BIODEGRADABLE TWINE REPORT TO THE ALASKA BOARD OF FISHERIES

by
Al Kimker
Area Shellfish Biologist

Regional Information Report [1] No. 2H90-05

Alaska Department of Fish and Game
Division of Commercial Fisheries Central Region
333 Raspberry Road
Anchorage, AK 99518-1599

Don W. Collinsworth - Commissioner
Ken Parker - Director of Commercial Fisheries

March 1990

[1]Contribution 90-05 from the Homer area office. The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up to date information, reports in this series may contain preliminary data.

TABLE OF CONTENTS

INTRODUCTION

Initial concern regarding mortalities of fish and crabs caused by "ghost pot" fishing first came from the public and advisory committees in Southeast Alaska. Crab and bottomfish pots, both lost and purposely abandoned, were found in many instances to continue fishing with a resultant high mortality of all animals captured. This problem led the then Alaska Board of Fish and Game to adopt a regulation in 1974 that provided for a gear destruct mechanism in a portion of the Southeast Alaska Tanner crab fishery. This regulation stated in part:

> 5 AAC 35.125. LAWFUL GEAR (b) South of the latitude of Cape Fairweather tanner crab pots shall have a seam in the mesh of one vertical wall from top frame to bottom frame laced in with untreated cotton twine, or have one of the walls of synthetic fiber attached to the frame with untreated cotton twine.

The intent of this regulation was to create an opening in lost gear which would allow crabs and fish to escape.

Concern for waste of the public resource provided the impetus for the Alaska State Legislature to enact a law in 1976 requiring a termination device on all shellfish and bottomfish pots. The statute reads:

> SEC. 1610.125 USE OF TERMINATION DEVICE ON SHELLFISH AND BOTTOMFISH POT REQUIRED. The Board of Fisheries shall, by regulation, prescribe a termination device or devices for all shellfish and bottomfish pots. In this section, termination device means a biodegradable seam or panel or other device which renders the pot incapable of holding shellfish or bottomfish for more than six months when it is continuously immersed in seawater.

This legislative action generated a regulation adopted by the Alaska Board of Fisheries in 1977, to become effective on August 1, 1978, which read:

> 5 AAC 39.145. ESCAPE MECHANISM FOR SHELLFISH AND BOTTOMFISH POTS. A sidewall of all shellfish and bottomfish pots must contain an opening with a perimeter equal to or exceeding one-half of the tunnel eye opening perimeter. For shrimp pots, the opening may be on the top of the pot. The opening must be laced, sewn, or secured together by untreated cotton twine or other natural fiber no larger than 120 thread. Dungeness crab and shrimp pots may have the pot lid tie-down straps secured to the pot at one end by untreated cotton twine no larger than 120 thread, as a substitute for the above requirement.

Limited research on an appropriate size for a biodegradable twine was conducted by both the Alaska Department of Fish and Game and National Marine Fisheries Service in the early to mid 1970's. Twine sizes 21, 48 and 108 were tested. Documentation of the results seemed to lend to an uncertainty as to how long it actually took for a certain size twine to degrade. This skepticism regarding the tested sizes led to the adoption of 120 thread into the current regulation. Choice of this relatively large thread size seemed to satisfy both the Board of Fisheries and public as a termination device that would not destruct during the season for the then relatively long term pot fisheries. No documented evidence was provided regarding the length of time it took 120 thread to breakdown while immersed in seawater. The current 120 thread regulation has been in effect from 1978 to the present time.

The inadequacy of the current biodegradable regulation came to both the Department's and public's attention after the 1988 Cook Inlet Tanner crab fishery. Delinquent gear left on the fishing grounds for a minimum 60 days after the closure was responsible for the

mortality of 15,000 Tanner crabs. When this gear was finally pulled none of the 120 thread biodegradable twine had degraded thereby permitting the numerous trapped crabs to escape.

As a result of aforementioned it became apparent to the Department that a smaller size biodegradable twine was necessary in order to carry out the intent of the legislation and conserve the public resource.

METHODS

The Department conducted tests on varying sizes of untreated cotton twine in Prince William Sound and Cook Inlet in 1989 and 1990. The Westward Region shellfish staff asked select commercial crab fishermen to try smaller twine in their gear for the 1990 Kodiak and Bering Sea Tanner crab fisheries. Cook Inlet Dungeness crab fishermen were also asked to test smaller twines in their gear in 1989.

The Cook Inlet experiment was conducted in two parts:

1) The Department sewed eight repetitions each of 30, 42 and 60 twine into their own commercial size, 700 pound, 7'x7, king crab pots, which were utilized for the annual king and Tanner crab surveys. An 18 to 24 inch cut was made in the webbing on the door of the pot within six inches of the bottom of the door. The twine was then used to rejoin the web where the cut had been made. The pots were then used for the survey. The number of lifts, crab and fish catch were documented. Days in wet storage along with lifts to check the twine were also recorded.

2) Two 4'x4' shrimp pot frames were used to emulate Dungeness crab pot lid tie down straps. The normal configuration of rubber strap, biodegradable twine and pot hook were stretched across the 20 inch space between the top and bottom of the shrimp pot frame. Twine numbers used in the test were 30, 42, 60 and 72 at five repetitions per frame. Each pot was suspended from the stern of the Department Vessel Pandalus while it was having a major engine overhaul in the Homer Boat Harbor. One frame was pulled three times per week. Each device was unhooked and hooked thereby emulating normal opening and closing of a Dungeness pot. The other frame was used as a control. It was only pulled once per week without unhooking the test configuration.

The testing in Prince William Sound consisted of hanging five repetitions each of 30, 42, 60, 72 and 96 cotton twine from three metal frames. Weights were then hung from the twine to maintain tension on the twines. The three frames were suspended from the Fish and Game dock in the Cordova Boat Harbor. They were all pulled three times per week.

The Department asked commercial crab fishermen in Kodiak to try number 30 and in one instance 60 twine in the commercial crab gear that they used in the Kodiak and Bering Sea Tanner crab fisheries.

In Cook Inlet, five Dungeness fishermen were asked to try 42, 60 and 72 twine on their Dungeness gear.

RESULTS

Experiment 1 - Cook Inlet

The first experiment conducted in Cook Inlet utilizing the Department's king crab gear began on June 7, 1990. The last twine

degraded on October 24, 1990. The average number of fishing lifts per pot was 17.8, while the maximum number was 21.0 lifts. Lost gear accounts for the variation between average and maximum lifts.

Average catch in number of animals per pot lift was as follows:

TWINE SIZE	30	42	60
Pacific Cod	4.0	4.3	4.2
Halibut	2.0	1.8	2.1
Tanner Crab	35.7	35.4	35.0
King Crab	3.9	3.3	4.2

The pots were in wet storage, between 20 and 30 fathoms, for a maximum of 117 days. The maximum number of lifts per pot in wet storage was 13.

The time to total degradation in days, including fishing and wet storage, was as follows:

TWINE SIZE	30	42	60
Average	89.4	101.2	107.4
Range	50 - 106	57 - 119	57 - 139

Experiment 2 - Cook Inlet

The second experiment conducted in Cook Inlet, emulating Dungeness pot closure configurations, began December 11, 1989 for the test frame and December 18 for the control frame. The last twine released on March 9, 1990. The test frame was lifted and the configurations unhooked and hooked a maximum of 33 times. The control configuration was pulled 12 times.

The time to total degradation in days was as follows:

TEST FRAME

TWINE SIZE	30	42	60	72
Average	74.4	79.2	80.8	80.0
Range	65 - 81	67 - 86	77 - 88	77 - 86

CONTROL FRAME

TWINE SIZE	30	42	60	72
Average	67.6	73.6	71.2	77.8
Range	58 - 70	70 - 76	70 - 76	76 - 79

Cook Inlet Commercial Dungeness

One of the five Cook Inlet fishermen returned documented results on Dungeness gear to the Department. He installed five repetitions of 42, 60 and 72 thread in his gear. He pulled the pots with 42 thread a total of 22 times between June 27 and September 6, 1989. The 60 and 72 twine gear was pulled 23 times between June 27 and September 12. Of the 15 pots with the test twine installed only one of the 60 twines degraded, and that was on the final day of fishing.

The time to degradation in days was as follows:

TWINE SIZE	42	60	72
Average	72.0	76.0	77.0
Range	All intact until end of fishing, except one 60 twine pot.		

Prince William Sound

The testing conducted in Cordova began on October 10, 1989. As of March 14, 1990 all but one of the 96 twines were still intact. These frames will be checked weekly.

The time to total degradation in days was as follows:

TWINE SIZE	30	42	60	72	96
Average	87.9	96.7	94.8	97.3	152.7
Range	76 - 99	87 - 108	90 - 101	85 - 106	14 of 15 remain intact as of 03/14/90.

Kodiak and Bering Sea Commercial Tanner

One Bering Sea vessel fishing bairdi Tanner crabs installed 10 repetitions each of both 30 and 60 twine. At last report he had fished for 37 days with no breakage. A second vessel fished in Kodiak for six days using 10 repetitions of 30 twine. He reported no breakage. A third Kodiak boat fished for approximately two weeks with 10 repetitions of 30 twine. He reported that one twine broke while being installed. The other nine remained intact for the two week period of fishing. The final Kodiak fisherman to report utilized 10 repetitions of 30 twine while fishing approximately 37 days in the Shelikof Strait. He was only able to pull his gear 11 times. Two of the 10 twines broke within the 37 day period.

DISCUSSION

The need for a revision to the biodegradable twine regulation seems obvious to most industry and Department personnel who have had practical experience with the current 120 thread. The Canadian Department of Fisheries and Oceans instituted a regulation in 1990 requiring installation of number 36 untreated cotton twine in all crab fishing gear. One Canadian experiment conducted using black cod pots showed 120 twine lasted at least 115 days at which time the experiment was terminated (Scarsbrook et al, 1988).

In response to the apparent need for a reduction in the size of biodegradable twine the Alaska Department of Fish and Game proposed a regulatory change to reduce the size of twine for all shellfish and groundfish pots to 30 thread. The experiments reported on in this text were conducted after the proposal was made. This was due to the earlier than normal proposal deadline. In retrospect some smaller twine sizes such as 12, 18 and 24 should have been tested; however, the twines were donated to the Department by a net company. The expense of special runs of non-commercial size twines, such as those used in this experiment, dictated a choice of a select number of sizes. Subjective evaluations were made resulting in the sizes utilized in this report.

Analysis of both the Cook Inlet and Prince William Sound data shows that on the average 30 twine degrades faster than the 42, 60, 72 or 96 sizes. Statistically there is no meaningful difference in the degradation time between all sizes except 96 thread, which is still intact as of this report date. Statistical significance aside, the practical application of 30 twine would give crabs in lost or delinquent gear an experimental advantage of 18 days over 60 thread in king and Tanner gear. The difference was less in experiments conducted to emulate Dungeness pots, ranging from four to seven days in both Cook Inlet and Prince William Sound tests.

Both 30 and 60 twine seem to able to withstand the rigors of commercial Dungeness and Tanner fishing with slightly more breakage in the 30 twine.

Based on experimental results, the length of time to degradation for 30 twine ranges from 67 to 89 days depending on the experiment. Although this length of time would still cause crab mortalities in lost or delinquent gear, it is far superior to 120 thread which, based on comparison to the longevity of the smaller 96 thread in the Prince William Sound experiment, would still be intact after 153 days.

Due to the stressed condition of many Alaskan crab stocks, it would seem appropriate to give the advantage to the crabs in selecting a new regulatory twine size regardless of how small this advantage may be.

First Washington Net Factory of Blaine, Washington, has assured the Department that any of the tested twine sizes can be produced in commercial quantities. First Washington supplied the twines for these experiments as well as the 36 twine which is required in the Canadian crab fisheries.

A final comment should be made regarding the location for twine installation on the king and Tanner crab pots. Positioning on the side wall should seem obvious, as the bottom of the pot is blocked by the substrate and the top would require the crab to suspend itself in the water column in order to utilize the created opening. The location on the sidewall, however, could make a real difference in the survival of crabs which are in a weakened state resulting from prolonged entrapment in lost pots. Placing the opening near the bottom of the pot would allow crabs to walk out; however, locating the opening higher up on the side wall would require the crabs to climb or swim in order to find and utilize the opening. Anyone who has seen crabs, particularly Tanners, after prolonged

capture in pots, realizes that these animals are often in poor physiological condition. Swimming or climbing for these crabs would be difficult at best. As in selection of twine sizes, the advantage should be given to the resource, even if it requires fishermen to bend over in order to install the twine near the bottom of the pot.

BIBLIOGRAPHY

Scarsbrook, J. R., G. A. McFarlane, and W. Shaw. 1988. Effectiveness of experimental escape mechanisms in sablefish traps. North American Journal of Fisheries Management 8:158-161.