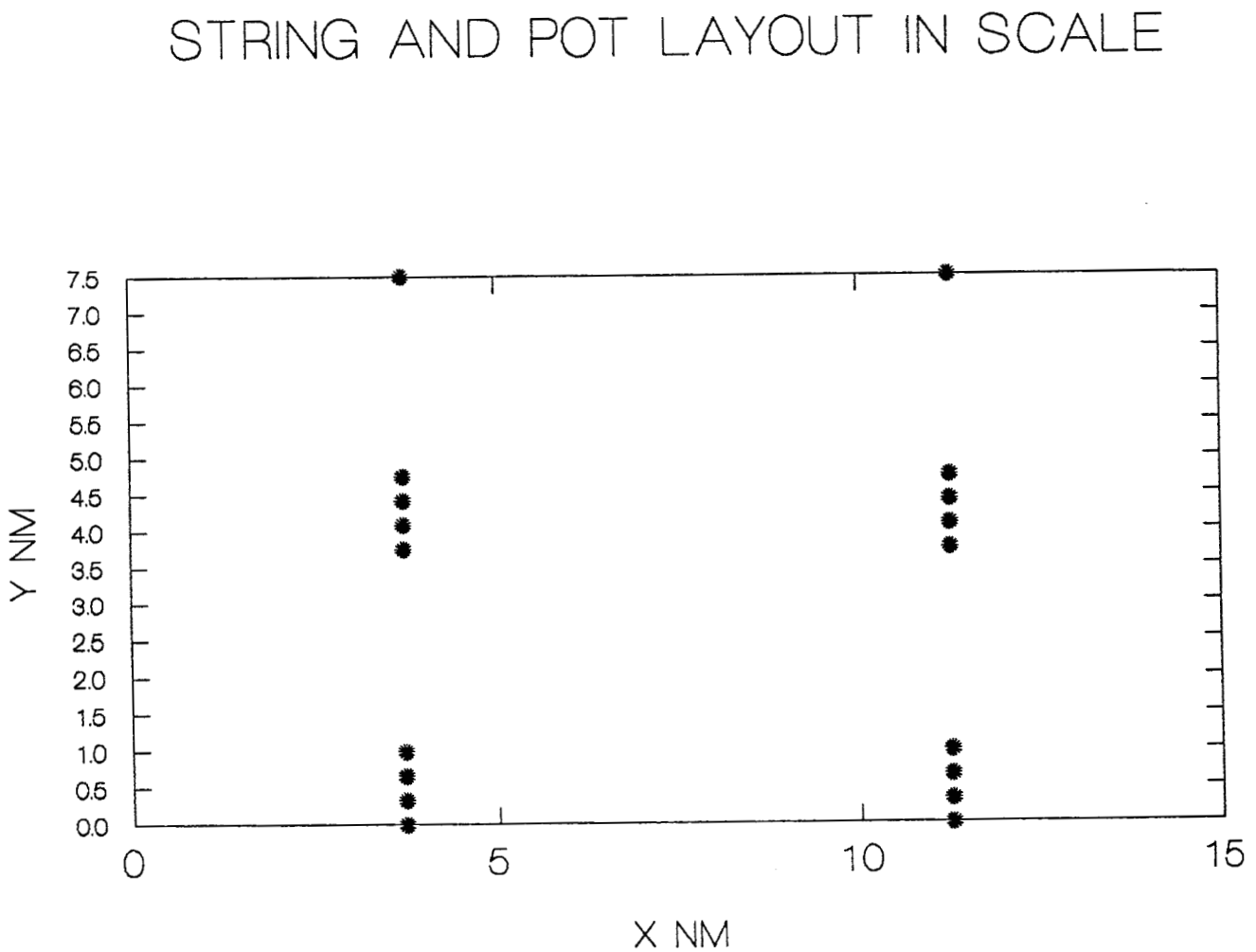
Appendix B.3. (page 9 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
107	1	56	0.22	162	0.29
107	2	56	0.22	162	0.28
107	3	56	0.23	162	0.27
107	4	56	0.23	162	0.27
108	1	56	0.26	162	0.21
108	2	56	0.27	162	0.20
108	3	56	0.27	162	0.19
108	4	56	0.28	162	0.19
109	1	56	0.31	162	0.13
109	2	56	0.31	162	0.12
109	3	56	0.32	162	0.11
109	4	56	0.32	162	0.11
110	1	56	0.35	162	0.05
110	2	56	0.36	162	0.04
110	3	56	0.36	162	0.03
110	4	56	0.36	162	0.03
111	1	56	0.40	161	0.97
111	2	56	0.40	161	0.96
111	3	56	0.40	161	0.95
111	4	56	0.41	161	0.95
112	1	56	0.44	161	0.89
112	2	56	0.44	161	0.88
112	3	56	0.45	161	0.88
112	4	56	0.45	161	0.87
113	1	56	0.04	162	0.29
113	2	56	0.05	162	0.28
113	3	56	0.05	162	0.27
113	4	56	0.05	162	0.27
114	1	56	0.09	162	0.21
114	2	56	0.09	162	0.20
114	3	56	0.09	162	0.19
114	4	56	0.10	162	0.19
115	1	56	0.13	162	0.13
115	2	56	0.14	162	0.12
115	3	56	0.14	162	0.11
115	4	56	0.14	162	0.11
116	1	56	0.18	162	0.05
116	2	56	0.18	162	0.04
116	3	56	0.18	162	0.03
116	4	56	0.19	162	0.03
117	1	56	0.22	161	0.97
117	2	56	0.22	161	0.96
117	3	56	0.23	161	0.95
117	4	56	0.23	161	0.95
118	1	56	0.26	161	0.89
118	2	56	0.27	161	0.88
118	3	56	0.27	161	0.88
118	4	56	0.28	161	0.87
119	1	56	0.31	161	0.81
119	2	56	0.31	161	0.80
119	3	56	0.32	161	0.80
119	4	56	0.32	161	0.79
120	1	56	0.35	161	0.73

Appendix B.3. (page 10 of 10)

STATION	POT	DEG LAT	MIN LAT	DEG LONG	MIN LONG
120	2	56	0.36	161	0.72
120	3	56	0.36	161	0.72
120	4	56	0.36	161	0.71
121	1	55	0.95	162	0.13
121	2	55	0.96	162	0.12
121	3	55	0.96	162	0.11
121	4	55	0.97	162	0.11
122	1	55	1.00	162	0.05
122	2	56	0.00	162	0.04
122	3	56	0.01	162	0.03
122	4	56	0.01	162	0.03
123	1	56	0.04	161	0.97
123	2	56	0.05	161	0.96
123	3	56	0.05	161	0.95
123	4	56	0.05	161	0.95
124	1	56	0.09	161	0.89
124	2	56	0.09	161	0.88
124	3	56	0.09	161	0.88
124	4	56	0.10	161	0.87
125	1	56	0.13	161	0.81
125	2	56	0.14	161	0.80
125	3	56	0.14	161	0.80
125	4	56	0.14	161	0.79
126	1	56	0.18	161	0.73
126	2	56	0.18	161	0.72
126	3	56	0.18	161	0.72
126	4	56	0.19	161	0.71
127	1	56	0.22	161	0.65
127	2	56	0.22	161	0.64
127	3	56	0.23	161	0.64
127	4	56	0.23	161	0.63
128	1	56	0.26	161	0.57
128	2	56	0.27	161	0.56
128	3	56	0.27	161	0.56
128	4	56	0.28	161	0.55

Appendix B.4. **String and pot layout for the 128 tagging stations in the 1991 Bristol Bay red king crab tagging survey (to scale).**



Appendix B.5. Itinerary for setting and retrieval of gear in the 128, 4 pot stations in the 1991 Bristol Bay red king crab tagging survey.

Sep 2	FV Kristen Gail departs Dutch Harbor to study area	
Sep 3	Survey Day 1	- set stations 1-8 and stations 9-16
Sep 4	Survey Day 2	- pick 1-8[1], set 17-24
Sep 5	Survey Day 3	- pick 9-16, set 25-32
Sep 6	Survey Day 4	- pick 17-24, set 33-40
Sep 7	Survey Day 5	- pick 25-32, set 41-48
Sep 8	Survey Day 6	- pick 33-40, set 49-56
Sep 9	Survey Day 7	- pick 41-48, set 57-64
Sep 10	Survey Day 8	- pick 49-56, set commercial pots
Sep 11	Survey Day 9	- pick 57-64, set commercial pots
Sep 12	Survey Day 10	- pull commercial pots
Sep 13	Fishing Day 11	- pull commercial pots
Sep 14	Fishing Day 12	- pull commercial pots
Sep 15	Fishing Day 13	- pull commercial pots
Sep 16	Fishing Day 14	- pull commercial pots
Sep 17	Fishing Day 15	- pull commercial pots
Sep 18	Fishing Day 16	- pull comm. pots, set stations 65-72 and stations 73-80, travel to Dutch Harbor
Sep 19	Fishing Day 17	- deliver crab/test Biosonics PIT tag unit/crew change
Sep 20	Survey Day 18	- Return to fishing grounds.
Sep 21	Survey Day 19	- pick 65-72, set 81-88
Sep 22	Survey Day 20	- pick 73-80[2], set 89-96
Sep 23	Survey Day 21	- pick 81-88, set 97-104
Sep 24	Survey Day 22	- pick 89-96, set 105-112
Sep 25	Survey Day 23	- pick 97-104, set 113-120
Sep 26	Survey Day 24	- pick 105-112, set 121-128
Sep 27	Survey Day 25	- pick 113-120, set commercial pots
Sep 28	Survey Day 26	- pick 121-128, travel to Dutch
Sep 29	Survey Day 27	- drop off 3 ADF&G people, return to fishing grounds w/D. Beers
Sep 30	Fishing Day 28	- pull commercial pots
Oct 1	Fishing Day 29	- pull commercial pots
Oct 2	Fishing Day 30	- pull commercial pots
Oct 3	Fishing Day 31	- pull commercial pots
Oct 4	Fishing Day 32	- pull commercial pots
Oct 5	Fishing Day 33	- pull commercial pots
Oct 6	Fishing Day 34	- pull commercial pots, travel to Dutch[3]
Oct 7	Fishing Day 35	- deliver crab, last paid day of charter. **May elect to continue fishing if cost recovery not complete - fishing can continue 10 additional days at no cost to the State.

[1]24-hr soak for these pots, 48-hr soak for all others.

[2]72-hr soak for these pots, 48-hour soak for all others.

[3]Continue commercial fishing if not enough crab caught.

Appendix C.1. **PILOT HOUSE LOG - POT SURVEYS 199 1**

Registration Area _____

STATION [ ][ ][ ][ ]

If longlining pots - distance between pots on string _____ fm.

Skipper _____

Recorder _____

Vessel _____

SET GEAR			DEPTH IN FMS.	BOTTOM TYPE *	SEQUENTIAL POT NUMBER	BOUY NO.	LIFT GEAR **			LATITUDE - N			LONGITUDE - W or E***			LORAN POSITION (Always record Lat.-Long.)
MONTH	DAY	MILITARY TIME					MONTH	DAY	MILITARY TIME	DEG	MIN	.	DEG	MIN	.	

* Bottom type codes: 1 - Rock; 2 - Sand; 3 - Silt; and 4 - Mud.

** *Skipper must tell ADF&G crew if pulling gear in reverse order than set. "Lost Pot" must be recorded under "Lift Gear" section by appropriate pot which was lost.* Immediately tell ADF&G deck crew whenever a pot is lost so their deck paperwork can stay in order.

*** Circle either W=west or E=east.

Revised 7/91

Appendix C.2.

ADF&G CRAB RESEARCH DATA FORM

SPECIES _____ STATION NUMBER [ ][ ][ ][ ][ ] REGISTRATION AREA Bristol Bay

SEX _____ BUOY NUMBER [ ][ ] MEASURER _____

VESSEL KRISTEN GAIL TRAWL HAUL NUMBER [ ][ ][ ][ ] RECORDER _____

DATE [ ][ ]-[ ]-[ ][ ] SAMPLING FACTOR [ ][ ]/[ ][ ] PAGE _____ OF _____

	SEQUENTIAL POT NUMBER	SPECIES	SEX	SIZE CRABS (MM) FISH (CM)	LEGAL	SHELL AGE	EGGS COLOR	EGGS DEVELOP	EGGS CONDITION	EGGS % CLUTCH	OTHER	TAG NUMBER	PIT I.D. REFERENCE NO.	COMMENTS
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														

Crab Species
1 - L. aequispina
2 - P. camtschaticus
3 - P. platypus
4 - Erimacrus
5 - C. bairdi x opilio
6 - C. bairdi
7 - C. opilio
8 - C. angulatus
9 - Cancer magister
A - L. couesi
D - C. tanneri

Fish & Invert. Species
See coded species list

Sex
1 - Male
2 - Female

Legal
1 - Sublegal
2 - Legal

Shell Age
0 - Soft
1 - New
2 - Old
3 - Very Old

Live Egg Color
1 - Tan
2 - Purple
3 - Brown
4 - Orange
5 - Purple-brown
6 - Pink
7 - Reddish
8 -
9 -
0 - Other, describe in comments

Egg Devel
1 - Uneyed
2 - Eyed

Clutch Condition
1 - Dead eggs not apparent
2 - Dead eggs <20%
3 - Dead eggs >20%

Percent Clutch
1 - Barren, clean pleopods
2 - Barren, with empty eggs cases and/or stalks
3 - Clutch 1-29% full
4 - Clutch 30-59% full
5 - Clutch 60-89% full
6 - Clutch 90-100% full

Others
1 - Dead
2 - Alive
3 - Nemerteans in clutch
4 - Turbellarians in clutch
5 - Black mat
6 - Bitter crab disease
7 - "cottage cheese" disease
8 - Shell rust
9 - B. callosus

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FORM I

Appendix D.1. TAGGING AND EXPERIMENT I - SHORT TERM FLOY/PIT RETENTION

TAGGING DATE		DISC TAG		REPLACEMENT DISC TAG		FLOY TAG		PIT TAG		Carapace Length (mm)	Shell Condition	TAG RECOVERY DATE		Fate of Crab c/	COMMENTS
mm	dd	Number	Fate a/	Number	Fate a/	Number	Fate a/	Number	Det. b/			mm	dd		

a/ Tag Fate: "0" = Missing; "1" = Present
b/ Pit Tag Detected: "0" = Missing; "1" = Detected; "2" = Not detected
c/ Fate of Crab: "0" = Crab not recovered; "1" = Crab recovered and used in Exp. II; "2" = Dead on arrival; "3" = Other

FORM II

Appendix D.2. **EXPERIMENT II - BUTCHERING AND PIT TAG AUTODETECTION**

CRAB NO.	DISC TAG NO.	TAIL FATE a/	R5 LEG FATE b/	L5 LEG FATE b/	PIT TAG			COMMENTS
					Location c/	Hand Held Detected? d/	Auto-detected? d/	

a/ Tail Fate: "0" = Missing; "1" = Attached to carapace; "2" = Unattached to carapace but present on waste conveyor.
b/ R5/L5 Leg Fate: "0" = Missing; "1" = Attached to tail; "2" = Unattached to tail but present on waste conveyor.
c/ PIT Tag Location: "0" = Missing; "1" = In right, fifth leg; "2" = Loose but present on waste conveyor.
d/ PIT Tag Detected by Handheld/Autodetector: "1'" = Yes; "2" = No.

FORM III

Appendix D.3. **EXPERIMENT III - DUAL PIT TAG DETECTION**

CRAB NO.	DISC TAG NO.	RIGHT FIFTH LEG		LEFT FIFTH LEG		COMMENTS
		PIT TAG NO	DET. a/	PIT TAG NO	DET. a/	

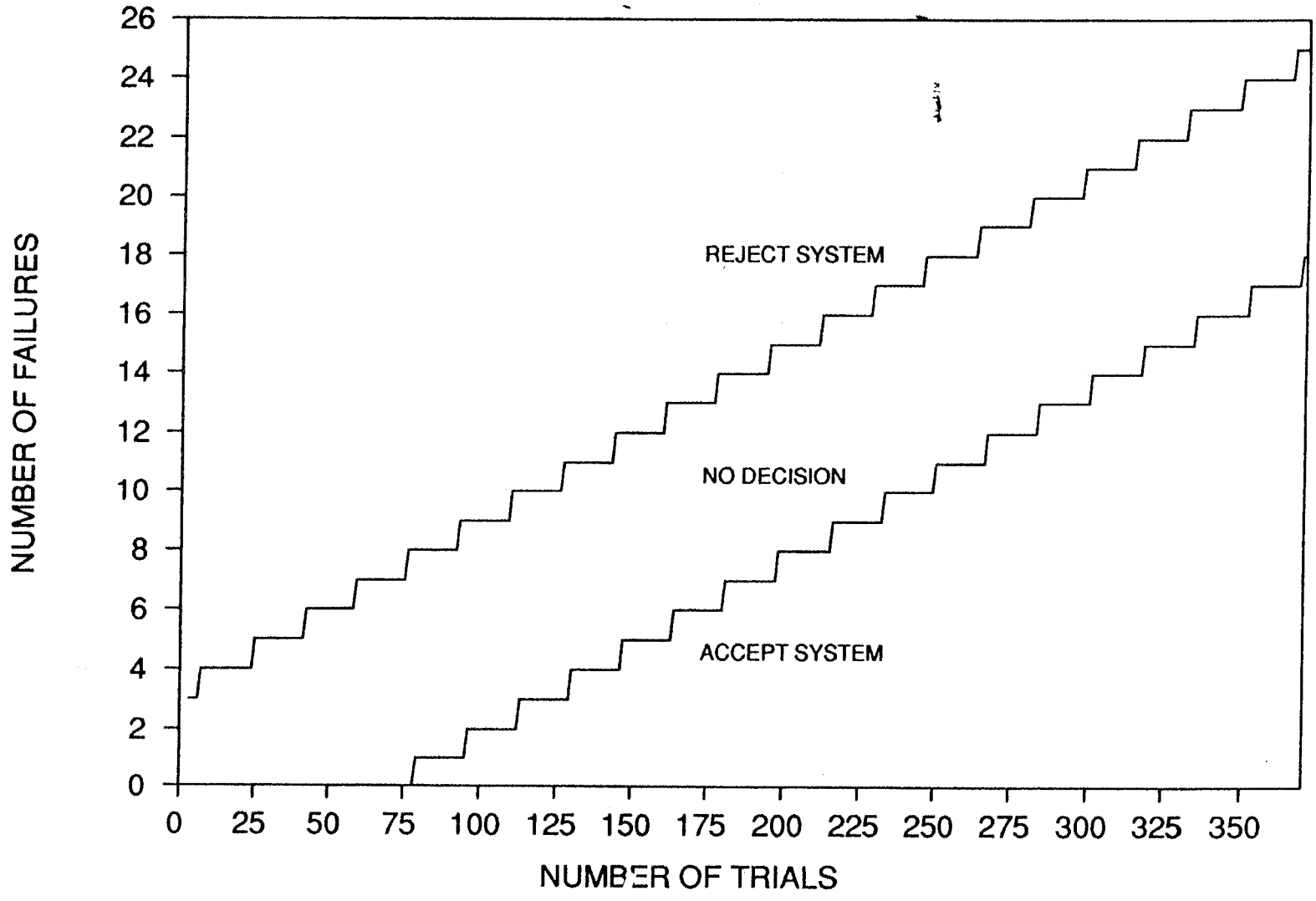
a/ Right and Left Leg Detection: "1" = Detected; "2" = Not detected

Appendix E.1. Rules for accepting or rejecting the prototype crab electronic identification system.

RANGE OF NUMBER OF TRIALS	ACCEPT SYSTEM IF NUMBER OF FAILURES EQUALS	REJECT SYSTEM IF NUMBER OF FAILURES EQUALS
3-6	*	3
7-24	*	4
25-41	*	5
42-44	*	6
45-58	0	6
59-75	0	7
76-78	0	8
79-92	1	8
93-95	1	9
96-109	2	9
110-112	2	10
113-126	3	10
127-129	3	11
130-143	4	11
144-146	4	12
147-160	5	12
161-163	5	13
164-177	6	13
178-180	6	14
181-194	7	14
195-197	7	15
198-211	8	15
212-215	8	16
216-228	9	16
229-232	9	17
233-245	10	17
246-249	10	18
250-263	11	18
264-266	11	19
267-280	12	19
281-283	12	20
284-297	13	20
298-300	13	21
301-314	14	21
315-317	14	22
318-331	15	22
332-334	15	23
335-348	16	23
349-351	16	24
352-365	17	24
366-368	17	25
369	18	25
370	18-21	22-25

* = too few trials to accept unit

Appendix E.2. SCHEMATIC OF ACCEPTANCE SAMPLING PROCEDURE



Appendix F.1. **ADF&G WESTWARD REGION CRAB TAG RECOVERY FORM**

SPECIES _____ **SEX a/** _____ **REGISTRATION AREA** _____ **RECORDER** _____

	External Tag Series & Number	Size (mm) King - CL Tanner - CW	Shell Age b/	Fate c/	CAPTURE Mo.	Day	Yr.	LATITUDE - N	LONGITUDE - E OR W		DEPTH (fm)	STATISTICAL AREA	ADF&G VESSEL NO.
1													
2													
3													
4													
5													
6													
7													

a/ If female crab record additonal data on back. b/ Shell Age: 0 = Soft; 1 = New; 2 = Old; 3 = Very Old. c/ Fate: 1 = Dead; 2 = Rereleased.

	Received Tag or Tagged Crab From: Who? When? Where? Address:	Recovery Location Data From: Who? When? Where? Address:	Vessel Name	Codes d	PIT TAGS ID Numbers & Letters
1					
2					
3					
4					
5					
6					
7					

d/ Pit Codes: 1 = Detected; 2 = Not detected (no Pit tag found upon dissection); 3 = Not checked (tail section unavailable); 4 = Not checked (tail section collected, must have flov tag attached).

Revised 7/91

Appendix F.2. Instructions for completion of the ADF&G Westward region crab tag recovery form.

Bristol Bay Red King Crab

Introduction

ADF&G initiated a tagging survey on legal and sublegal male red king crabs from the Bristol Bay area (Area T) in August 1990. The primary objective of the study was to implement a pilot mark-recapture study testing the feasibility of internal, Passive Integrated Transponder (PIT) tags in Bristol Bay male red king crabs. A total of 7,000 legal and sublegal crabs were tagged using internal (PIT) tags; half of these crabs were also marked using external, spaghetti (or Floy) tags (Figure 1). The role of onboard observers in the recovery of external tags during the November 1990 fishery was substantial as 10% of the 1990 Bristol Bay red king crab harvest was produced by this harvesting category. Onboard observers provide a unique opportunity for collection of tagged animals directly from the commercial fishery.

In September 1991, a tagging survey will be conducted in the Bristol Bay area **using external (Floy) tags only**. Approximately 7,000 legal and sublegal male red king crabs will be externally-marked using Floy tags. Recovery of crabs tagged in 1990 and 1991 is described below.

Tag Description

Both the 1990 and 1991 tags are identical in color and style. The tags are yellow with orange tabs. The yellow tubing has the tag number on it. The orange tab has 'LEAVE TAG ON CRAB-NOTIFY ADF&G' on one side; on the other side is the tag number. **Tag numbers are unique and sequential and are distributed as shown below:**

1990 Tag Numbers: 1-3,420

1991 Tag Numbers: 3,421-10,000

General Instructions

All tag recoveries should be noted on the attached form. A sample form is also attached. The form should be completed and submitted along with any tags (and tails from crabs tagged in 1990), to appropriate ADF&G staff at the time of debriefing.

-All sublegal crab are to be returned (alive) to the sea following the recording of tag recovery data.

-If a tagged crab from 1990 is caught (see tag number list above), please remove the tail section and place it in a ziplock bag with the Floy tag and freeze. Return these tails with completed tag recovery forms at your debriefing.

-Make sure names and addresses are complete and legible to ensure eligibility for tag reward program (see below).

Tag Reward Program

A tag reward program will be instituted to enhance tag returns during the 1991 Bristol Bay red king crab fishery. Specifics of the program are not available at this time, but will be fully described in a Department news release issued in early October. In the interim, onboard observers will collect names and addresses for all tag returns. Tag returns will be credited to the vessel captain if tag returnee information is unavailable.

- NOTE: Onboard observers are not eligible for tag rewards; please credit tag returns appropriately.

Recovery of Tags From Crabs Tagged by Other Agencies

The National Marine Fisheries Service (NMFS) and the University of Washington (UW) have instituted independent tagging programs on Bristol Bay red king crabs. Onboard observers will handle tagged animals from other agencies in the same fashion as for ADF&G tagged crabs. Tag recovery data may be recorded on the ADF&G form and returned to ADF&G at the time of debriefing.

Appendix F.3. Tag recovery and reward news release, October 15, 1991.

COMMERCIAL FISHERIES

NEWS RELEASE

ALASKA DEPARTMENT OF FISH & GAME

STATE OF ALASKA

Department of Fish and Game
Carl Rosier, Commissioner

Denby Lloyd, Director
Division of Commercial Fisheries

IMMEDIATE RELEASE

Westward Region

211 Mission Road
Kodiak, Alaska 99615

Contact: Dean Beers/Leslie Watson
Fishery Biologists

Date: October 15, 1991

ATTENTION ALL BRISTOL BAY RED KING CRAB FISHERMEN

The Alaska Department of Fish and Game (ADF&G) is asking for your help in the recovery of tagged red king crabs during the upcoming 1991 Bristol Bay red king crab season. Tag recovery data should provide fishery managers with additional data on the red king crab population in Bristol Bay. The ADF&G crab tag is yellow with an orange tab which says "LEAVE TAG ON CRAB - NOTIFY ADF&G". The Department is requesting that captains who catch tagged red king crabs do the following:

1. Record captain's name, vessel name, tag number, fate of the crab, date and location (latitude-longitude) of capture and depth on the attached form as described below.

2. For catcher processors, the observer will remove tags from legal males, record capture and reward data and return the crab to the processing area. Sublegal males should also be given to the observer to record and measure; these animals will be released live, with their tags left on, as soon as possible.

3. For catcher-only vessels, leave the tag on legal males, record the requested information and keep the tagged crabs separate from the others in the hold. Contact ADF&G personnel upon delivery so that the crab can be measured and the capture and reward information can be recorded. Release all sublegal males live, with their tags left on, after recording the capture data on the attached form.

4. Forward all tags and tag recovery information not collected by observers or Department personnel to the Dutch Harbor ADF&G office. Rewards up to $500 per tag will be given on a lottery basis for persons who return tags with capture information from legal-size crabs. Please complete the tag reward information section to assure your participation in the tag reward program.

ADF&G WESTWARD REGION CRAB TAG RECOVERY FORM

CAPTAIN'S NAME _____ VESSEL NAME _____

SPECIES _____ SEX _____ REGISTRATION AREA _____

	Tag Number	Fate a/	DATE			CAPTURE LOCATION		DEPTH (fm)	STATISTICAL AREA
			Mo.	Day	Yr.	N. LATITUDE	E OR W LONG.		
1									
2									
3									
4									
5									
6									
7									

a/ Fate: 1 = Dead; 2 = Rereleased; 3 = Retained.

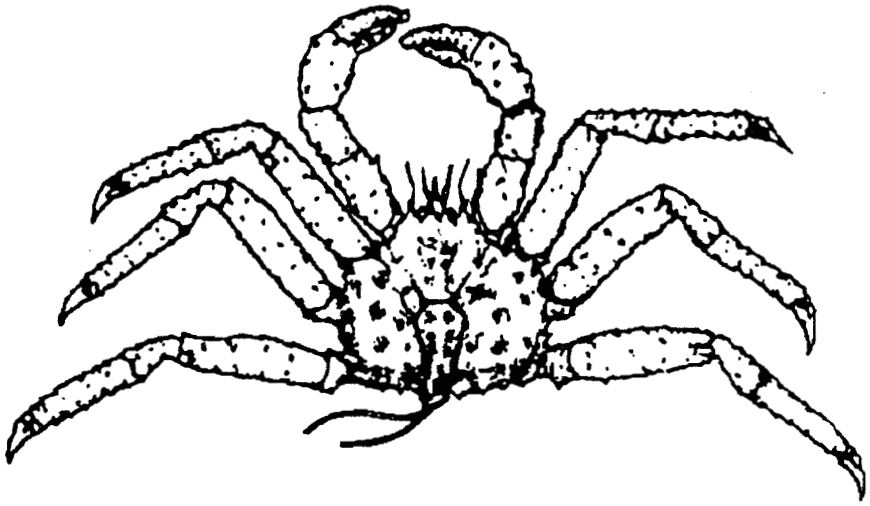
TAG REWARD INFORMATION:

	NAME	ADDRESS	PHONE NUMBER
1			
2			
3			
4			
5			
6			
7			

Revised 10/91

REWARD

FOR TAGGED KING CRAB



The ALASKA DEPARTMENT OF FISH AND GAME has tagged **Bristol Bay red king crab** and **Adak/Dutch Harbor brown king crab** to determine their distribution, growth, and migration.

RED KING CRABS have yellow tags with orange tabs.

BROWN KING CRABS have orange-red tags.

WHEN YOU CATCH A TAGGED KING CRAB:

1. Record vessel name, tag numbers, date, location and depth.
2. Leave tags on legal male crabs.
3. Record capture information and RELEASE all sublegal male and female crabs live, with their tags left on.
4. Report tagged crabs to ADF&G upon delivery OR forward all tags, capture and reward information to the address below.

REWARDS up to **$500** per tag will be given on a **LOTTERY BASIS** for persons who return tags with capture information from legal-size crabs. In addition to tag lottery entry, finders will receive the original tagging location of each tagged crab documented.

ALASKA DEPARTMENT OF FISH AND GAME
P.O. Box 308
Dutch Harbor, Alaska 99692-0308

Appendix F.4. Tag reward poster for returns of 1991 Bristol Bay red king crab and Adak/Dutch Harbor brown king crab.

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