

PROJECT OPERATIONAL PLAN FOR THE 2002
BRISTOL BAY RED KING CRAB TEST FISHERY PROJECT



By

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**ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES DIVISION
PROJECT OPERATIONAL PLAN**

Title: *Project Operational Plan for the 2002 Bristol Bay Red King Crab Project*

Yellow Book Project No(s): *TF-785 (Appendix A)*

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APPROVALS

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Headquarters' Receipt:	_____	_____
Headquarters' Recommendation:		
Further Review:	_____	_____
Approval:	_____	_____

FOREWORD

The Bristol Bay Test Fish Project (BBTF), authorized by the State of Alaska under the Test Fish Program (AS 16.05.050 (15)), funded this project. Initiated in 1990 as the Bering Sea Teat Fish Project (BSTF), project research has focused on the population dynamics of and fishing effects on Bristol Bay red king crabs. Triennial surveys of Norton Sound red king crab, Aleutian Islands golden king crab, and St. Matthew Island blue king crab stocks from 1995 through 2000 were also funded under the BSTF program. Operational plans for previous Bristol Bay Test Fish and BSTF projects are documented in Gish and Byersdorfer (2002), Gish et al. (2002), Tracy and Pengilly (1996 and 1997), Tracy et al. (1999), Watson and Pengilly (1992, 1993a, 1993b, 1994 and 1996), and Watson et al. (1995). Operational plans for past BSTF projects are itemized in Tracy et al. (1999). The program budget is itemized in Appendix A.

ABSTRACT

This report describes the operational plan for the 2002 Bristol Bay red king crab *Paralithodes camtschaticus* test fish project: a study on the short-term (12 to 42 days) and long-term (>1 year) effects of two types of handling injuries commonly observed during commercial fishing. A description of the objectives, study area, handling injury study design, tagging procedures, sampling methods, data analysis and reporting, and the comprehensive tag recovery effort are given. The Alaska Department of Fish and Game (ADF&G) will conduct the tagging project aboard the chartered *F/V Fierce Contender* (a 51.9-m pot vessel) in the Bristol Bay king crab registration area. The tag recovery effort will be conducted by ADF&G in Dutch Harbor, Akutan, False Pass, King Cove and Kodiak, and by at-sea observers.

INTRODUCTION

The economic importance of the Bristol Bay red king crab *Paralithodes camtschaticus* fishery is significant; recent dockside value of harvests have averaged over \$40 million annually from 1996 through 2001 (Bowers et al. 2002). Lethal and sublethal effects attributable to handling of crabs have been identified as a potential factor influencing stock productivity for a number of species (Kruse 1993). Studies designed to describe and quantify injury types and their effects in Bering Sea/Aleutian Islands king crab fisheries have been conducted both at-sea and in laboratory settings. Urban (1987) evaluated handling induced injuries of male and female red king crabs during the 1986 Bristol Bay commercial fishery and reported an overall injury rate of 3.2% among 6,732 crabs examined. Leg injuries or autotomies dominated injury type at 67.8%, compared to injury rates of around 10% each for chelae, rostrum and carapace. Long term mortality was not within the scope of that study, although results suggested the need for further investigations of the survival rate of crabs with crushed leg injuries versus those with autotomized limbs, whether crushed legs were later autotomized or not, and the long term impacts of rostrum injuries. At-sea examination in 1992 of 981 Bristol Bay male red king crabs subject to handling practices identical to those occurring during the commercial fishery indicated that, among injured crabs, carapace spine and rostrum damage were much more prevalent (71.9%) than leg injuries (28.1%) (Stevens and MacIntosh 1993).

Results from an at-sea observer study in 1997 and 1998 to describe and quantify handling-induced injury rates of female and sublegal male red king crabs during commercial fisheries in the Bering Sea indicated that 12.4% of the 6,874 crabs examined had at least one injury (Tracy and Byersdorfer 2000). Injuries identified were categorized by anatomical reference and classified as either 'major' or 'minor' based on the presence or absence, respectively, of soft tissue visible at the injury site, which was defined to include punctures, cracks, and other types of shell damage. Leg autotomies were classed as minor injuries since crabs are known to drop limbs during combat or to escape predators, with self-cauterization of the resulting wound. Of the injured crabs, 16.5% sustained major injuries and 83.5% had minor injuries. The most common major injury observed was leg damage (55% of major injuries) while damage to the rostrum was the most frequently observed minor injury (56% of minor injuries).

We initiated a tagging study during the 2001 ADF&G Bristol Bay test fish charter to assess effects to short and long term survival due to commonly observed handling injuries in red king crabs (Gish and Byersdorfer 2002). Approximately 3,000 legal-sized male Bristol Bay red king crabs were tagged prior to the commercial fishery in 2001. Approximately one-third of the crabs were in a control group (uninjured crabs), the remaining crabs were divided into two treatment groups. The first treatment group had a leg injury and the second treatment group had a rostrum injury. Preliminary results from that first year of our study indicated that both treatment groups were recovered at a 25% lower rate than the control group during the 2001 commercial fishery.

To substantiate our preliminary results from the 2001 study, we will repeat the at-sea handling study by applying the same injuries to tagged legal-sized male Bristol Bay red king crabs prior to the 2002 commercial fishery. We will analyze their recovery rates as compared to uninjured crabs during subsequent commercial fishing seasons. Recovery rates for crabs tagged in each of the two

treatment (injury) groups and the control (uninjured) group will be determined and compared. Recovery rates during the 2002 fishery of crabs tagged in 2001 will also be determined and compared among the two treatment groups and controls. Recovery rates during the 2002 and subsequent fisheries of control (uninjured) crabs tagged in 2001 and in 2002 will be assessed as a means to estimate the one-year survival of legal-sized males from preseason 2001 to preseason 2002. This operational plan describes a 18-day vessel charter in Bristol Bay to conduct the at-sea tagging and environmental and biological data collection portion of the study. The collection of Tanner crab genetic samples for an ongoing departmental stock identification project and an intensive tagged-crab recovery program during the 2002 and subsequent Bristol Bay red king crab fisheries are also described. Cost-recovery fishing will also be conducted during the vessel charter to offset expenses for the study and follow-up tag recovery activities.

OBJECTIVES

Prioritized objectives of the 2002 Bristol Bay red king crab test fish project are as follows:

1. Catch approximately 3,850 legal-sized male red king crabs (≥ 6.5 -inches carapace width) for delivery to Royal Aleutian Seafoods in Dutch Harbor between October 1 and 11, 2002.
2. Tag approximately 5,000 legal male red king crabs to ascertain if two artificially inflicted injuries affect the short-term recovery rate of tagged legal male red king crabs in the 2002 Bristol Bay commercial fishery and the longer-term recovery rate in the 2003 Bristol Bay commercial fishery. Also, assess the utility of comparing tag recovery rates of control (uninjured) crabs tagged preseason 2001 and preseason 2002 to estimate the one-year survival rate of legal male red king crabs in Bristol Bay from preseason 2001 to preseason 2002.
3. Obtain sex and length frequency data from a random sample of pots retrieved during the cost recovery portion of the charter.
4. Obtain Tanner crab genetic samples for an ongoing departmental stock identification project
5. Deploy two temperature and one conductivity/temperature/density data loggers per day to obtain environmental conditions concurrent with catch per pot data.

METHODS

Charter Itinerary

The 18-day cruise will be conducted aboard the chartered vessel *F/V Fierce Contender* from approximately September 23 to October 10, 2002 in Bristol Bay Management Area 'T'. The charter

will begin and end in Dutch Harbor, with the captain, four crewmembers, and four ADF&G staff biologists.

It is anticipated that the tagging part of the charter will be from approximately September 25 to October 6. The cost-recovery fishing will occur toward the end of the charter, the timing of which will be determined by the ADF&G crew leader and the vessel captain. It is anticipated this part of the charter will be from approximately October 7 to October 9.

If sufficient densities of red king crabs are not located initially, cost-recovery fishing will start earlier and delivery of those crabs may be in the middle part of the charter period. In this event, the at-sea research will be conducted after the delivery of cost-recovery crabs if sufficient charter time exists. Sufficient charter time for at-sea research will be determined mutually by the vessel captain and the ADF&G crew leader.

Handling Injury Tagging Study

Study Area and Design

The study area will be generally located where legal male red king crabs are concentrated in commercial quantities. The anticipated area of tagging and cost-recovery operations will be from 161°40' to 164°20' W long. and from 55°50' to 57°10' N lat., while staying approximately 22 nmi seaward of the Alaska Peninsula. (Figure 1).

Tagging will commence on the first day pots are pulled and will continue until all available tags have been distributed. Approximately 5,000 legal-sized male red king crabs, equally distributed among control (uninjured), leg-injured, and rostrum-injured crabs, will be tagged and released. The number of crabs tagged per pot, the distance between stations, and the total number of tagging stations will be adjusted during the charter to insure coverage of commercially exploitable concentrations of crab. It is anticipated that 50 to 60 tagging stations will be required to accomplish the tagging goal.

Stations will be set in any array necessary to optimize catch of legal males for tagging under the constraints of the survey schedule, with the restriction that stations are spaced a minimum 2 nmi from each other station. Each station will consist of three pots set in a line with a spacing of 1/8 (01.25) nmi between pots (Figure 2).

Each pot within a station will be randomly assigned for tagging and releasing captured legal-sized males as either Control (uninjured) crabs, Injury Type 1 (leg-crush) crabs, or Injury Type 2 (broken-rostrum) crabs. All legal males, up to a maximum of 30, will be tagged from each pot. Tagged crabs will be at liberty for approximately 10 to 21 days prior to opening on October 15 of the 2002 Bristol Bay red king crab commercial fishery.

Individual pot locations, set and pull dates, and CPUE of legal-sized male red king crabs will be recorded by the charter vessel captain on a "Pilot House Log" (see Appendix B) for all fishing conducted during the study.

Injury Description and Application

Only legal-sized male red king crabs with no obvious external injuries, including broken rostrums, new leg injuries, and previously autotomized legs, will be selected for each of the Control and two Treatment groups. Techniques employed for inflicting injuries on crabs in each of the treatment groups will be standardized to ensure uniform results. Injury types and general methods of application to treatment groups are as follows:

Type 1 – Leg-Crush Injury. This treatment will simulate a crushing injury to the merus (leg section), such as can occasionally occur when crab legs extend through the webbing while pots are brought aboard and are caught between the pot frame and fixed structures. A crushing injury that results in compressed and/or cracked legs, if severe enough, can produce leg autotomy. Although, the short- and long-term effects of such an injury on crab vitality and viability are unknown, perforating exoskeleton injuries are known to promote chitinoclastic bacterial infections in king crabs (Sindermann 1990).

Study results and anecdotal information suggest that, in Bristol Bay red king crabs, the propodus or the distal section of the leg is prone to crushing injury. A study by Niwa and Kurata (1968) showed the third walking leg to sustain an injury rate roughly two times or higher than those of other legs, including the cheliped. The anatomical site for Type 1 injury will be the propodus of the third right walking leg for crabs in this treatment group. The injury will be applied by using a hand-lever-gripping device (such as Vice Grips®). The device will be adjusted to a gap width or pressure setting appropriate to cause a uniform compression injury across the mid-point of propodus parallel to the dorso-ventral plane (i.e., the top and underside of the leg). The selected leg, propodus, and correct injury site are illustrated in Appendix B.7. Modification of the method and severity of the injury may be altered if crabs autotomize the selected leg prior to being released, or if crab viability appears poor immediately following application of the treatment as described.

Type 2 – Broken-Rostrum Injury. This treatment will simulate breakage of the rostrum, which occurs when crabs brought aboard commercial fishing vessels impact hard surfaces during removal from the pot. Rostrum injuries are the most common injury observed in the Bristol Bay red king crab commercial fishery (Tracy and Byersdorfer 2000). Although Zhou and Shirley (1995) found minimal short-term effects on crabs exhibiting rostrum injuries, the long-term effects on viability remain unknown. Chitinoclastic bacteria infection may be a significant consequence when, as noted above, the integrity of the exoskeleton is broken.

The anatomical site for the Type 2 injury will be the distal portion of the rostrum at approximately one-third of the total length. The injury will be inflicted by severing the exoskeleton of the rostrum at the specified location; special care will be given not to detach the underlying soft tissue. This will be accomplished with use of a hand lever-cutting device (such as wire cutters) by gripping the rostrum and twisting until broken. Modification of the method and severity of the injury may be altered if crab viability appears poor immediately following application of the treatment as described.

Tagging and Release Method

Study crabs will be tagged through the isthmus muscle using fluorescent-yellow Floy spaghetti tags fitted with fluorescent-orange tabs and locking metal sleeves. Tagging techniques are detailed in Appendix B. Tagged crabs will be released back into the water as close to the capture location as possible by direct placement in an upright position onto a low elevation inclined ramp leading to a ballast overflow trough. Overlap in release sites of crabs from different treatment pots within a station will be avoided to the extent possible. No overlap in release sites of crabs from different stations will be tolerated.

Handling Injury Study Catch Sampling

All crabs selected for tagging will be shell-aged and measured for carapace length (CL) to the nearest millimeter (mm). If all legal sized crabs from a pot are not tagged (e.g., due to condition of crabs or a catch of legal males in excess of the per-pot tagging goal), the remaining untagged legal crabs will be counted to obtain a total catch of legal crabs for the pot and the sampling fraction for measured crabs from the pot. Detailed catch sampling instructions and data forms are in “Shipboard Instructions for the 2002 Bristol Bay Test Fish Charter” (Appendix B).

Environmental Data Collection

Two temperature data loggers and one conductivity/temperature/density (CTD) data logger will be deployed per day. The temperature data loggers and CTD will be deployed in a manner that provides coverage over the range of area and depths fished during the charter; no more than one temperature data logger will be deployed at any single station.

Cost-Recovery Fishing

Cost-recovery fishing goals for the 2002 test fish charter are equivalent to the expense of the survey, tag recovery, and associated training costs. The total cost of FY02 test fish program is approximately \$167,280. The cost-recovery harvest necessary to attain this goal equals approximately 3,850 legal-sized male red king crabs at an estimated average weight of 6.5 pounds. Cost-recovery operations will occur at a time to be determined by the vessel captain and the ADF&G crew leader. It is anticipated that this portion will take place toward the end of the charter. If sufficient densities of red king crabs are not located initially, cost-recovery fishing will start earlier and delivery of those crabs may be in the middle part of the charter period.

Offloading of the catch will be monitored and sampled for size distribution by ADF&G staff to ensure accurate accounting of crabs for fish ticket documentation and correct payment to the State of Alaska.

Cost-Recovery Catch Sampling

Fishing data such as catch date, location, and CPUE of legal-sized male red king crabs will be recorded for each cost-recovery pot. Additionally, up to 20 randomly selected cost-recovery pots will be sampled each day to determine legal status, sex, size, and shell age distribution of red king crabs and other commercially important shellfish species. Detailed catch sampling instructions and data forms are provided in “Shipboard Instructions for the 2002 Bristol Bay Test Fishery Charter” (Appendix B).

Tag Recovery

Following completion of the at-sea portion of the study, an intensive tag recovery program will be carried out during the 2002 and 2003 Bristol Bay commercial fisheries to supplement the tag recovery data obtained from the 2001 fishery. Daily catches aboard all catcher-processors and approximately 10 percent of the catcher-only vessels will be monitored for tagged crabs throughout the season by at-sea observers. Additionally, ADF&G staff deployed at shoreside processors and observers deployed on floating processors will examine delivered catches for tagged crabs and interview vessel crews for recapture information. Fishing industry participation in the tag recovery program will be solicited by public notice through various media outlets, and tag recovery incentive rewards will be offered to all participants. When possible, all tagged crabs recovered will be measured, assessed for legal status (female and sublegal crabs have been tagged in previous studies), shell age, and (for legal males only) injuries to the rostrum and the propodus of the third right walking leg; the recapture date, location, and depth will be documented. Tag recovery instructions, and forms for observers and dockside samplers are provided in Appendix C.

Data Analysis

Tag recovery rates of crabs treated with Leg-crush and Rostrum injuries relative to those of uninjured (Control) crabs will be estimated and analyzed according to a band-recovery model (Brownie et al. 1985).

Let

$N_{C,j}$ = the number of Control crabs tagged prior to the fishery season in year j ,

$N_{L,j}$ = the number of Leg-crush crabs tagged prior to the fishery season in year j ,

$N_{R,j}$ = the number of Rostrum-injured crabs tagged prior to the fishery season in year j ,

$R_{C,j,k}$ = the number of Control crabs tagged prior to the fishery season in year j that were recovered during the fishery season in year k ,

$R_{L,j,k}$ = the number of Leg-crush crabs tagged prior to the fishery season in year j that were recovered during the fishery season in year k , and

$R_{R,j,k}$ = the number of Rostrum-injured crabs tagged prior to the fishery season in year j that were recovered during the fishery season in year k

for $j = 2001$ or 2002 , $k = 2001$ or 2002 , and $k \geq j$.

Also let

$p_{C,j,k}$ = The probability that a Control crab tagged prior to the fishery season in year j is recovered during the fishery season in year k ,

$p_{L,j,k}$ = The probability that a Leg-crush crab tagged prior to the fishery season in year j is recovered during the fishery season in year k , and

$p_{R,j,k}$ = The probability that a Rostrum-injured crab tagged prior to the fishery season in year j is recovered during the fishery season in year k

for $j = 2001$ or 2002 , $k = 2001$ or 2002 , and $k \geq j$.

Finally let

$\Pi_{L,j,k} = p_{L,j,k} / p_{C,j,k}$, and

$\Pi_{R,j,k} = p_{R,j,k} / p_{C,j,k}$

for $j = 2001$ or 2002 , $k = 2001$ or 2002 , and $k \geq j$.

$\Pi_{L,j,k}$ is estimated by

$$\pi_{L,j,k} = (R_{L,j,k} / N_{L,j}) / (R_{C,j,k} / N_{C,j}).$$

$\Pi_{R,j,k}$ is estimated by

$$\pi_{R,j,k} = (R_{R,j,k} / N_{R,j}) / (R_{C,j,k} / N_{C,j}).$$

Methods for making statistical inferences from the estimates, $\pi_{L,j,k}$ and $\pi_{R,j,k}$, are provided in Brownie et al. (1985).

SCHEDULES AND PERSONNEL

Dates	Personnel	Activity
02/01-09/22	Gish and Pengilly	Project planning, vessel charter procurement, operational plan, shipboard instructions.
09/01	Neufeld	Survey database application.
09/19-09/22	Burt, Alinsunurin	Survey staging activities.
09/23-10/11	Gish, Byersdorfer, Burt and Alinsunurin	Conduct at-sea fishing mortality study and cost-recovery fishing.
10/12	Byersdorfer and Neufeld	Initiate tag recovery program by informing the fleet prior to the commercial fishery and briefing observers and dockside samplers.
10/12-11/30	Chisum and Birdsong	Enter survey data electronically.
10/15-12/01	Gish and Byersdorfer	Edit and compile survey data, complete the survey summary report.

REPORTS

Date	Author(s)	Report
09/02	Gish and Pengilly	Project Operational Plan for the 2002 Bristol Bay red king crab project.
12/02	Byersdorfer	A summary of biological data collected during the 2002 Bristol Bay red king crab test fish charter.
06/03	Gish et al.	Effects of injury on recovery rates of tagged red king crabs in the 2001 and 2002 Bristol Bay commercial fishery.
06/03	Gish and Pengilly	One-year survival rates of as determined by recovery rates of tagged red king crabs in the 2002 Bristol Bay commercial fishery.

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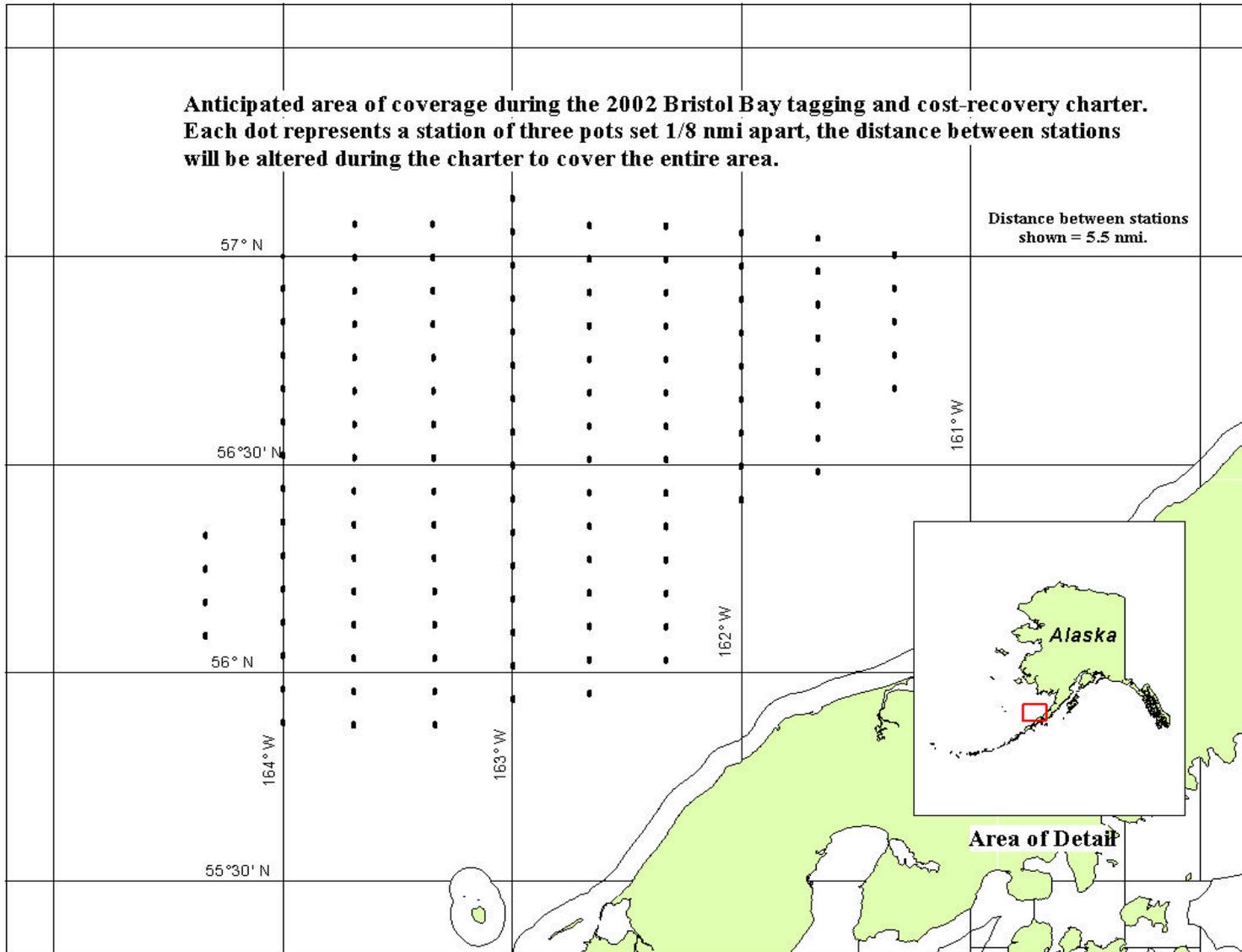


Figure 1. General location of the 2002 Bristol Bay red king crab cost-recovery fishery and at-sea injury study.

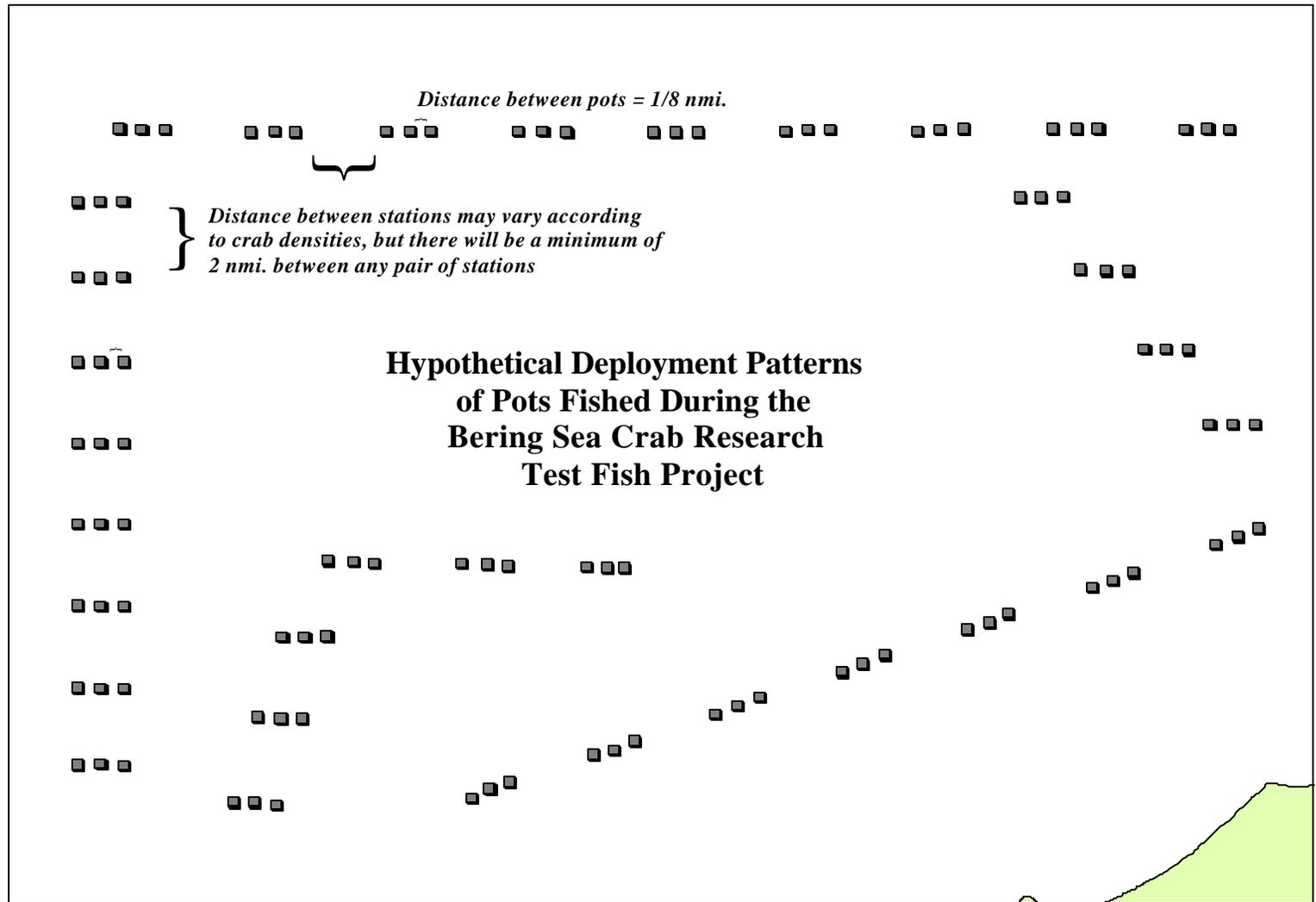


Figure 2. Hypothetical deployment pattern for stations containing control and treatment pots fished during the at-sea injury study planned for the 2002 Bristol Bay red king crab charter.

APPENDIX

Appendix A. FY03 Yellowbook for the Bristol Bay Red King Crab Test Fish Project.

PROJECT TITLE: Bristol Bay Red King Crab Test Fish PROJECT NUMBER: TF-785
 FISHERY UNIT: Bering Sea/Aleutian Islands Crab REGION: IV
 COMPONENT: 400110100-Fish. Mgmt. BPS# ____ LEDGER CODE: 11100741-11147785
 SUBCOMPONENT: _____ LOCATION: Kodiak
 LEGISLATIVE DIST: 27 PROGRAM ELEMENT: Test Fish-funded project
 FISHERIES AFFECTED: Bristol Bay SPECIES AFFECTED: Red King Crab
 USER GROUPS AFFECTED: Red King Crab Fishers, Vessel Owners, and Processing Industry

PROJECT DESCRIPTION

Funding for this project will support the state’s expenses for conducting shellfish research projects in the Bristol Bay king crab management area. The state’s commercial red king crab fisheries in this area have recently (1996 – 2001) been valued in excess of \$240 million. Studies funded under this project provide a better understanding of species biology and the impacts of commercial fishing. Insight toward effective shellfish management policy is a major product of this project. Interim management measures and Alaska Board of Fisheries actions are oftentimes dependent on information obtained from studies funded through the Bristol Bay Red King Crab Test Fish Project.

PROJECT OBJECTIVES

The Bristol Bay red king crab population is assessed to provide information for development of harvest levels and fishery management policy. Data will be collected on all crab captured during the vessel charter. Results of fishing activity experiment findings, and short and long-term tag recovery data will provide information on stock parameters such as natural mortality and fishery harvest rates. Data may also be used to design management strategies to meet the conservation and economic objectives established by the Alaska Board of Fisheries and the North Pacific Fisheries Management Council. These objectives are set forth in the Fishery Management Plan for Bering Sea / Aleutian Islands king and Tanner Crabs as established by the Magnuson-Stevens Fishery Conservation and Management Act.

BUDGET MANAGER: Robert K. Gish, Fishery Biologist III PCN: 11-1857

BUDGET DETAIL:	FY00	FY01	FY02	FY03
100 PERSONNEL SERVICES	149.4	171.4	30.9	37.0
200 TRAVEL	25.3	30.9	23.5	49.9
300 CONTRACTUAL	237.4	231.5	69.8	54.6
400 COMMODITIES	21.5	14.8	6.7	17.4
500 EQUIPMENT	25.5	10.5	0.0	8.5
700 GRANTS	0.0	0.0	0.0	0.0
PROJECT TOTALS:	459.1	459.1	130.9	167.3

-Continued-

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FUNDING SOURCES	FY00	FY01	FY02	FY03
FEDERAL RECEIPTS	0%	0%	0%	0%
GENERAL FUND	0%	0%	0%	0%
INTERAGENCY RECEIPTS	0%	0%	0%	0%
PROGRAM RECEIPTS	100%	100%	100%	100%
CIP FUNDS	0%	0%	0%	0%
STAFF MONTHS	12.0	23.7	2.8	3.8

PERSONAL SERVICES DATA:

PCN	R	S	LOC	R&S	NAME/TITLE	MM	OT	PREMIUM PAY				COST	
								SEA	HAZ	SWG	GRV		
1857	A	P	CAA	18	F	R. Gish/FB III	0.0	0	35	0	0	0	4,586
1131	A	S	BKB	14	B	R. Alinsunurin/FB I	1.0	30	35	0	0	0	9,718
1409	A	S	BKB	14	C	R. Burt/FB I	1.0	30	35	0	0	0	10,032
1117	A	S	CAA	14	K	S. Byersdorfer/FB I	0.0	30	35	0	0	0	5,074
1961	A	S	CAA	14	A	K Spalinger/FB I	0.0	30	0	0	0	0	1,031
1361	P	S	CAA	11	L	T. Dinnocenzo/FWT III	0.0	30	0	0	0	0	1,141
1825	P	S	CAA	11	K	K. Phillips/FWT III	0.0	30	0	0	0	0	1,099
1963	A	S	CAA	11	C	D. Higginbothan/FWT III	0.0	30	0	0	0	0	907
5287	P	S	CAA	9	C	D. Parson/FWT III	0.0	30	0	0	0	0	804
1637	P	S	BKB	8	K	T. Chisum/ADC III	0.0	30	0	0	0	0	998
1755	A	S	BKB	8	C	S. Kochuten/ADC II	0.0	30	0	0	0	0	911
1319	A	S	BKB	8	A	A. Birdsong/ADC I	0.0	30	0	0	0	0	714
PERSONNEL TOTALS						2.0	330	140	0	0	0	0	37,015

PROJECT LINE ITEM DETAIL:

LINE	DESCRIPTION	AMOUNT	COMMENT
72240	Field travel	34.3	travel for charter and tag recoveries
72500	Per Diem/Other costs	15.6	travel per diem, vehicle rental
73000	Charters/Other	54.5	vessel charter, observer testing
74520	Commodities	25.9	research equipment, tags and tag rewards, printing, telephone, freight and storage
TOTAL LINES 200-700:		130.3	
TOTAL PROJECT COST:		167.3	

Appendix B. Shipboard Instructions for the 2002 Bristol Bay Red King Crab Test Fish Charter.

Alaska Department of Fish and Game
Westward Region
211 Mission Road
Kodiak, Alaska 99615

September 2, 2002

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GENERAL INFORMATION

The purpose of this manual is to provide instructions and information relating to the 2002 Bristol Bay red king crab test fish charter. Refer to it for project objectives and sampling procedures. Expect standard methodologies to remain constant, but be prepared to accept changes to sample protocols when circumstances warrant.

This year's survey will be conducted aboard the charter vessel the F/V *Fierce Contender*. The vessel and her crew have been contracted to provide charter service to ADF&G for the 18-day period beginning on September 23 and ending on October 11. Any misunderstandings arising between the vessel and ADF&G crew in regard to the charter service requirements can be resolved by referring to the crew leader.

Following is a list of personnel participating in this year's red king crab test fish charter:

ADF&G Crew	Crew of the <i>F/V Fierce Contender</i>
Skip Gish - biologist crew leader	Glenn Casto - captain
Susie Byersdorfer - biologist	Erik VanKirk - engineer
Ryan Burt - biologist	Matt Ungaro - deckhand
Rachel Alinsunurin - biologist	Scott Vekich - deckhand
	Doug Stensgard - deckhand

Safety Briefing

Prior to commencement of the survey, the captain will provide the ADF&G crew with a shipboard safety orientation, which will at least include pulling the general alarm, the designation of emergency stations, and where to convene in case of an emergency. Specific information and/or vessel policies will be provided for each of the following:

1. Shipboard Safety Drill: Where personnel should be and what to do in emergency situations; the location of survival suits and EPIRBs. A surprise drill will also be held to test the ability of all crew members and ADF&G personnel to don survival suits and assist others to do the same.
2. General Vessel Orientation: The location of fire stations, medical supplies, safety placards, emergency information, and safe/hazardous areas on deck .
3. Vessel Rules: Storage location for rain gear and boots, galley etiquette, water use policy (showers, laundry, dishes, bathroom), etc.

The safety and well being of both the vessel and ADF&G crew as well as the vessel itself are the primary concern at all times during the charter. Obey the captain in this regard, as he is legally responsible for ensuring the safety of all onboard personnel. Do not go on the back deck or anywhere outside alone, especially when seas are rough. When the gear is being worked, pay attention to buoy lines and trailers, slick decks, and pots. ADF&G personnel will not stack pots, operate hydraulics, or throw buoy lines. Be aware of the crane and hydraulic blocks at all times, particularly when pots are being moved. Retreat to a safe area previously designated by the captain while pots are being set, retrieved, moved, or stacked.

Prior to departure, each ADF&G crew member should check their survival suit, lubricating or waxing the zipper to ensure proper operation. Personal EPIRBs can be checked by calling the US Coast guard in Dutch Harbor (581-3466) for rules on testing. Tested EPIRBs and strobes should be securely attached to survival suits.

E-mail Reporting / Radio Schedule

A daily status report on charter activities will be transmitted to ADF&G in Kodiak. This report will be by e-mail contact with Doug Pengilly (doug_pengilly@fishgame.state.ak.us) or Leslie Watson (leslie_watson@fishgame.state.ak.us). The crew leader, designated ADF&G crew member, or the vessel captain will relay the status report. During the directed research leg of the charter the number of stations pulled and legal male red king crabs tagged will be reported as outlined on the E-mail / Radio Log provided in Appendix B.1. During the cost-recovery portion of the charter the report will consist of the number and estimated poundage of crabs retained by the vessel, and the number of pots pulled for that day. If e-mail contact is not possible, a radio schedule will be maintained with the Dutch Harbor office to verify the well being of the vessel and crew; no data will be transmitted during this contact. This radio contact on SSB 4125 will be at 10:00 AM; if this schedule is missed a 2nd check will occur at 2:30 PM. The ADF&G office call sign is WIM 76 Dutch Harbor. Prior to departure a shore-based contact for the *F/V Fierce Contender* will be established and relayed to Doug Pengilly and Leslie Watson in Kodiak via e-mail.

Miscellaneous Shipboard Rules and Information

During the charter tasks and responsibilities will be delegated amongst the onboard ADF&G crew for the duration of the cruise. Any problems that arise should be channeled through the crew leader. Clean up all work areas used, including the galley table. All data should be kept as dry as possible and organized. Make sure the deck paperwork tracks with the pilothouse records; every pot will have a unique Sequential Pot Number that will enable cross referencing on a pot by pot basis. Although it is the crew leader's responsibility to ensure data integrity, (s)he will rely on other ADF&G crew for assistance. Be sure to ask the crew leader about any unexpected changes in sample protocols or anything else related to collecting data.

Completed data forms will be edited daily. This practice ensures that the often important short-term details of the day's events are not overlooked. There will be no compromise with regard to this responsibility. If time permits, the vessel pilot house logs will be entered into a spreadsheet on a daily basis using the laptop computer.

Prior to the vessel's departure from Dutch Harbor to the survey grounds, check off all items on the equipment list (Appendix B.2) including forms, sampling equipment, and personal gear (e.g., seasick medication). Maintain all sampling equipment by ensuring it is cleaned up and stored safely inside the vessel at the end of each day (calipers, clipboards, measuring sticks, etc.).

Keep a daily log of sampling activities, hours worked, contingencies, miscellaneous observations, Floy tag recoveries, sampling irregularities, etc. Record for later reference in this log details on the procedure used to apply experimental injuries for the tagging study. Included in the daily log should also be observations on conditions under which experimental treatments were applied, such as daily temperature, wind, and sea condition and observations on the time that tagged crabs by treatment type were out of the water prior to release. Any problems or concerns with experimental procedure should also be noted in the daily log. This log would also be appropriate for recording any photographs taken.

Offer assistance to the vessel crew whenever possible. ADF&G personnel are allowed to help out with some of the on deck activities that aren't inherently dangerous, such as filling bait containers. When time permits, offers for washing dishes, making coffee, cooking, and general cleaning should be routine. During previous charters the vessel crew has typically had a busier work schedule than the onboard ADF&G personnel and a cooperative effort toward maintaining living conditions on the boat can be a great benefit to everybody's morale.

There will be no home-packing of any animals captured during the survey by vessel or ADF&G crewmembers. All halibut (dead or alive) are to be placed overboard immediately. However, it is acceptable to consume mortally injured crabs, cod and other groundfish while at-sea. Collection of crabs for display or other purposes will be authorized through the crew leader only.

Additional Instructions and Reminders

1. Leave timesheets with Maryjane Rogers in Kodiak or Kathleen Herring in Dutch; project coding of regular and premium sea pay must be reviewed by crew leader prior to submission of time sheet.
2. CFEC cards must be aboard vessel (the crew leader).
3. Check your survival suit and EPIRP prior to departure.
4. Survey itinerary and schedules are reviewed in Appendix B.3.
5. All receipts for purchases to the crew leader prior to September 22.
6. If there are no forms to record other data you collect, make them up.
The Pilot House Logs must be completed at the end of each day.
Complete every column in every form as required.
7. Be careful and have fun.

SURVEY OBJECTIVES

Prioritized objectives of the 2002 Bristol Bay red king crab test fish charter and subsequent tag recovery program during the 2002 commercial fishery are as follows:

Cost-Recovery Fishing

Catch approximately 3,850 male red king crabs ≥ 6.5 -inches carapace width (CW) (25,000 pounds) for delivery to Royal Aleutian Seafood's in Dutch Harbor on or before October 11, 2001. Sample catches for species composition and size distribution from up to 20 randomly selected pots per day during cost recovery. Carapace lengths (or widths), legal status, shell age, and other associated data will be taken for all crabs caught in sampled pots.

Handling Mortality (Tagging) Study

This is second year of a study using at-sea tagging to determine short-term (<45 days) and long term (>1 year) mortality of legal male red king crab following injuries during capture and release.

Floy-Tagged Crab Recovery

Document all captures of tagged crabs, regardless of agency or date of tagging. Release crabs immediately after documentation is complete.

Environmental Data Collect

Four submersible temperature recorders will be randomly deployed on a daily basis. One conductivity/temperature/ density recorder will be deployed in a manner to cover all depths fished during the charter.

Photographic Documentation

Take a series of photographs documenting examples of the experimentally applied treatment injuries and the method for applying those treatments. When possible, take photos of various other crab injuries observed and how they occur, especially of rostrum breaks and leg crushes that the experimental treatments are meant to emulate. Other documentary photographs, with lower priority, include those of on-deck work and catch: sorting; tagging procedures; and male and female king, Tanner and snow crab. Keep a log identifying all photographs taken.

Genetic Sampling

Collect tissue samples from 100 autotomized Tanner crab *Chionoecetes bairdi*, snow crab *C. opilio*, and Tanner/snow crab hybrid legs and store in vials provided by the genetics laboratory.

METHODS

Catch Reporting

The e-mail report will be the number of stations and tagged crabs for the injury study portion, or the daily catch, estimated poundage of crabs retained by the vessel, and number of pots for the cost-recovery portion.

A daily log will be kept of activities, dates, any miscellaneous observations, Floy tag recoveries, problems, a running tally of how many crabs you have aboard, how many crabs were tagged, sampling irregularities, etc. All data forms will be reviewed for accuracy and completeness at the end of each day.

Pilot House Logs

The charter vessel captain will complete the Pilot House Logs (Forms 2 and 3, Appendix B.4), for each string fished during cost recovery and tagging. Check to ensure that the Pilot House Logs are completely filled out at the end of each day, including the catch per pot (C/P) for male red king crabs ≥ 6.5 -inches CW that are put in the tanks. All pots fished for tagging will be entered sequentially on Form 2 (Pilot House Log-Tagging Strings) and all pots fished for cost recovery will continue sequentially but be entered on Form 3 (Pilot House Log-Cost-recovery Strings). It is the crew leader's responsibility to make sure the captain completes this task. If the ADF&G crew is asleep during cost-recovery fishing, make sure the deck boss hails the C/P of legal males to the captain for recording.

Each pot will be assigned a Sequential Pot Number in the order the gear is set - i.e., the first station set would have sequential pot numbers 1-3, the second station set sequential pot numbers 4-6, and so forth. The sequential pot numbers are extremely important since they link the pot location, depth fished and soak time to the catch data. Prior to sampling each retrieved pot, the ADF&G crew will ask the captain to convey (via the loud hailer) the appropriate sequential pot number and record it on the Survey Data Form, also shown in Appendix B.4 (Form4). Sequential numbers for lost pots will be recorded on a blank row on the survey data form along with the words "LOST POT". Likewise, if a retrieved pot is unbaited, the sequential pot number is still recorded and the words "NO BAIT" written on the form.

Handling Mortality (Tagging) Study

The purpose of the handling study is to test for significant differences in catch rates of legal crabs following capture, injury and release. The issue of handling-induced mortality has been an on going topic of discussion and more research is needed.

The charter is 18 days and will be split into two sections: tagging and cost recovery. It is expected to take <1 week for the cost-recovery portion of the charter. The areas fished for tagging may also be prime sites for cost-recovery fishing; however, if any tagged crabs are recaptured during cost-recovery fishing in the tagging areas, cost-recovery fishing will need to be moved as necessary to

avoid any more recaptures. Cost-recovery fishing will commence once tagging is complete and will continue until the end of the charter. We would like to tag 5,000 legal male red king crabs.

Sample Design

A minimum of 10 tagging stations will be attempted each day. Each tagging station will consist of three pots spaced 0.125 nmi apart; geographic orientation of the pots may be arbitrary as long as the distance between any two pots is 0.125 nmi. Stations may be arrayed in any geographic pattern necessary for expedience and for staying on concentrations of legal crabs and the distance between individual stations may vary as long as stations are spaced a minimum of 2 nmi apart. One of the three pots in each station will be a control and the others will be treatment pots. The control pot will be recorded as Sample Type 0 on Appendix B.4, Form 4, the crushed-leg injury pot recorded as Sample Type 1, and the broken-rostrum injury pot as Sample Type 2. The type of pot will be randomly chosen for each station (see Appendix B.5).

Tagging Procedure

Tagging procedures will be identical for crabs captured in control and treatment pots, except the crabs in the treatment pots will be injured just prior to release. During tagging, it will not be necessary to sample the contents beyond what is required to obtain legal crabs for tagging. All healthy, non-injured legal male red king crabs up to a maximum of 30 crabs per pot will be tagged. Crabs will be measured (carapace length), “stuck” for legal status, shell-aged, tagged, and then released immediately after tagging (control crabs) or injury application (treatment crabs). Untagged legal males from each pot will be counted to obtain a total catch of legal males for the pot and the sampling fraction of measured crabs. Refer to Appendix B.6 for detailed Floy tagging procedures. Record all required data on the ADF&G Crab Survey Data Form (Appendix B.4, Form 4). For assigning and recording Tag Station Number, begin with station number 1 (remember that a single tagging station consists of three pots). Tag Station Number is not in the Pilot House Log, but individual pots are linked between the ADF&G Crab Survey Data Form and the Pilot House Log by the Sequential Pot Number. So, make sure that you know what Sequential Pot Numbers the tagging pots are and that they match those in the Pilot House Log.

All crabs should be handled gently during sorting, measuring, and tagging. In the control and treatment pots do not tag any crabs with cracked carapaces, torn leg segments, or any other major, new injury. Crabs with old injuries (regenerated legs, black caps, etc.) may be tagged.

Up to 30 healthy, uninjured, legal crabs in the treatment pots will be injured prior to release. An illustration of injury site placement is in Appendix B.7. Pliers or wire cutters will do the same injury to the same leg or rostrum. Repeatable and efficient methods for applying the experimental injury treatments will be established and documented in writing before any crabs are tagged and released. Experimental injuries must be applied to crabs in a timely and efficient fashion so that their time out of water is not significantly greater than that for control crabs.

The tags we will be using this year will be “D” series, numbered 10,000 to 15,000. In order to maintain organization and avoid erroneous recording of duplicate tag numbers, every effort should be made to employ the tags in numerical order.

Any recoveries of red king crabs tagged during previous surveys or the current 2002 ADF&G surveys will be documented on the ADF&G Tag Recovery Form (Appendix C). Following sampling for size, sex, etc., all previously tagged crabs will be re-released.

Cost-Recovery Fishing and Delivery, and Charter Vessel Payment

The purpose of cost-recovery fishing is to catch approximately 3,850 male red king crabs ≥ 6.5 -inches CW (approximately 25,000 pounds using 6.5-pound average weight). For reference, last year's survey average catch of legal crabs was 49 per pot. For this year's needs, this translates to approximately 79 pot lifts.

We need a minimum of \$167,280 to cover the cost of the Bristol Bay project. The bid price for red king crab from Royal Aleutian Seafoods is \$6.56 per pound. Delivery is to be on or about October 11, 2002.

Fish Ticket for Cost-Recovery Delivery

The crew leader will handle the paperwork for the delivery of crabs to Royal Aleutian Seafood; this transaction in no way involves the *F/V Fierce Contender* or the captain of the *F/V Fierce Contender*. A designated crewmember from ADF&G will verify and record the weight of every brailer of cost-recovery crabs offloaded during deliveries. Counts of crabs will be made for at least 6 brailers per delivery (this information will be used to calculate the average weight of the catch) and at least 100 crabs will be measured for biological and legal size by an ADF&G crew member or dockside sampler. If for some reason the crew leader is unable to oversee the transaction with the processor, complete the fish ticket by bringing the CFEC card to the processor's business office and fill in the required information as follows:

- record "Vessel Name" as "ADF&G-Kodiak 2002 Bering Sea Test Fish" (do not write the vessel name on any part of the ticket);
- compute the average weight of the crabs and record the appropriate proportion of the catch for each statistical area by weight and number of animals;
- weigh the deadloss and record on the ticket using the appropriate code;
- verify the poundage, and the price agreed upon in the processing contract;
- re-check the fish ticket for accuracy before you sign it, do not sign the fish ticket until you have received a check for payment-in-full (remember the state is tax-exempt);
- make sure the check is made out to: State of Alaska, 211 Mission Road, Kodiak, Alaska 99615.

Any disagreement with the processor on the cost-recovery settlement can be resolved by contacting the crew leader.

Payment for the Vessel Charter

Please ask the captain to send an invoice for the amount agreed to in the charter contract to ADF&G, ATTN Skip Gish, 211 Mission Road, Kodiak, AK 99615.

Random Catch Sampling

The ADF&G crew will count catches of retained crabs (≥ 6.5 ") from every pot pulled during cost-recovery fishing, and ensure that the captain records this data in the appropriate column on the pilot house log. A goal of up to 20 pots will be randomly selected for sampling (see Appendix B.8 for random sampling procedures). Record all required data (species, sex, CL or CW, legal or sublegal, shell age, egg clutch conditions, etc.) on the Crab Survey Data Form (Appendix B.4, Form 4). Record all data for each species according to protocols outlined below.

Recording Data

When a pot comes aboard, divide the catch of all crabs by species, and if possible subdivide by sex. Separate data sheets must be used for each sex of the same and separate species; separate species of the same sex may be recorded on the same sheet but must be delimited by skipping a few lines between each. Before sampling each pot, complete all header information (i.e. date, station number, buoy number, measurer, recorder) and record the sequential pot number on the survey data form. Once sampling has commenced, record the appropriate code for each data category using the choices provided at the bottom of the survey data form. Carapace length measurements to the nearest millimeter will be taken for all king crabs (and any hair crabs captured) from the posterior margin of the right eye socket to the midpoint of the rear margin of the carapace. Carapace width (CW) measurements will be taken to the nearest millimeter for all species of Tanner crabs. The measurement will be the straight-line distance across the carapace in-between the marginal spines at a right angle to a line midway between the eyes to the midpoint of the posterior portion of the carapace. Extra care should be taken to obtain accurate carapace measurements from crabs selected for tagging. Legal-sized male red king crabs are ≥ 6.5 -inches (≥ 165.1 -mm) in carapace width, measured outside the spines. Because there is a considerable size overlap of sublegal and legal-sized males with the same carapace lengths, the legal measurement of all king crabs less than 140-mm CL should be verified by with either a measuring stick or calipers.

Shell Aging

Shell age should be determined by examining the ventral side of the coxa (shoulders) of the walking legs (pereiopods) for discoloration and deterioration from scratching and other abrasive action attributable from prolonged contact of the crab's shell with the substrate. Although the following categories were developed for shell-age assessment of red king crabs, each can also be applied to other commercially important crab species encountered during the survey. Record shell age for each crab sampled as follows:

New-shell-pliable (code # 0) - Coxa and ventral surface of exoskeleton are shiny, not scratched or pitted. Legs are easily compressed when pinched since legs contain little meat at this time. Exoskeleton is fragile and subject to breakage when handled or dumped from the pot. If carapace is removed, the gills will be translucent to light cream in color. Crabs estimated to have had new, pliable exoskeletons for approximately 1-3 months.

New-shell (code # 1) - Coxa and ventral surface of exoskeleton are dull. Legs are mostly full of meat; meri not easily compressed by pinching. If carapace is removed, the gills will be a light cream color.

Old-shell (code # 2) - Distal portion of the ventral coxa is partially or totally covered with brown scratches or dots. Legs are full of meat, meri are not easily compressed when pinched. If carapace is removed, gills will be tan in color due to fouling by micro-organisms. Generally, male red king crabs which have retained their exoskeleton through a molt (“skipmolt”). May have barnacles and other fouling marine organisms on the carapace.

Very old (code # 3) - Distal portion of ventral coxa densely covered with black scratches or dots. Legs full of meat, meri not easily compressed when pinched. Tips of dactyls are worn, rounded, and black. If carapace is removed, gills will be dark gray or gray-black in color due to fouling by microorganisms. Crabs that failed to molt during consecutive growth cycles. Frequently covered with barnacles or other fouling organisms.

Other biological characteristics of red king crabs that should be given special attention during sampling include the following:

embryo color - normally appears purple (code #2) for uneyed eggs, or tan (code #1).

embryo hatching - under the ‘development’ column, uneyed eggs (code #1) is the most common.

diseases - black matt (code #5); cottage cheese (code # 7) and shell disease (also known as shell rust, code # 8) are the most common occurring diseases in red king crabs.

Ancillary Data Collections

Genetic Sampling

Collect muscle tissue from autotomized legs of 100 Tanner crabs, snow crabs and Tanner/snow crab hybrids from the Bristol Bay area. The samples will be placed in a SED (table salt-ETDA-DMSO) buffer solution to preserve the sample and stored in the vials provided. Vials will be sent to Stew Grant at the ADF&G genetics laboratory, 333 Raspberry Rd., Anchorage, AK 99518.

Photographic Documentation

Whenever time permits, activities aboard the charter vessel should be documented with photographs and video. The following photos of sampling and fishing activities are needed: rostrum and leg-crush injuries resulting from the experimental treatment; the method for applying experimental treatment injuries; examples of specific injuries that occur during capture and handling or prior to capture (broken rostrum, autotomized leg, smashed carapace, broken leg); how injuries occur during capture and handling (pot falling on crab, flinging crab overboard, kicking crab through scupper); sorting (dumping pot, tote, slides); tagging crab; as well as various items of biological interest. Edited video footage provides the best means of documenting the survey operation for future reference. A digital camera, 35mm SLR camera and film, and 8-mm format camcorder (with blank tapes) have been included in the survey equipment inventory. Note: All photographs should be documented with a short written caption relevant to what is being filmed (i.e., date, time and location, and photographic objective).

Environmental Parameters Sampling

Submersible temperature recorders (2) and the conductivity/temperature/density recorder will be deployed as often as possible and in a manner that will sample all depths fished during the charter; no more than one temperature data logger will be deployed at any single station.

Appendix B.2. Equipment List.

Personal Gear:

- survival suits with EPIRBs & strobe attached (4)
- rain gear, boots and gloves (4 pr liners, 5 pr rubber gloves) per person
- earplugs (12 pr)-3 per person
- Stormy Seas jackets (4) *2 will be brought from Kodiak
- EMT 1 medical jump kit (Dutch Harbor)

Books and charts:

- books
 - a. Hart- Pacific Fishes of Canada
 - b. Kessler-Alaska's Saltwater Fishes
- shipboard instruction manuals (6 copies)
- US Dept. Commerce-ESSA Bathymetric chart
- 2000-2002 ADF&G Commercial Shellfish Fishing Regulations

Office Supplies:

- rite-in-rain notebooks (5)
- pencils no. 2 (3 doz.) & or mechanical pencils plus extra lead (1 doz.)
- permanent black markers (3)
- paper clips (assorted)
- rubber bands (assorted)
- 10"X13" manila envelopes for data (15)
- calculator w/ extra batteries
- duct tape (1 lg. roll)
- 12" metal ruler
- pencil sharpener
- legal pads (3)
- sticky pads (2)
- 200 sheet ream of printing paper (1)

Sampling Equipment/Supplies:

- clipboards(4)
- 12" vernier calipers (8) *4 pr. from Kodiak
- 6.5" measuring sticks (4)
- 5.5" measuring sticks (2)
- tallywackers (1)

- ratchet and socket set plus ½"X 3" lag bolts (2 doz.)
- WD40 (1 cans)
- adjustable leg aluminum measuring tables (1) 4'X8' aluminum sampling table
- tube of silicon (1)
- skid fish totes (if needed)

Tagging Equipment:

- 5,000 series 'D' Floy tags
- ¼" dia. X 46" stainless steel rods (used as tag racks) (6)
- wire for tagging needles (2 rolls 16 & 18 gauge);
- wire cutters
- needle nose pliers(2)
- 1-1/2" pliers (2)
- 1-1/2" channel lock (2)
- file
- paint sticks (6)
- small wooden box w/ styrofoam cushion for needles (1)
- 5/8" closed cell foam sleeping pads

Electronics:

- Dell Inspiron laptop computer (Kodiak)
 - surge protector (1)
 - 25' extension cord
 - Minolta video camera + 4 tapes (Kodiak)
 - Minolta 35mm SLR + 8 rolls 100-400 ASA film (Kodiak)
-

Appendix B.3. Survey Itinerary and Schedule.

Date	Activity
9/23	depart Dutch Harbor/travel to grounds
9/24	set tagging pot gear
9/25	pull/set tagging pots
9/26	pull/set tagging pots
9/27	pull/set tagging pots
9/28	pull/set tagging pots
9/29	pull/set tagging pots
9/30	pull/set tagging pots
10/1	pull/set tagging pots
10/2	pull/set tagging pots
10/3	pull/set tagging pots
10/4	pull/set tagging pots
10/5	pull/set tagging pots
10/6	pull/set tagging or cost-recovery pots
10/7	set/pull cost-recovery gear
10/8	set/pull cost-recovery gear
10/9	set/pull cost-recovery gear
10/10	travel to Dutch Harbor
10/11	deliver cost-recovery crabs

Appendix B.4. Data Forms.

Form #1. 2002 Tagging/Cost Recovery Daily Tally and Cumulative Tagging/Catch Record.

Form #2. 2002 Pilot House Logs - Tagging Strings.

Form #3. 2002 Pilot House Logs - Cost-recovery Strings.

Form #4. ADF&G Crab Survey Data Form.

Form #5. Environmental Data Collection Form.

Appendix B.4. Form #4.

ADF&G CRAB SURVEY DATA FORM

SPECIES _____

VESSEL _____

SEX _____

STATION NUMBER

--	--	--

MEASURER _____

DATE:

--	--	--	--	--	--

BOUY NUMBER

--	--	--

RECORDER _____

SAMPLE TYPE

--

SAMPLE FACTOR

--	--	--

OF

--	--	--

PAGE _____ OF _____

SEQUENTIAL POT NUMBER	SPECIES	SEX	SIZE	CRAB (MM)	FISH (CM)	LEGAL	SHELL	EMBRYOS				OTHER	TAG NUMBER	COMMENTS
								COLOR	DEVEL.	COND.	% CLUTCH			
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														
26														
27														
28														
29														
30														

Crab Species

- L. aequispinus
- P. camtschaticus
- P. platypus
- E. isenbeckii
- Tanner hybrid
- C. bairdi
- C. opilio
- C. angulatus
- C. magister

Crab Species

- L. couesi
- C. tanneri
- Paralomis multispina
- Paralomis verilli

Sample type

- Control
- Leg-crush
- Broken-rostrum

Sex

- Male
- Female

Legal

- Sublegal
- Legal

Shell Age

- New-Pliable
- New
- Old
- Very Old

Live Egg Color

- Tan
- Purple
- Brown
- Orange
- Purple-brown
- Pink
- Reddish
- Other, describe in comments

Egg Development

- Uneyed
- Eyed
- Hatching
- Clutch Condition
- Dead eggs not apparent
- Dead eggs < 20%
- Dead eggs > 20%

Percent Clutch

- Barren, clean pleopods
- Barren, with empty egg cases and/or stalks
- Clutch 1-29% full
- Clutch 30-59% full
- Clutch 60-89% full
- Clutch 90-100% full

Other

- dead
- Nemertean in clutch
- Turbellarians in clutch
- Black mat
- Bitter crab disease
- "Cottage cheese disease"
- Shell disease
- Briarosaccus callosus
- Leatherback

Appendix B.5. Random Assignment of Treatments for Tagged Crabs by Pot within Stations.
 Pots within station are identified by the order in which they were set.
 "0" = control; "1" = Leg-crush treatment; "2" = Broken-rostrum treatment.

Station	Pot 1	Pot 2	Pot 3
1	0	1	2
2	1	0	2
3	2	0	1
4	2	1	0
5	1	0	2
6	2	1	0
7	0	2	1
8	2	1	0
9	0	1	2
10	1	0	2
11	2	1	0
12	1	2	0
13	0	2	1
14	0	1	2
15	0	2	1
16	0	2	1
17	2	1	0
18	2	0	1
19	2	1	0
20	1	2	0
21	0	2	1
22	2	1	0
23	2	0	1
24	2	0	1
25	1	0	2
26	2	0	1
27	1	2	0
28	2	0	1
29	1	0	2
30	1	2	0
31	0	1	2
32	1	2	0
33	1	2	0
34	2	0	1
35	2	1	0
36	2	1	0
37	0	2	1
38	1	0	2
39	2	0	1
40	1	2	0

-Continued-

Appendix B.5. (page 2 of 3)

"0" = control; "1" = Leg-crush treatment; "2" = Broken-rostrum treatment.

Station	Pot 1	Pot 2	Pot 3
41	2	0	1
42	2	1	0
43	0	2	1
44	0	1	2
45	1	0	2
46	2	0	1
47	2	1	0
48	0	1	2
49	1	2	0
50	2	0	1
51	2	0	1
52	1	2	0
53	0	2	1
54	1	2	0
55	0	1	2
56	1	2	0
57	1	2	0
58	0	1	2
59	2	1	0
60	0	2	1
61	1	2	0
62	1	0	2
63	2	1	0
64	1	0	2
65	1	0	2
66	2	1	0
67	0	1	2
68	1	0	2
69	2	0	1
70	1	0	2
71	2	0	1
72	1	2	0
73	1	0	2
74	0	1	2
75	2	1	0
76	1	2	0
77	2	1	0
78	1	0	2
79	2	0	1
80	2	0	1

-Continued-

Appendix B.5. (page 3 of 3)

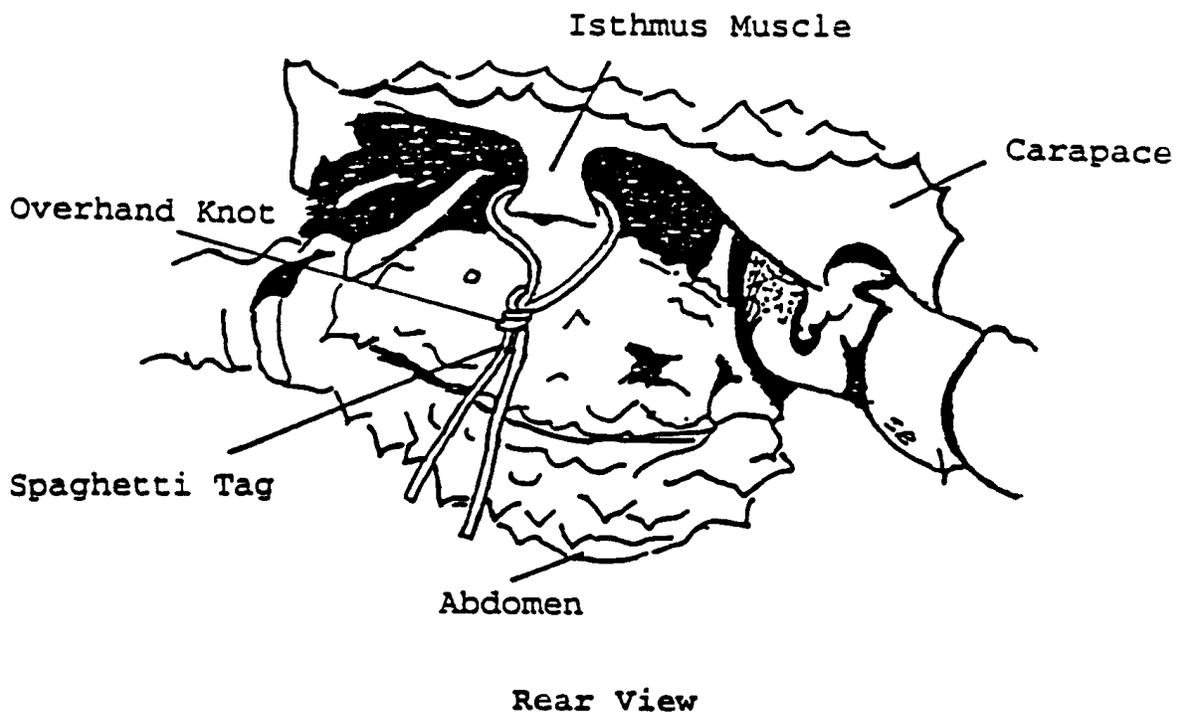
"0" = control; "1" = Leg-crush treatment; "2" = Broken-rostrum treatment.

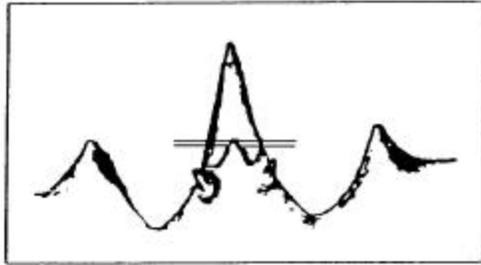
Station	Pot 1	Pot 2	Pot 3
81	0	1	2
82	0	1	2
83	0	1	2
84	1	0	2
85	1	0	2
86	2	1	0
87	0	2	1
88	2	0	1
89	1	2	0
90	2	1	0
91	2	1	0
92	1	2	0
93	1	2	0
94	0	1	2
95	2	1	0
96	1	0	2
97	2	0	1
98	0	2	1
99	2	0	1
100	2	1	0

Appendix B.6. Floy Tagging Procedures

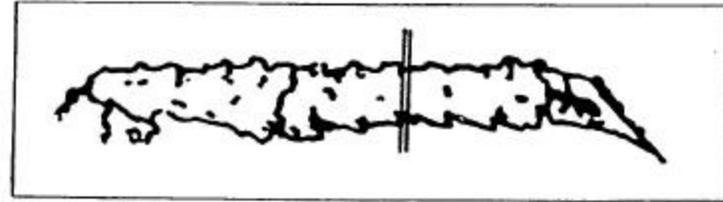
After being measured and shell-aged, crabs selected for tagging can be immobilized by securely holding the posterior portion of the body and gently pressing the anterior portion against the foam “tagging pad”. This measure will effectively pin the chelipeds between the body and tagging pad, and thus prevent the sampler from being pinched. While holding the crab in this position the isthmus muscle can be exposed by prying the posterior carapace margin away from the tergum. A ‘U’-shaped wire needle made of 16-gauge galvanized metal and threaded onto one end of the tag can be used to pierce the isthmus and draw the tag through. After equal lengths of the tag lay on either side of the isthmus, the needle is removed and that end inserted into the metal locking sleeve and drawn through until again flush with the other end. The locking sleeve is then forcefully crimped using a standard or slip-joint pliers.

If the locking sleeves do not adequately secure the loose tag ends, an overhand knot can also be used (see below). The knot should be tied as close to the isthmus muscle as possible while remaining visible outside the posterior carapace margin. Prior to pulling the knot tight, the two sides of the tag next to the carapace must be held in order to prevent the tag from tearing through the isthmus muscle. If a tag is torn through the isthmus muscle (either when threading the tag through or tightening the overhand knot), the crab must not be tagged again. On these occasions a note must be made in the ‘Comments’ section of the survey data form indicating the crab as damaged during tagging and therefore the tag (number) was not used.

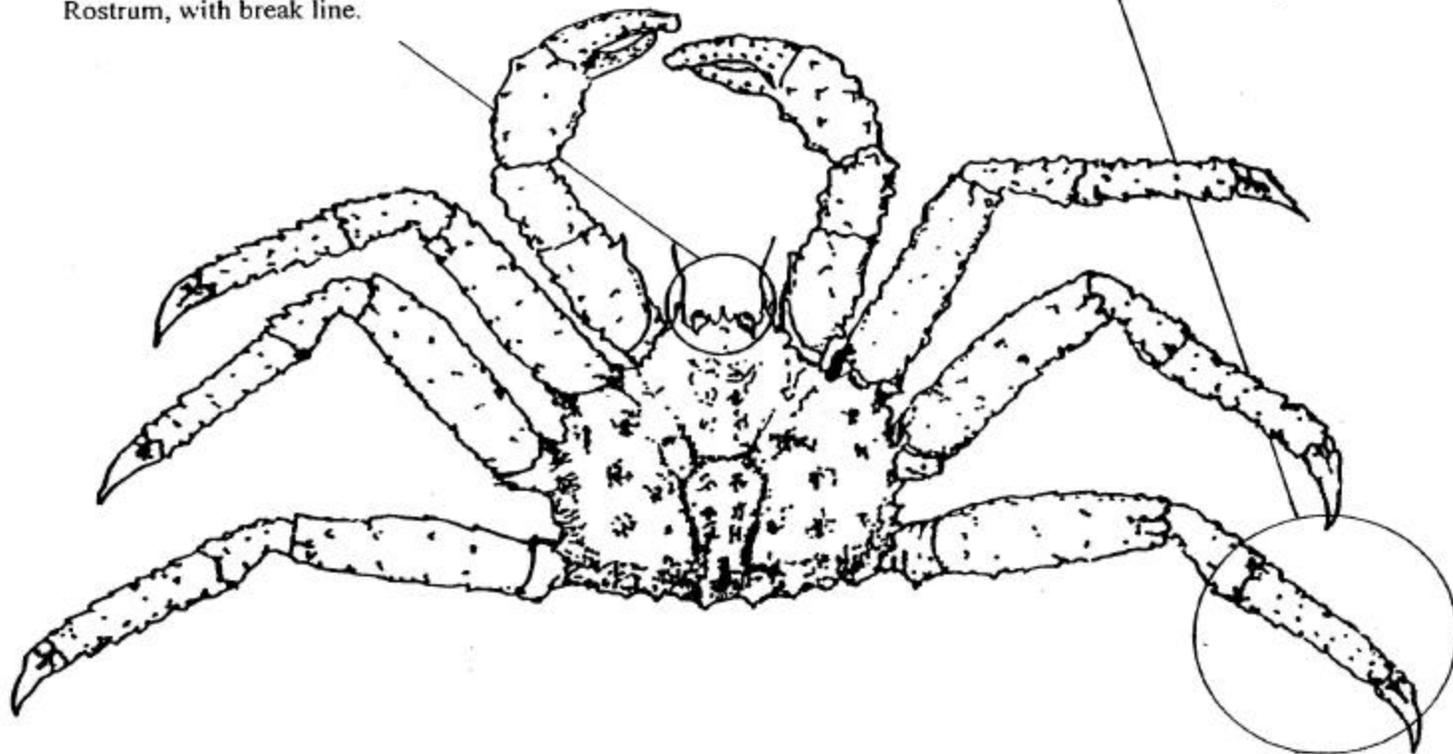




Rostrum, with break line.



Leg merus (propodus), with crush line.



Appendix B.7. Illustration of Handling Injury Site Placement.

Appendix B.8. Procedure for Selecting Sample Pots.

The goal is to obtain a systematic random sample of 20 pots per day during cost-recovery fishing. To do so, you will sample every n^{th} pot retrieved that day. To choose which pots to sample find out how many pots will be retrieved from the captain. The n^{th} pot will be where $n = \text{total pots for the day}/20$. Choose, at random, a number between 1 and n to start, then sample every n^{th} pot retrieved.

Appendix C. Instructions and form for recovery of tagged crabs during the 2002 Bristol Bay red king crab fishery.

Instructions for Dockside Samplers

Introduction

ADF&G tagged Bristol Bay red king crabs as part of a study focused on effects of handling injuries most commonly observed in the commercial fishery. Approximately 5,000 legal male red king crabs were recently tagged during the Bering Sea Crab Research Test Fish Project charter between September 23 and October 11 aboard the *F/V Fierce Contender*. Also, there are as many as 2,500 tagged crabs still at-large from the 2001 charter. Dockside samplers are a vital component of a successful effort to retrieve tagged crabs and tag recovery information through vessel captain and crew interviews. Recovery information from tagged crabs is necessary for analysis and interpretation of the tag study results, the objective of which includes estimating mortality resulting from injuries.

Tag Description

The 2001 & 2002 Floy tags are made of 14-inch fluorescent yellow tubing threaded through a fluorescent orange tab. Tags are attached to each crab at the isthmus muscle (between the posterior carapace and abdomen). The yellow tubing is imprinted with a 5-digit tag number. The orange tab has the inscription "LEAVE TAG ON CRAB - NOTIFY ADFG" on one side and the tag number inscribed on the reverse side. Tags from previous studies may be present and should be handled the same as tags in the current study.

General Instructions

A news release has been issued to Bristol Bay fishermen requesting their help in the recovery of tagged crabs. During catch sampling or the confidential interview, ask the captain and crew of each vessel whether tags or tagged crabs are aboard and if they have recapture information for retained tagged crabs or any caught and re-released at sea. Please collect this information during your interview and sample all tagged crabs for size, sex, and shell age. If you are given a tag with no other recovery information, note that fact on the recovery form and record the fate of the crab as dead. Let the offloading crew for the processor know that tagged crabs may be aboard, while keeping an eye out for them as the offloaders throw crabs into the brailers. Also, inform the foreman that there may be tagged crabs in deliveries and ask workers on the crab processing line for any tags or tagged crabs they may have recovered. Remember tagged crabs from previous studies may still be captured; obtain all relevant data from those crabs.

After sampling has been completed, tagged crabs should be handled as follows:

Legal male red king crabs will be returned to the processing line after all required data is recorded and the tag is removed.

Sublegal male and female red king crabs will be fully sampled, the tag removed, and the crab placed in the vessel's deadloss pile. Do not leave tags on live sublegal males or females and do not discard them over the side of the vessel.

-Continued-

All tag recoveries will be fully documented on the attached two-page form. All tags and tag-recovery forms, including those collected from vessel captains, should be returned to the research staff at the end of each workday.

Tag Reward Program

Tags and tagged crabs may come from the vessel crews, captains, or processing workers whereas recovery information may only come from the captain or his relief skipper. Tag reward hats will be given to individuals who present either a tagged crab or a tag to the dockside sampler and a tag reward hat will be given to the captain of each vessel that supplies capture location information. Dockside samplers will issue tag rewards at the time of sampling; if the reward is unavailable at the time tag is returned, the reward will be given directly or mailed to the tag finder at a later date. Rewards will be available from the research staff prior to the close of the fishery. Dockside samplers are not eligible to receive tag rewards. Be sure to credit tag returns appropriately.

-Continued-

Instructions for Shellfish Observers

Introduction

ADF&G has recently completed tagging Bristol Bay red king crabs which are part of a study focused on effects of handling injuries most commonly observed in the commercial fishery. Approximately 5,000 legal male red king crabs were recently tagged during the Bering Sea Crab Research Test Fish Project charter between September 23 and October 11 aboard the *F/V Fierce Contender*. Also, there are as many as 2,500 tagged crabs still at-large from the 2001 charter. At-sea observers are a vital component of a successful effort to retrieve tagged crabs, especially because of their unique opportunity to monitor pot catches for tagged crabs. Recovery information from tagged crabs is necessary for analysis and interpretation of the tag study results, the objective of which includes estimating mortality resulting from injuries.

Tag Description

The 2001 & 2002 Floy tags are made of 14-inch fluorescent yellow tubing threaded through a fluorescent orange tab. Tags are attached to each crab at the isthmus muscle (between the posterior carapace and abdomen). The yellow tubing is imprinted with a 5-digit tag number. The orange tab has the inscription "LEAVE TAG ON CRAB - NOTIFY ADFG" on one side and the tag number inscribed on the reverse side. Tags from previous studies may be present and should be handled the same as tags in the current study.

General Instructions

A news release has been issued to Bristol Bay red king crab fishermen requesting their help in the recovery of tagged crabs. Observers assigned to floating processors should ask for recovered tags (and completed tag recovery forms) from captains and crews of all vessels delivering catches. Observers assigned to catcher-only vessels and catcher-processors should inform the captain, crew, and processing workers (if applicable) to be on the look-out for tagged crabs and to set them aside and immediately contact the observer so that (s)he may sample the crab(s). Stress to the captain, crew, and processing personnel that the crabs should not be damaged or processed and that the tags should be left on the crabs until the observer samples them. Also, inform crews that tagged sublegal male or female crabs encountered must be re-released following sampling with tags intact. If you are given a tag with no other recovery information, note that fact on the recovery form and record the fate of the crab as dead.

After tagged crab sampling has been completed, crabs will be returned as follows:

Legal male red king crabs will be returned to the processing line after all required data is recorded and the tag has been removed.

Sublegal male and female red king crabs will be sampled as soon as possible and, *with the tag intact*, returned to the sea as gently as possible. If the tag is pulled out, the crab will bleed to death; if the tag is cut off, the possibility of multiple recaptures of that animal have obviously been eliminated.

-Continued-

All tagged crab recoveries should be fully documented as shown on the attached two-page form. Remember tagged crabs from previous studies may still be captured; obtain all relevant data from those crabs. All tags and tag recovery forms, including those collected from vessel captains should be returned to ADF&G in Dutch Harbor at the time of your debriefing.

Tag Reward Program

Tags and tagged crabs may come from the observer, vessel crews, captains, or processing workers whereas recovery information may only come from the observer or the captain or his relief skipper. Tag reward hats will be given to individuals who present either a tagged crab or a tag to the observer and a tag reward hat will be given to the captain of each vessel that supplies capture location information. Observers will issue tag rewards; the rewards will be provided to them during briefings. If the reward is unavailable at the time tag is returned, the reward will be given directly or mailed to the tag finder at a later date. Observers will not be eligible to receive tag rewards. Be sure to credit tag returns appropriately.

-Continued-

**Instructions for Completing the ADF&G Bristol Bay
Tagged Crab Recovery Form**

SIDE 1: Tag Recovery Information

SPECIES: Red king crab (species code = 921).

FISHERY CODE: TR02 (Bristol Bay Area T Red King Crab), or CR02 (CDQ fishery).

OBSERVER/DOCKSIDE SAMPLER: Your name.

SEQUENTIAL POT NUMBER: For observer use only. Record the sequential pot number when tagged crabs are recovered from pots selected for **bycatch sampling** (Do not record sequential pot numbers for tagged crabs recovered during any other type of sampling). If tagged crabs are found within the 600-crab **legal tally**, note this fact in the ‘Comments’ section on Side 2 of this form.

FLOY TAG SERIES & NUMBER: See tag description above. Year 2001 & 2002 tags are fluorescent yellow with a fluorescent orange tab, and are imprinted with a 5-digit number; tagged crabs from previous Bristol Bay tagging surveys may also be captured.

SIZE: Record the carapace length in millimeters (mm). Measure the crab twice before recording, as any growth information is extremely important, and 1-2 mm variation in measurement due to sampling error is relatively common.

LEGAL: Enter 2. Legal crabs are 6.5” or greater in carapace width outside the spines.

SEX: Male=1

SHELL: Soft=0; 9=New Pliable; New=1; Old=2; Very Old=3.

FATE: 1=Retained for sale; 2=Released alive; 3=Dead (not retained for sale; e.g., found in the deadloss pile or frozen for ADF&G/Observer sampling, etc.).

CAPTURE DATE: Use month-day-year format.

CAPTURE LOCATION: Latitude and longitude coordinates from the captain, in degrees and minutes, with minutes to the hundredths (convert seconds to hundredths of minutes). If lat./long. information is not available, write “N/A” across the lat./long. data columns.

DEPTH: In fathoms.

STATISTICAL AREA: Determine from statistical area charts unless identified as capture location by captain in absence of lat./long. coordinates.

ADF&G VESSEL NUMBER: The ADF&G number of the vessel that landed the tagged crab.

INJURIES: Rostrum broken off distal to rostral horn. 3^d right walking leg: most distal segment of the propodus (excluding the dactyl) broken (see attached).

RECEIVED TAG OR TAGGED CRAB FROM: Record name and address of the individual who gave you the tag or tagged crab only when the reward needs to be issued later; also, check the “Needs reward” box. When the reward has been given to the tag finder, check the “Issued reward” box.

RECEIVED RECOVERY LOCATION DATA FROM: Record full name, address and phone number. Check the “Issued reward” box or “Needs reward” box which ever is appropriate.

VESSEL NAME: The vessel that landed the tagged crab.

PROCESSOR NAME: The processor the tagged crab was delivered to.

SAMPLING DATE: Date the tag or tagged crab was received and/or sampled.

BRISTOL BAY TAGGED CRAB RECOVERY FORM

SPECIES Red King Crab

FISHERY CODE _____

OBSERVER/ _____

DOCKSIDE SAMPLER

SEQ. POT NO.	FLOY TAG SERIES & NUMBER	SIZE (mm) Carapace Length	LEGAL (a)	SEX (b)	SHELL (c)	FATE (d)	CAPTURE DATE			CAPTURE LOCATION				DEPTH (FM)	ADF&G VESSEL NO.	INJURY (e)					
							MO.	DAY	YEAR	N LATITUDE		W LONGITUDE				Rostrum	3rd Right	Walking	Leg		
1																					
2																					
3																					
4																					
5																					

- (a) **LEGAL:** 1 = Sublegal; 2 = Legal. (b) **SEX:** 1 = Male; 2 = Female. (c) **SHELL AGE:** 0 = Soft; 9 = new-pliable; 1 = New; 2 = Old; 3 = Very Old.
 (d) **FATE:** 1 = Retained for sale; 2 = Released alive; 3 = Dead (legal male deadloss). (e) **INJURY:** 0 = No injury. Rostrum injuries: 1 = fresh or 2 = healed. 3rd walking leg injuries: 1 = fresh autotomy, 2 = healed autotomy, 3 = crushed/broken & dangling, or 4 = broken/cut off.

Note any additional information on back of form.

	Received Tag or Tagged Crab From: Name, Address & Phone	Received Recovery Location Data From: Name, Address & Phone	Vessel Name	Processor	Sampling Date		
					Mo.	Day	Year
1	Need reward <input type="checkbox"/> Issued reward <input type="checkbox"/>	Need Reward <input type="checkbox"/> Issued reward <input type="checkbox"/>					
2	Need reward <input type="checkbox"/> Issued reward <input type="checkbox"/>	Need Reward <input type="checkbox"/> Issued reward <input type="checkbox"/>					
3	Need reward <input type="checkbox"/> Issued reward <input type="checkbox"/>	Need Reward <input type="checkbox"/> Issued reward <input type="checkbox"/>					
4	Need reward <input type="checkbox"/> Issued reward <input type="checkbox"/>	Need Reward <input type="checkbox"/> Issued reward <input type="checkbox"/>					
5	Need reward <input type="checkbox"/> Issued reward <input type="checkbox"/>	Need Reward <input type="checkbox"/> Issued reward <input type="checkbox"/>					

Edited by:

Date:

Entered by:

Date:

source: shellfish research 09/02

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