

PROJECT OPERATIONAL PLAN:

A STUDY TO TEST EFFECTIVENESS OF MODIFICATIONS TO COD-FISHING POTS IN
REDUCING CATCH RATES FOR TANNER CRAB *CHIONOECETES BAIRDI* AND
MAINTAINING CATCH RATES FOR PACIFIC COD *GADUS MACROCEPHALUS*.

PHASE II: PACIFIC COD CATCH RATES

by

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Commercial Fisheries Management and Development Division
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ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

PROJECT OPERATIONAL PLAN

Title: A study to test effectiveness of modification to cod-fishing pots in reducing catch rates for Tanner crab *Chionoecetes bairdi* and maintaining catch rates for Pacific cod *Gadus macrocephalus*. Phase II: Pacific cod catch rates

Yellow Book Project No(s): SP-426 (Appendix A)

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Date Submitted: March 2, 1998

Region: Westward
Fishery Unit: 4400
Fishery: Kodiak Area Pacific Cod Pot Fishery
Fishery Management Plan: Kodiak Area Pacific Cod Management Plan (5 AAC 28.467)

File Name: E:\pcod97\popII.doc

APPROVALS

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

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FOREWORD

This document provides the Project Operational Plan for the second phase of a two-phased field study on the effectiveness of cod-pot modifications in reducing bycatch rates of Tanner crab *Chionoecetes bairdi* without reducing catches of targeted Pacific cod *Gadus macrocephalus*. This phase focuses on evaluating the utility of pot modifications in maintaining Pacific cod catch rates relative to that of a "standard" cod pot. The first phase of field studies to evaluate the modifications relative to catch rates of Tanner crabs was conducted in November 1997 (Watson and Pengilly, unpublished manuscript).

INTRODUCTION

Pot gear accounts for a large and increasing portion of the Tanner crab *Chionoecetes bairdi* bycatch in the Gulf of Alaska Pacific cod *Gadus macrocephalus* fishery. The need to develop crab-bycatch reduction measures in the cod pot fishery is indicated by the depressed status of affected crab stocks, the expected effort increases in the pot fishery, and provisions in the Magnuson-Stevens Fishery Conservation and Management Act that place increased emphasis on reduction of incidental catch. The Scientific and Statistical Committee of the North Pacific Fishery Management Council (NPFMC) has identified expanded research on gear modifications and other methods for reducing bycatch as the top research priority relative to bycatch problems. Testimony presented to the NPFMC in 1996 suggested that significant reductions in crab bycatch in the cod pot fishery could be effected by simple alterations to cod pots. The goal of this research is to eliminate or reduce catch of Tanner crabs in the Pacific cod pot fishery without reducing catch rates of cod through use of low-cost designs or modifications to standard cod-fishing pots.

OBJECTIVES

The objectives of this study are:

1. to solicit pot fishermen and pot manufacturers for cod pot alterations to "standard" cod pots designed to reduce Tanner crab bycatch;
2. to test and compare the effectiveness of those alterations in reducing Tanner crab bycatch; and
3. to report the results in a manner that is understandable to pot cod fishing industry and managers and can be incorporated as a tool to reduce unwanted bycatch of Tanner crab in the pot cod fishery.

METHODS

Pot Design and Modifications

All known pot fishermen and pot manufacturers participating in Alaskan crab or cod fisheries were solicited during June through August 1997 for ideas on alterations to standard cod pots that would reduce Tanner crab bycatch but maintain catch rates of cod. Eleven suggested modifications or variants of modifications were received by September 1997. After consulting with Industry representatives (Mr. J. Stephens, United Fishermen's Marketing Association; Captain J. Bongen, FV *Pacific Venture*, Captain L. Dochtermann, FV *Stormbird*, Captain T. Olsen, FV *Enterprise*, and two Agency representatives (Dr. R. Otto, National Marine Fisheries Service; Dr. Shijie Zhou, Alaska Department of Fish and Game) three designs were chosen to include in this study. Choice of the three competing designs was based on presumed effectiveness, on corroborative information supplied by designers, and on feasibility of the alterations for use in a commercial fishery. All alterations chosen for study were designed to inhibit the entry of Tanner crabs into cod pots. The single submitted alteration that was designed to enhance the escape of captured Tanner crabs was not chosen for inclusion.

All designs studied in this project involve modifications to standard cod pots, i.e., rectangular king crab pots with tunnel eyes modified for groundfish consistent with 5 AAC 28.050 (e) (ADF&G 1997). Each of the three modified cod pots will be evaluated against the standard cod pot and each of the three modified pots will be fitted as standard cod pots prior to modification as described below.

Standard Cod Pot. A commercial size crab pot measuring 19.8 m x 19.8 m x 7.6 m (6½ ft x 6½ ft x 2½ ft), with 20.3 cm x 91.4 cm (8 in x 36 in) vertically-placed tunnel eye openings, cod triggers or fingers and halibut excluder devices placed vertically in the tunnel eye every 22.9 cm (9 in) (Figure 1). Each pot is webbed with 7.6 cm (3 in) stretched mesh.

False Tunnel Modification. A standard cod pot fitted with a trapezoidal web panel attached to the lower edge of the tunnel eye, extending horizontally and parallel to the bottom of the pot, outward to the tunnel sides at a height of 25.4 cm (10 in) from the base of the pot (Figure 2).

Slick Tunnel Ramp Modification. A standard cod pot fitted with a trapezoidal panel of 2-mm thick hard plastic attached flush to the tunnel ramp from the lower edge of the tunnel eye outward to the base of the tunnel and extending 10.2 cm (4 in) up the tunnel sides (Figure 3).

Vertical Board Modification. A standard cod pot fitted with 2.5 cm x 20.3 cm x 19.8 m (1 in x 8 in x 6½ ft) planed pine boards installed lengthwise across the bottom of each tunnel and flush with the bottom frame and lower 20.3 cm (8 in) of each side of the tunnel (Figure 4).

Comparison of Pacific Cod Catch Rates

Catch rates of Pacific cod in the modified pots will be compared to that in unmodified standard cod pots during March 9-20 1998 in known areas of Pacific cod concentration on the east side of Kodiak Island. The ADF&G research vessel, R/V *Resolution*, will be used to fish the study pots.

Deployment, Baiting, and Soak Time of Pots

A total of 16 pots (four standard cod pots and four of each of the three modification types) will be fished concurrently. Each pot will be baited with two hanging net bags, each containing 2.2 kg (5 lb) of chopped frozen herring. The 16 pots will be set in four groupings of four pots each. Each group of four pots (quad) will consist of a standard pot and one of each of the three modification types. Pots in a quad will be set at the corners of a square with 0.24 km (0.13 nm) sides. The arrangement by pot type within quads will be determined randomly and independently of other quads (Appendix B). The separate quads will be spaced a minimum of 0.93 km (0.5 nm) apart and in any array (e.g., square, rectangle, line, or curved.) necessary to enable placement within concentrations of Pacific cod. An example deployment of the 16 pots is provided in Figure 5.

All effort will be made to minimize differences in soak times of pots lifted on the same day within the same quad. Pots will be rebaited and reset following the constraints on deployment provided above. Target soak times will be 8 hr (short soak) and 16 h, however, soak times may exceed 24 h due to poor weather.

A minimum of 10 d of pot-lifting is targeted during March 9-20. Data on pot deployments (e.g., set locations, set time and date, and lift time and date) will be recorded by the vessel skipper in the Pilot House Log (Appendix C.1).

Catch Sampling and Data Recording

The following data will be recorded prior to releasing pot catches.

Catch Composition. Catch of all species (or species group) will be enumerated and recorded on the Species Composition Form (Appendix C.2). Daily examination of Pacific cod catch on the Species Composition Form will allow for adjusting plans for soak times and number of pot-lift days within the allotted March 9-20 study period.

Additional data from any Tanner crab, king crab, or Pacific cod, will also be recorded as outlined below.

Data Recorded From Tanner and King Crabs. Tanner and king crabs will be enumerated separately from crabs captured inside the pot and (if any) crabs that were retained on the outside surface of the pot. Crabs will then be separated by species and sex and, if necessary for subsampling (see below), into sublegal males, legal males, juvenile females and adult females.

Sex, shell age, and carapace width (Tanner crabs) or carapace length (king crabs) will be recorded from each crab. Legal or sublegal status of male, juvenile or adult status of female Tanners, and reproductive condition of females will also be recorded. Crab data will be recorded on the Crab Data Form (Appendix C.3). Data from crabs retained on the outside of a pot will be recorded on a separate sheet from crabs captured inside the same pot.

Subsampling of crab catch from a pot for recording of data is to be avoided. Subsampling will be performed only if the crew leader (Watson) judges that the catch of a crab species is so numerous that whole-catch sampling would interfere with completion of the day's fishing goals within regular working hours. If subsampling of a species within a pot is to be performed, the following guidelines: 1) the crab species will be divided into sublegal males, legal males, juvenile females, and adult females; 2) an appropriate sampling fraction will be estimated for each of those four sex-size groups (note that some or most of those groups may not need to be subsampled); 3) data from only one subsampled sex-size group will be recorded on any form; and, 4) the actual sampling fraction (number measured out of number captured) for the subsampled sex-size group will be determined and recorded on the Crab Data Form.

Data Recorded From Pacific Cod. Pacific cod catches will be fully enumerated. Lengths (unsexed) of all captured Pacific cod will be recorded on the Fish Length Form (Appendix C.4). On a time-available basis, Pacific cod will be tagged and released as per D. Urban (ADF&G, Kodiak, Alaska, personal communication).

Data Analysis

Statistical Tests for Significance of Variation in Pacific Cod Catch Rates Among Pot Types. Catch per pot or catch per unit effort (CPUE) of Pacific cod will be computed for each fished pot, including any cod retained on the outside of the pot. Catch per pot by pot type will first be examined by soak time (e.g., 8 h, 16 h, and other soak time groupings as needed) prior to performance of statistical tests to determine if any trends attributable to soak time may exist that would warrant blocking by soak time.

Pacific cod CPUE will be analyzed according to a repeated measure model in which the data from a single quad is treated as a four-variate random variable (with CPUE of cod in the standard cod pot, in the false tunnel pot, in the slick tunnel ramp, and the vertical board pot comprising the four components of the random variable). Results for one quad will be assumed to not influence the results of any other quad (i.e., the four-variate random variables are assumed to be mutually independent). Pot types within each quad will be ranked from 1 (lowest CPUE for quad) to 4 (highest CPUE for quad). Friedman's test (Conover 1971) will be used to test the null hypothesis,

H_0 : Each ranking of pot type by Pacific cod CPUE within a quad is equally likely,

against the alternative hypothesis,

H₁: At least one of the pot types tends to yield larger Pacific cod CPUEs than at least one other pot type.

Examination of Size Frequencies and Other Exploratory Data Examinations. Data summaries that may aid in interpretation of results of statistical tests or in formulating new hypotheses will be performed. Those data summaries will include, but may not be limited to the following.

1. CPUE of Pacific cod by pot type will be summarized and compared.
2. Length frequency distributions for unsexed Pacific cod will be prepared for each pot type and compared.
3. Number (if any) of Pacific cod retained outside of pots will be summarized by pot type and soak time.
4. CPUE of Tanner crab by pot type will be summarized and compared.
5. Carapace width frequency distributions for male and female Tanner crabs will be prepared for each pot type and compared.
6. Number (if any) of Tanner crabs retained outside of pots will be summarized by pot type and soak time.

SCHEDULES

DATE(s)	Activity
February 23-27	Organize all forms and supplies
March 6	Load pots on vessel, <i>R/V Resolution</i>
March 9	First set of 16 baited pots in four quads of four pots.
March 9-20	Period allotted for fishing experiment
March 20	Off-loading pots from vessel
March 23-25	Data entry/edit
March 25-May 1	Data analysis, results completed as an RIR (Project Biometrician, Principal Investigators)
May 30	Project completion report; submit to No. Am. Jour. Fish. Manag.

REPORTS

Watson L.J., D. Pengilly, and D.R. Jackson. 1998. A study to test effectiveness of modification to cod-fishing pots in reducing catch rates for Tanner crab *Chionoecetes bairdi* and maintaining catch rates for Pacific cod *Gadus macrocephalus*. Phase II: Pacific cod catch rates. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K98-XX, Kodiak. Scheduled completion date: May 1, 1998.

Watson L.J., D. Pengilly, and D.R. Jackson. 1998. A study to test effectiveness of modification to cod-fishing pots in reducing catch rates for Tanner crab *Chionoecetes bairdi* and maintaining catch rates for Pacific cod *Gadus macrocephalus*. Submission to the North American Journal of Fishery Management. Scheduled completion date: May 30, 1998.

LITERATURE CITED

- Alaska Department of Fish and Game (ADF&G). 1997. 1997-1998 Groundfish fishery commercial fishing regulations. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Juneau.
- Conover, W.J. 1971. Practical nonparametric statistics. John Wiley and Sons Inc., New York.
- Watson, L.J., D. Pengilly, and D.R. Jackson. MS. Effects of modifications to cod-fishing pots in reducing catch rates for Tanner crabs *Chionoecetes bairdi* and maintaining catch rates for Pacific cod *Gadus macrocephalus*. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, unpublished manuscript, Kodiak.

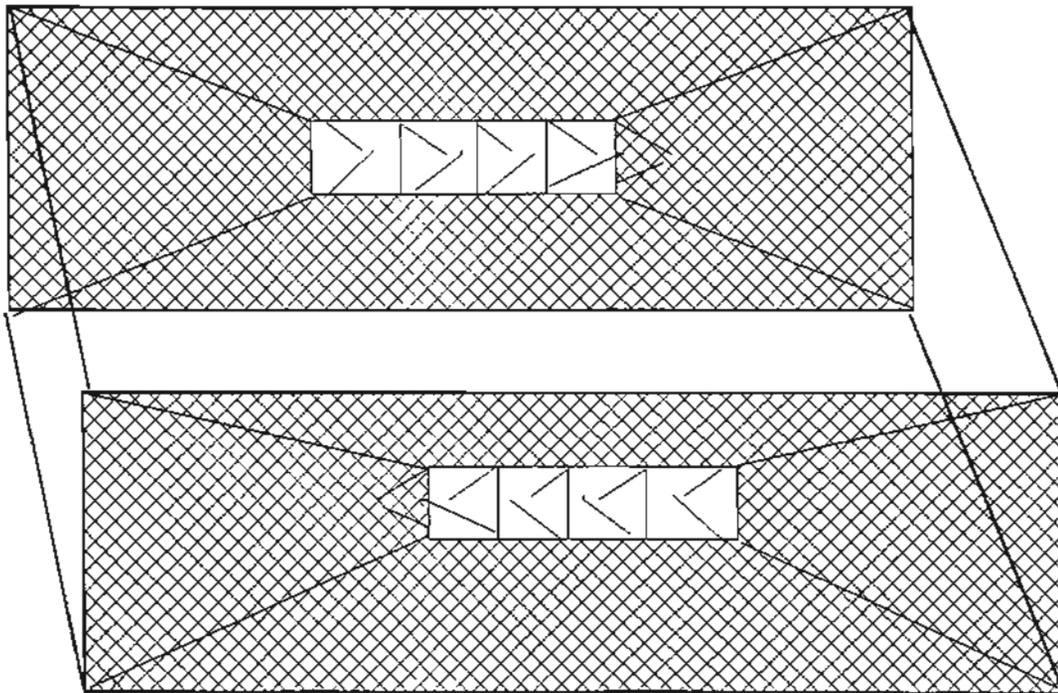


Figure 1. Standard cod pot with cod triggers and vertical halibut excluders installed in each tunnel eye.

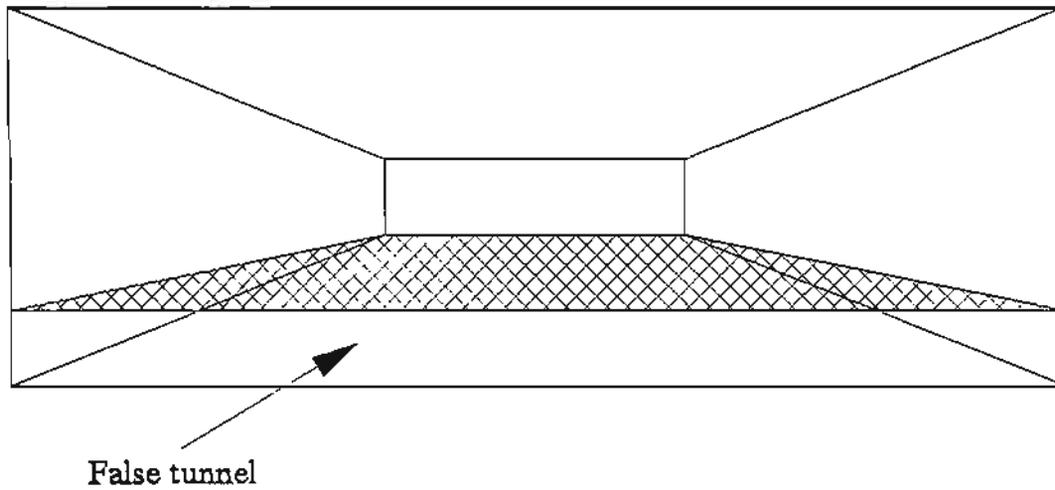


Figure 2. False tunnel modification to a standard cod pot. Cod triggers and halibut excluders are not shown so that the trapezoidal web panel is clearly shown.

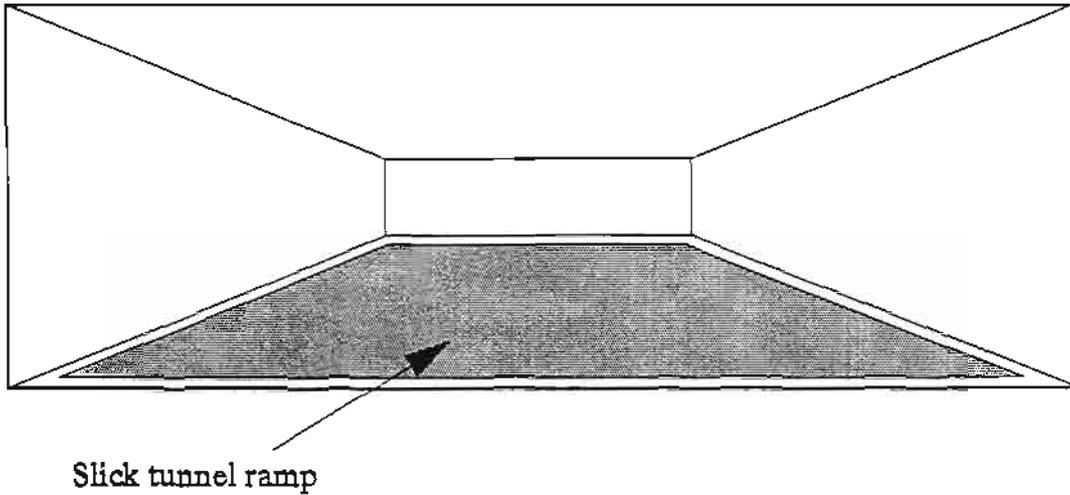


Figure 3. Slick tunnel ramp modification to a standard cod pot. Cod triggers and halibut excluders are not shown so that the trapezoidal plastic tunnel ramp is clearly shown.

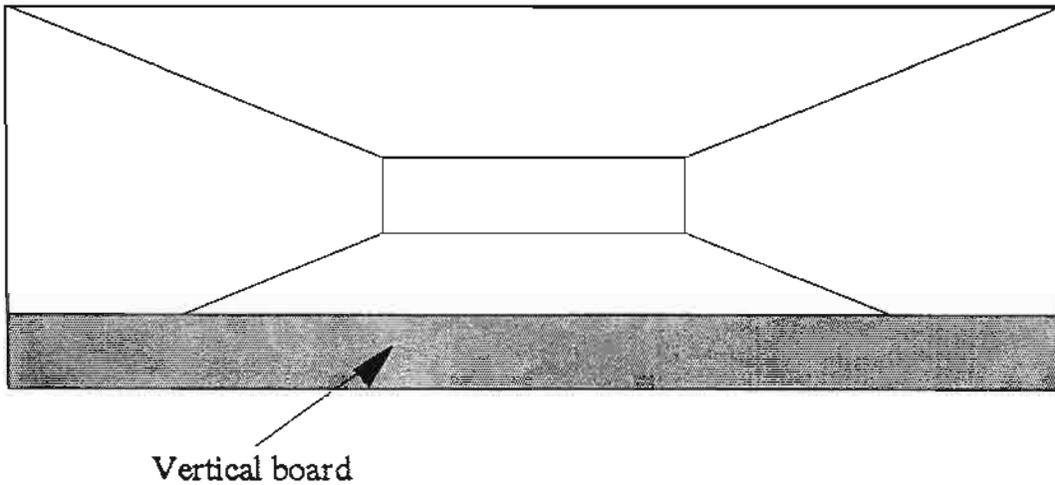


Figure 4. Vertical board modification to a standard cod pot. Cod triggers and halibut excluders are not shown so that the vertical board is clearly shown.

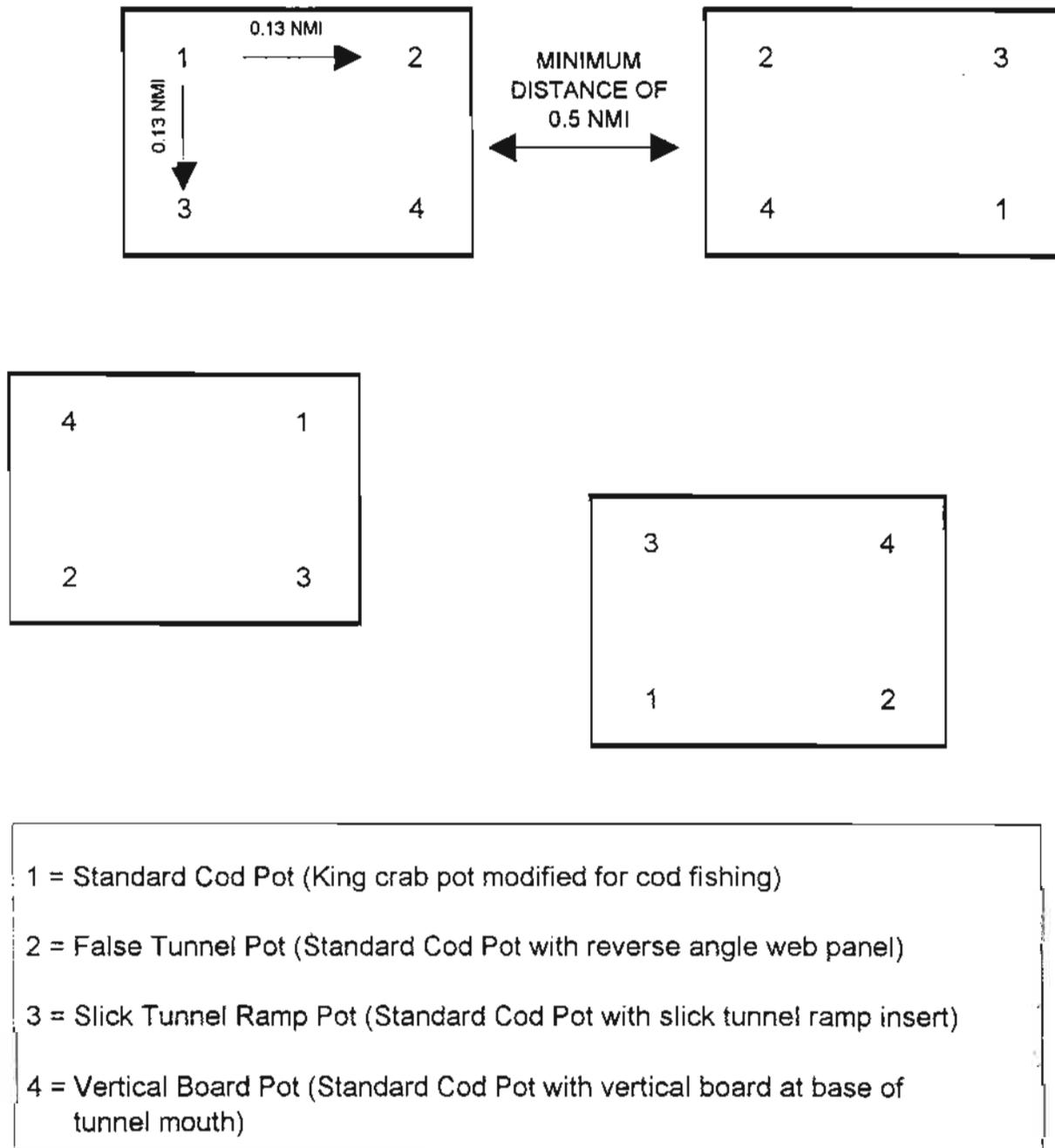


Figure 5. Sample pot deployment pattern showing placement of 16 pots. One of each pot type per quad is randomly placed approximately 0.13 nmi apart. The quads are a minimum distance of 0.5 nmi apart but can be laid out in any direction from each other.

APPENDICES

Appendix A. 1998 Yellowbook allocation for the 1997 modified pot cod study.

Project Number: SP-426

Project Title: Cod Pot Study

Region: 4 Westward
 Fishery Unit: 4400 Interagency Receipts
 Location: CAA Kodiak
 Program Element:
 Funding Level:

Ledger Code: 11340231
 Component Code: 4001010700 Special Projects
 Legislative District: 11,12
 Region Priority: 4

Project Description:

Pot gear accounts for a large and increasing portion of the Tanner crab bycatch in the Gulf of Alaska Pacific cod fishery. The need to develop crab-bycatch reduction measures in the cod pot fishery is indicated by the depressed status of affected crab stocks, the expected effort increases in the pot fishery, and provisions in the Magnuson-Stevens Fishery Conservation and Management Act that place increased emphasis on reduction of incidental catch. The Scientific and Statistical Committee of the North Pacific Fisheries Management Council (NPFMC) has identified expanded research on gear modifications and other methods for reducing bycatch as the top research priority relative to bycatch problems. Testimony presented to the NPFMC in 1996 suggested that significant reductions in crab bycatch in the cod pot fishery could be effected by simple alterations to cod pots.

Project Objectives:

1. To solicit pot fishermen and pot manufacturers for cod pot alterations designed to reduce Tanner crab bycatch.
2. To test and compare the effectiveness of those alterations in reducing Tanner crab bycatch.
3. Test and compare the effectiveness of those alterations in maintaining catch rates of Pacific cod.

Budget Manager: 11-1202 Douglas Pengilly

Budget Manager Title: Fishery Biologist IV

BUDGET DETAIL	Prior Year Allocations			Summary FY 98 Allocation
	FY 95	FY 96	FY 97	
71000 Personnel Services	159.5	22.9	32.5	44.4
72000 Travel	1.1	0.0	2.5	0.9
73000 Contractual	0.0	0.0	5.0	47.5
74000 Commodities	0.0	0.0	8.0	10.5
75000 Equipment	0.0	0.0	5.0	0.0
Project Totals	160.6	22.9	53.0	103.3
1002 Federal Receipts	0.0	0.0	0.0	0.0
1003 General Fund Match	0.0	0.0	0.0	0.0
1004 General Fund	0.0	0.0	0.0	0.0
1005 Program Receipts	160.6	22.9	0.0	0.0
1007 Interagency Receipts	0.0	0.0	0.0	0.0
1024 Fish and Game Fund	0.0	0.0	0.0	103.3
1061 CIP Funds	0.0	0.0	0.0	0.0
1091 DPR Funds	0.0	0.0	53.0	0.0
Staff Months	0.0	5.0	5.0	9.0

FY 98 Allocation

9/30/97

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Appendix A. (page 2 of 3).

Project Number: SP-426

Project Title: Cod Pot Study

Region: 4 Westward
 Fishery Unit: 4400 Interagency Receipts

Ledger Code: 11340231
 Component Code: 4001010700 Special Projects

PCN	Job Title	Name	R	S	S	Loc	Mo	SEA	RDO	OT	HAZ	GR	SW	SB	Total Salary
11-1361	FWT III	Dinnocenzo, Thomas	11	M / M	PE	CAA	2.0			35					\$10,363
11-1428	FB I	Watson, Leslie	14	J / J	PE	CAA	5.0			38					\$26,430
11-5287	FWT II	Worton, Carrie	9	C / D	PE	CAA	2.0			35					\$7,652
							9.0			108					\$44,445

Appendix A. (page 3 of 3).

Project Number: SP-426

Project Title: Cod Pot Study

Region: 4 Westward
Fishery Unit: 4400 Interagency Receipts

Ledger Code: 11340231
Component Code: 4001010700 Special Projects

<u>Account Code</u>	<u>Description</u>	<u>Comments</u>	<u>Amount</u>
72000	Travel		0.9
73000	Other Svcs/Charges		47.5
74000	Supplies		10.5
			<hr/>
			58.9

Appendix B. Random pot order deployments by quad number and pot type. Pot types:
 1=Standard Cod Pot; 2=False Tunnel Ramp Pot; 3=Slick Tunnel Ramp Pot; 4=Vertical Board
 Pot.

Date Set	Quad No.	Pot Order			
		A	B	C	D
3/9/98	1	2	1	3	4
	2	4	2	1	3
	3	2	4	1	3
	4	4	3	2	1
3/10/98	1	3	1	2	4
	2	3	1	4	2
	3	3	1	4	2
	4	3	2	4	1
3/11/98	1	2	1	4	3
	2	2	3	4	1
	3	3	2	4	1
	4	2	4	3	1
3/12/98	1	2	1	4	3
	2	2	3	4	1
	3	4	3	2	1
	4	2	1	3	4
3/13/98	1	3	4	2	1
	2	1	3	2	4
	3	1	3	2	4
	4	2	4	3	1
3/14/98	1	2	3	1	4
	2	2	3	4	1
	3	3	2	1	4
	4	1	3	4	2
3/15/98	1	3	1	4	2
	2	1	3	4	2
	3	4	2	1	3
	4	2	3	4	1
3/16/98	1	3	1	2	4
	2	2	4	1	3
	3	3	2	4	1
	4	2	1	4	3
3/17/98	1	2	4	3	1
	2	4	1	3	2
	3	3	1	4	2
	4	3	4	2	1
3/18/98	1	3	1	2	4
	2	2	1	4	3
	3	1	2	3	4
	4	4	2	1	3
3/19/98	1	2	4	3	1
	2	3	4	1	2
	3	3	4	1	2
	4	3	4	1	2

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