1999

Efficiency of Haul-Seine Cull Panels A Comparison of Size Selectivity and Relative Release

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Fisheries Research Grant Program Final Report

Submitted to

Fishery Resource Grant Program
Virginia Graduate Marine Science Consortium
170 Rugby Road
Charlottesville, Va. 22904-4146

Efficiency of Haul-Seine Cull Panels
A Comparison of Size Selectivity and Relative Release

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Abstract

In the summer of 2000, two methods of reducing haul-seine bycatch were tested on the York River, located on the southwestern shore of the Chesapeake Bay. Both methods allowed sub-marketable fishes to escape the haul-seine's pocket through a 4' diameter metal panel containing 298 rings with 2" diameters. The release methods differed due to the placement of this panel. The first method placed the panel in the side of the pocket. It released approximately 33% of the croaker < 252 mm (9.9 ") and 65% of the spot < 206 mm (8.1 "). The second method placed the panel at the end of a funnel that was connected to the pocket. This arrangement released 16% of the croaker < 252 mm (9.9 ") and 46% of the spot <206 mm (8.1"). Unfortunately, the funnel directed so many large fishes toward the panel that the mechanism became overcrowded and small fishes were prevented panel access. Statistical analysis of method 1's release of sub-marketable croaker and spot revealed probabilities of occurrence of < .0005. This study shows great promise. Continued refinement of panel placement and design promises a significant means of release for sub-marketable fishes. Sparing sub-marketable fishes will increase catch-per-unit-effort (CPUE) and allow large numbers of juvenile fishes to survive, which are currently harvested before their growth potential is maximized.

Introduction

As a result of the passage of the Magnuson-Stevens Fishery Conservation and Management Act (MCFCMA) of 1996, laws exist to protect the fisheries against overfishing through management for sustainability. Often a significant portion of the mortality due to fishing (F) is the result of bycatch. One of the major factors affecting the quantity of bycatch a gear retains is the size distribution of fishes present. In the Chesapeake Bay, this variable is often driven by environmental fluctuations that are not easily predictable. The other major factor influencing the quantity of bycatch is the selectivity of the gear. Gear alteration is relatively simple and can often drastically affect the quantity of sub-marketable fishes retained. The performance of alterations can also be tested and refined over time to maximize sub-marketable fishes release.

Haul-seines take large numbers of juvenile fishes in Virginia waters of the Chesapeake Bay. Their impact has been recognized somewhat by VMRC and their gear and methods regulated in an effort to reduce juvenile mortality. Unfortunately, these modifications were based on theoretical bycatch percentages and anecdotal statistics. Basing bycatch-per-unit-effort (BPUE) on such data can lead to serious miscalculations in total mortality due to fishing (F).

While seines have been operated in the Chesapeake Bay since colonial times, haul-seining is the only commercial method that survives today. Like all of the other modern commercial methods, haul-seiners have been forced, due to

shrinking resources and stiffened regulations, to revaluate the impact of their gear. This study was conducted to determine the number of sub-marketable fishes that are taken during the operation of a legal haul-seine and to explore methods of reducing these numbers.

Methods

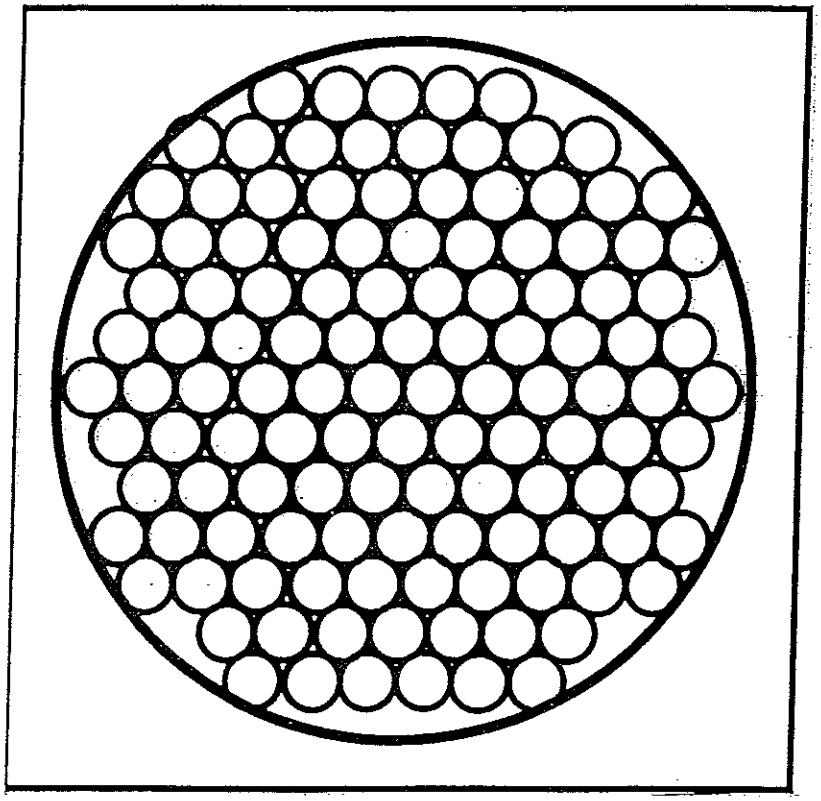
The experiment was conducted at three study sites. The first site was located just south of Cheatham Annex and had a sand bottom; the second site was located in front of Mumfort Island and had a sand and mud bottom; and the third site was located on the south side of Goodwin Island and contained a benthic community composed of macro-algae and submerged aquatic vegetation. For the first three hauls, the seine was actively swept approximately 170 degrees, however, this method stressed the gear and resulted in gear failure. A different method was used behind Goodwin Island. The net was set out on a high tide so that it isolated a body of water and the tide was allowed to drop before the net was swept back to the beach. This method caused less stress to the gear even though the grass and algae were present. Other fishermen actively use both fishing methods.

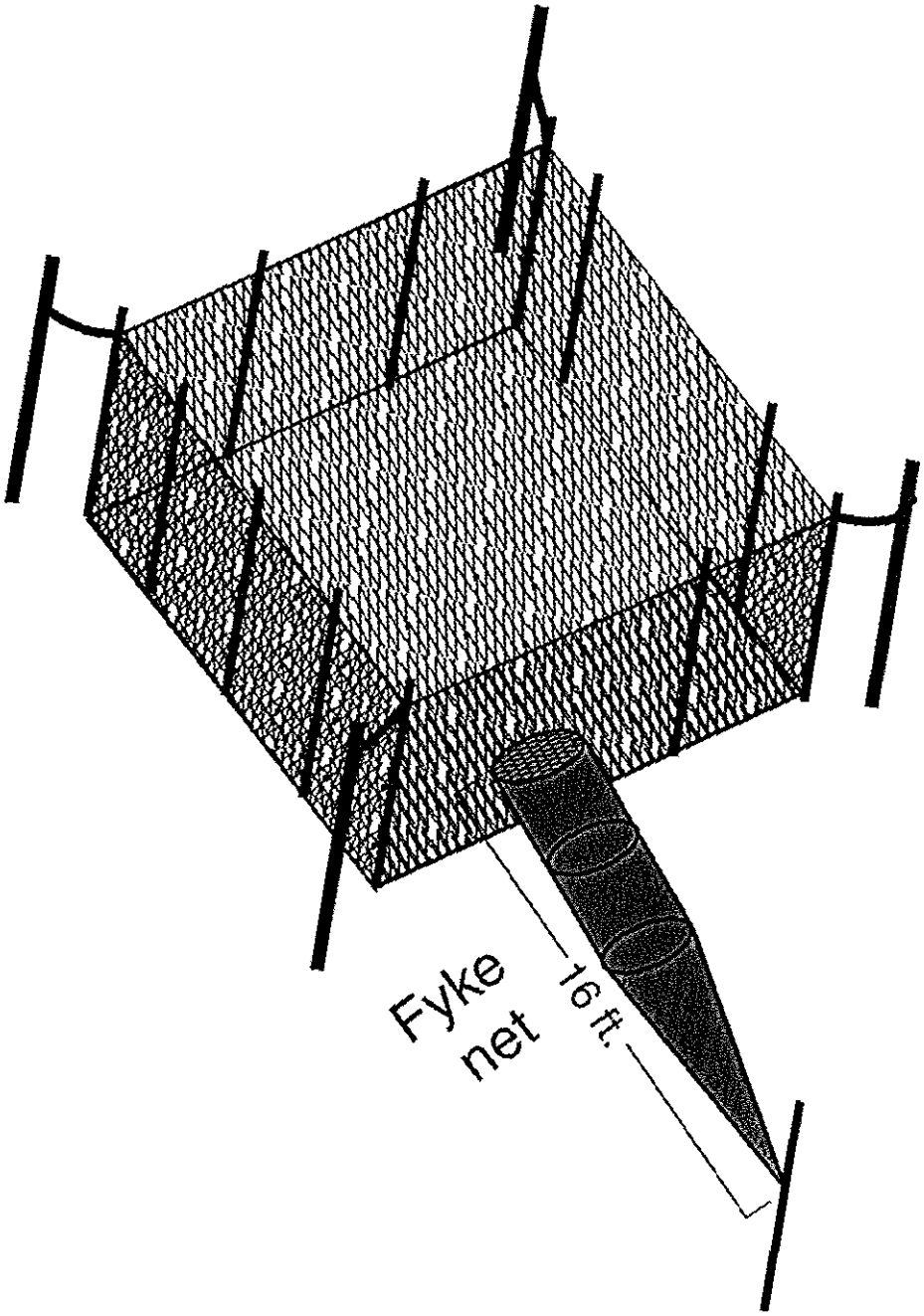
Nine experimental seine sets were run from 5/3/00 to 11/16/00 on the York River, though the first was a complete failure and provided no data. Two different methods of reducing bycatch were successfully tested four times each. Both methods used a 4' diameter metal panel consisting of 298 rings with 2"

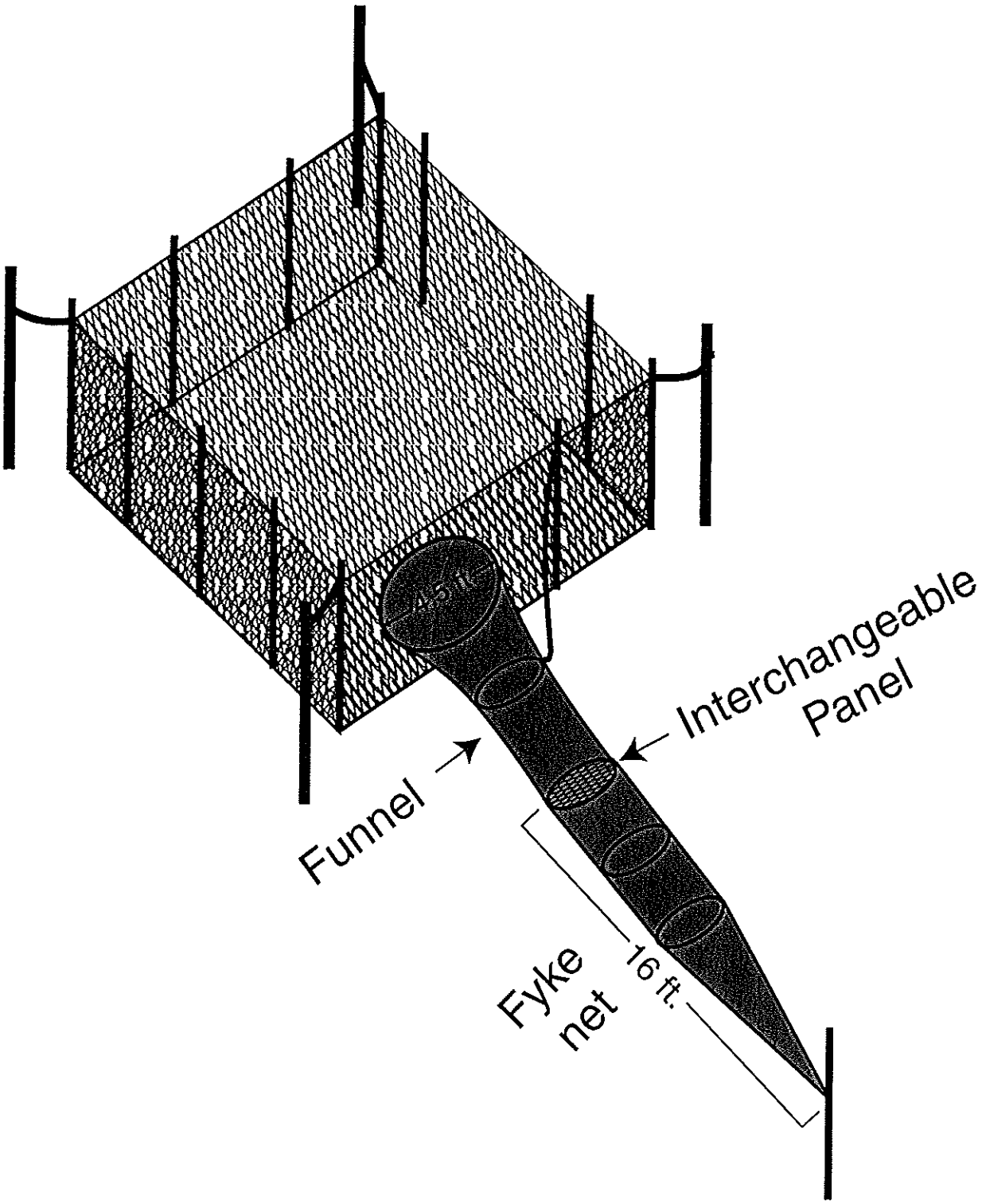
diameters (fig 1) in order to provide for sub-marketable fishes' release. This panel is too bulky and heavy to be used in commercial applications, but the design's culling performance was well documented due to its use in pound-nets in 1998. Knowing the culling ability of the panel simplified our objectives and allowed us to concentrate on the other variables that effected fishes' release. In 1998, the 2" rings culled croaker less than 252 mm (9.9") and spot less than 206 mm (8.1") (Hager, 2000).

The bycatch reduction designs differed due to the panel's placement, but both designs directed escaping fishes into a fyke-net that retained them until harvest. Recapturing all released fishes simplified statistical analysis and provided for rapid assessment of methodology when statistically significant results could not be attained. The first design placed the panel directly into the pocket's side (fig 2). The second set the panel back in a 7' funnel. The funnel opened with a 4.5 ' diameter mouth (fig 3) and tapered to a 4' tail hoop. This hoop could be attached easily to the cull panel and fyke-net with plastic zip ties. Long time haul-seine fishermen and my net-man suggested this method and I agreed to try it because a similar approach had worked well when applied to pound-net bycatch reduction devices (Hager, 2000).

Diameter 4 ft.




Fyke net
16 ft.


Interchangeable
Panel
Funnel
Fyke
net
16 ft.

Results

Over 65,000 pounds of fishes were captured during the study, however only spot and croaker were taken in large enough sub-marketable numbers to justify a statistical examination of cull panel use. Gizzard shad that have no market value made up by far the greatest mass and number of all species taken. Their numbers were often large enough that the pocket's sides were lowered to encourage release before the whole catch perished for lack of oxygen. Only one sub-marketable (illegal) weakfish was ever taken and it used the bycatch reduction device (BRD).

Croaker and Spot Data Listed by Method

BRD Design	Cruise	Species	Pocketed Fish	Released Fish	% Released	Gilled (BRD)	Gilled (Seine)
Pocket	5/6/00	Croaker	20< 252mm	3	?15?	0	20
Pocket	5/11/00	Croaker	67< 252mm	24	36	4	77
Pocket	6/2/00	Croaker	44< 252mm	13	30	0	1026
Pocket	10/16/00	Croaker	0	0		0	5
			131 total		33% total		
pocket	5/6/00	spot	0	0		0	0
pocket	5/11/00	spot	78< 206mm	61	78	0	0
pocket	6/2/00	spot	20< 206mm	6	30		0
pocket	10/16/00	spot	14< 206mm	2	14		99
			112 total		61% total		
funnel	7/17/00	croaker	134< 252	10	7%	13	479
funnel	9/8/00	croaker	0	0		0	0
funnel	9/18/00	croaker	0	0		0	27
funnel	11/15/00	croaker	0	0		0	0
			134 total		7% total		
funnel	7/17/00	spot	0	0		0	
funnel	9/8/00	spot	11< 206mm	6	55	0	
funnel	9/18/00	spot	16< 206mm	6	38		
funnel	11/15/00	spot	0	0		0	
			27 total		44% total		

The percent of croaker released using design 1 on 5/6/00 is marked with question marks and was not included in the total percentage released because croaker that gilled on this cruise were released into the pocket. These injured fish attracted birds and the only fish that survived were the three that found shelter in the BRD's fyke-net. As a result, gilled fishes were retained immediately for market in subsequent runs. The other percentages are valid and suggest that the method can provide adequate release of the croaker < 252 mm.

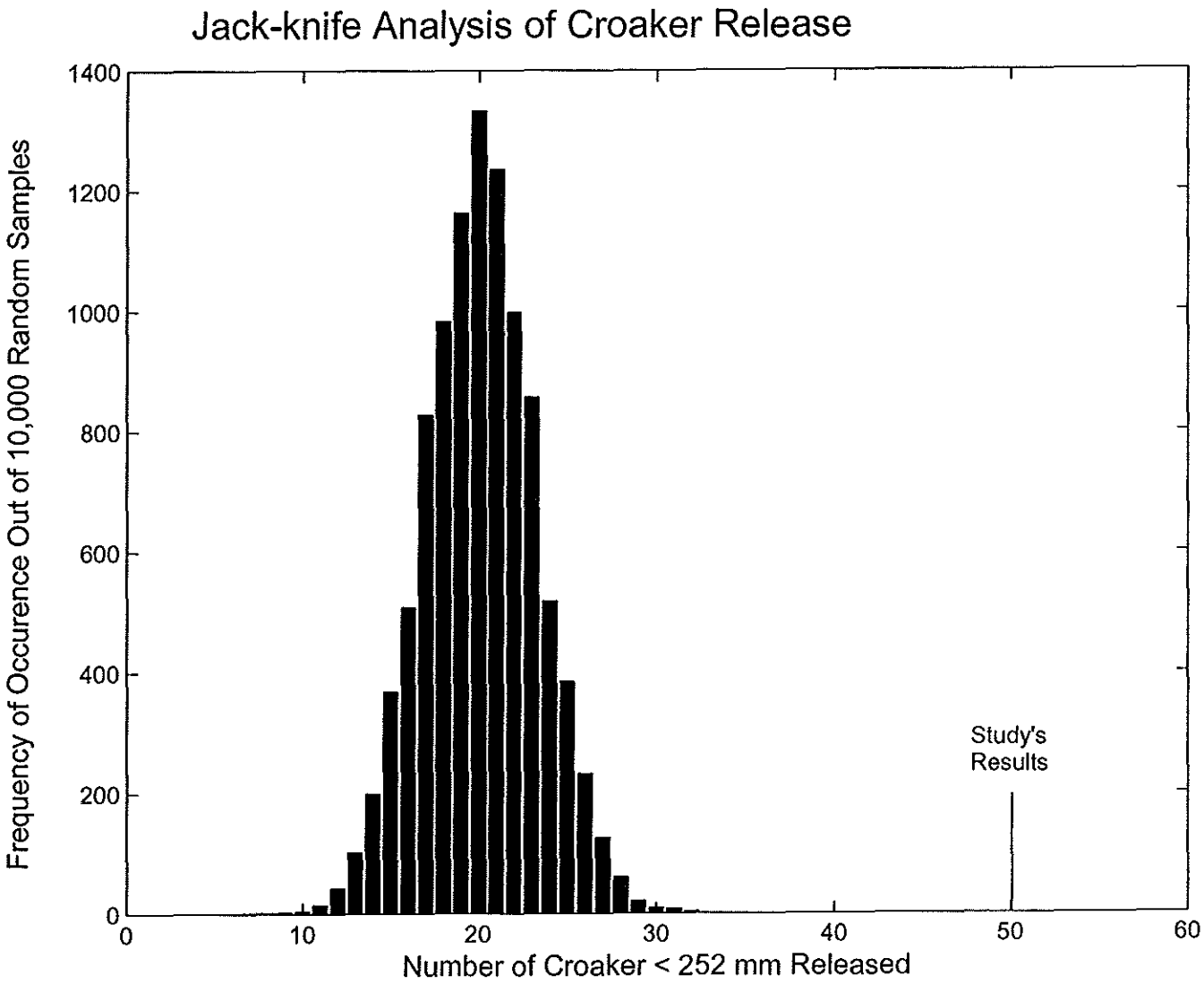
Statistical Analysis

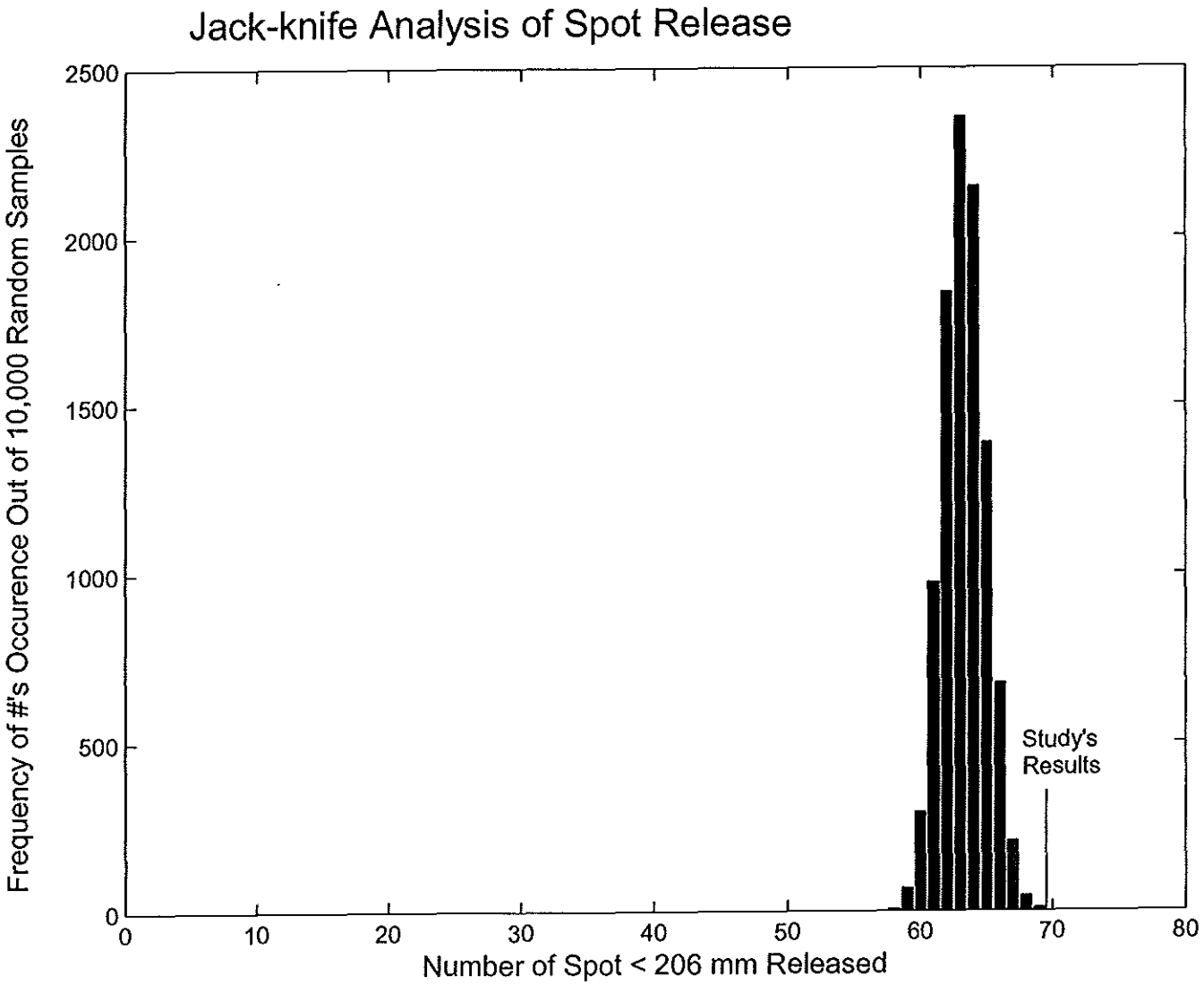
One advantage of using the Jack-knife method of statistical analysis is that it relies on no assumptions. One does not have to know the total population of fishes present or assume that it is some mathematically derived figure in order to run the analysis. If one had the time, the test could even be performed at dockside. First, all fish of a species are measured and labeled as marketable (croaker> 252 mm) or sub-marketable (croaker< 252 mm). All the fish are then put back together and the number of fish that were released by the BRD is randomly picked from the whole catch. This procedure is repeated 10,000 times. Each time, the number of sub-marketable fish that each selection contains is recorded. The results are plotted and the graph shows how often each number would naturally occur given the total catch. By comparing the number of sub-marketable fish released during the study to the graph's distribution of possible outcomes, one can determine how unusual each study's results were, given their catch composition.

Because we repeated the process 10,000 times, we attained a significance of occurrence that is sensitive to 1/10,000 or .0001. The following graphs show the result of Jack-knife analysis of method 1's croaker and spot release. Both the release of sub-marketable croaker and spot were highly significant with a probability of occurrence of < .0005. Method 2 was not statistically analyzed because it encountered a smaller number of sub-marketable fishes and it had obvious weaknesses due to gear saturation.

Discussion

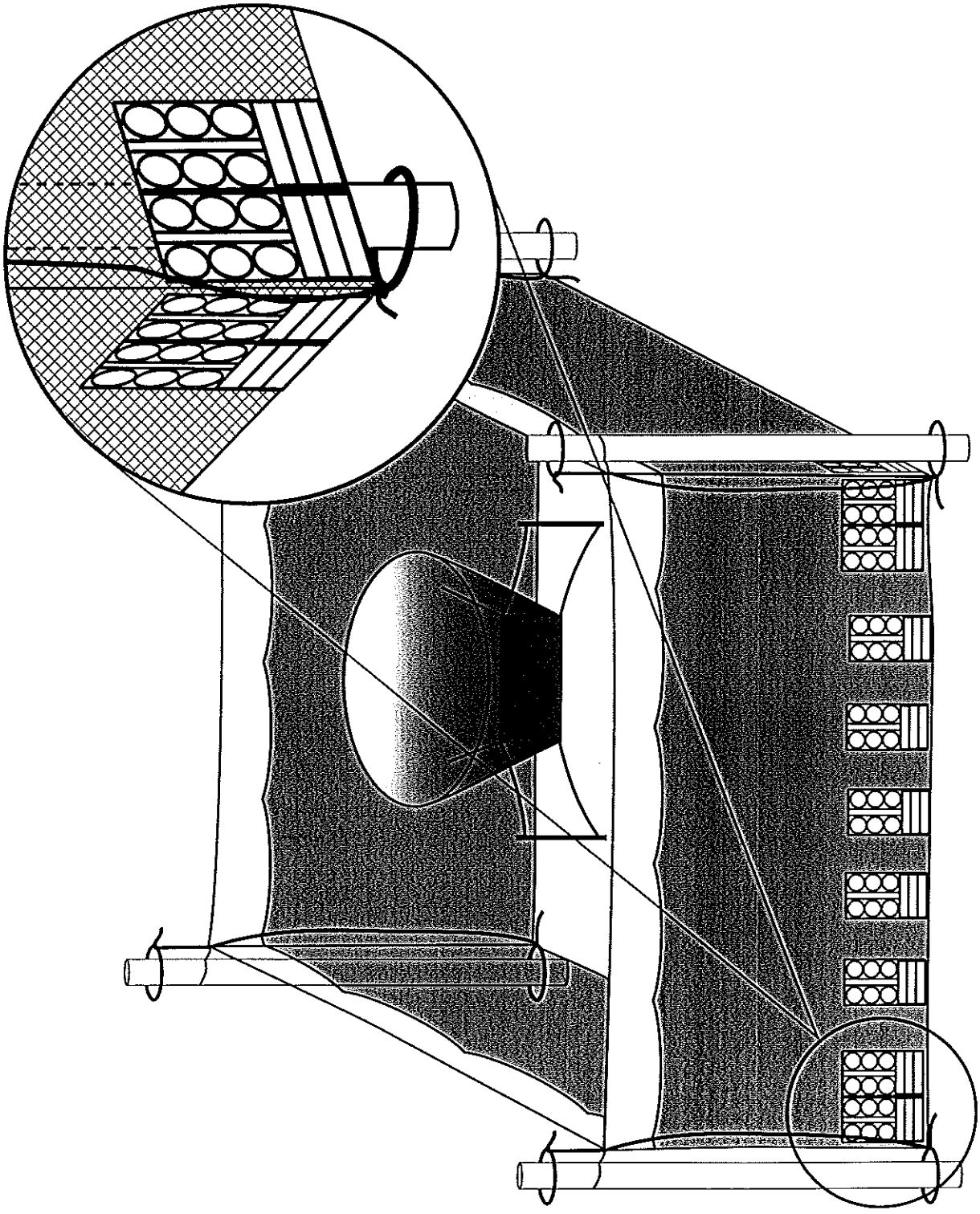
Placing the panel directly in the side of the pocket functioned more efficiently than placing it at the back of a funnel. A large catch of croaker on 7/17 demonstrated this performance inequality. The funneling method worked, but it directed too many fishes towards the panel at once. Schools of large fish filled the funnel and prevented panel access to most fishes small enough to escape. This method was continued only to supply numbers sufficient to statistically support this observation. Unfortunately, these numbers did not materialize. Spot release percentages suggest that the funnel method is inferior as well. This hypothesis should be viewed with some skepticism, however, due to low numbers of pocketed spot and possible girth length ratio differences later in the season.


Jack-knife Analysis of Croaker Release
Frequency of Occurence Out of 10,000 Random Samples
1400
1200
1000
800
600
400
200
0
0
10
20
30
40
50
60
Number of Croaker < 252 mm Released
Study's
Results


Jack-knife Analysis of Spot Release
Frequency of #'s Occurence Out of 10,000 Random Samples
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
Number of Spot < 206 mm Released
Study's
Results

The 2" rings culled croaker < 252 mm (9.9") and spot < 206 mm (8.1"). These fish lengths were recognized as being slightly larger than most fishermen would like to release. However, these lengths were attained from the largest specimen of each species that has ever used the 2" ring for escape, not the average length fish that used the ring. Using this length as a standard of release implies that the average croaker 252 mm or spot 206 mm long could use the rings. As fishes may vary significantly in their length to girth ratios, this may not be the case (Myers, 1973).

In the future it is recommended that the ring's diameter is reduced slightly to 1 7/8 ", in order to address the fishermen's concern of release of marketable croaker and spot. Panel placement should maximize access and reduce the chances of panel gilling. In order to achieve these objectives, panels should be distributed along the bottom of the pocket as well as being placed in the corners (fig 4). Newly developed plastic bycatch reduction panels (BRP) available from the Potomac River Fisheries Commission (PRFC) and paid for by the National Marine Fisheries Service (NMFS) provide light, durable, previously tested panels that are perfect for such applications.



Bibliography

Hager, C.H., 2000. Efficiency of Pound-net Cull Panels for the Release of Weakfish and Summer Flounder. MA thesis, School of Marine Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Va., 45 p.

Meyers, H.L., 1973. Retention and escape characteristics of pound nets as a function of pound-head mesh size. MA thesis, School of Marine Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Va., 25 p.

Expenditures to Date

First Period

Haul-seine purchased	from Charles Tench	$2500.00
Haul-seine repaired	by Steve Kellum	$2200.00
Haul-seine pocket	from Bobby Brown	$400.00
Thread / needle purchased	from Kings Marine	$9.15
Totes/block	from Kings Marine	$116.00
4' fiberglass hoops	from Netco	$43.54
Paint for net markers	from Ace	$4.90
8 hours labor	from John Walters	$64.00
hours driving		free
Many hours personal labor		free
	1st total	5337.59

Second Period

Construction of B.R.D. and sewing of pocket		free
Dip for B.R.D. and pocket		164.58
Varsol for dipping		43.20
3 days for deckhands	60 hours	480.00
4 days for chief	80 hours	960.00
3 days food		60.00
3 hauls		1500.00
3 days travel	60 miles round-trip	58.50
	2^{nd} total	3266.28
	1st total	5337.59
	total	8603.87

Third Period

4 days food		80.00
4 days deckhands	80 hours	640.00
4 days chief	80 hours	960.00
4 hauls		2000.00
4 days travel	60 miles round-trip	78.00
	3^{rd} total	3758.00

1^{st} total	5337.59
2^{nd} total	3266.28
3^{rd} total	3758.00
other	6494.26
Grand total	**18856.13**
GRANT AMOUNT	10315.00

One day's work not yet completed.

Food			20.00
Deckhands	20 hours		160.00
Chief	20 hours		240.00
Haul			500.00
Travel	60 miles		19.50
		total	939.50

FREE

SOME OTHER COSTS NOT INCLUDED IN TOTALS

David Lange	haul seine work	85.00
Fish boxes, gloves	King's Supply	37.00
Gas hose, net twine,needles	King's Supply	41.30
Totes, block, ropes, electrical	King's Supply	116.00
Hibbard's Iron Works	trailer parts	213.30
Hibbard's Iron Works	trailer parts	38.19
Hibbard's Iron Works	trailer parts	74.30
Hibbard's Iron Works	trailer parts	176.65
Boaters World	VHF replacement	182.70
York Marine	Boat oil	52.29
Bill's Welding	rings for haul seine	60.00
Paul Angel	engine repair	165.00
Paul Angel	engine repair	182.00
Paul Angel	engine repair	685.00
Paul Angel	engine repair	65.00
Friday's Marine	new engine	2800.00
John Foster	Pay check	160.00
Erin Burge	Pay check	360.00
John Walter	Pay check	600.00
Lee's Marine	Engine Upkeep	400.53
	total	**6494.26**