

Project Title:

“Supporting the Full Use of an Underutilized Species in the Northeast:
Initial Work to Develop a Cost Effective Processing Technique for Scup
(*Stenotomus chrysops*)”

Funded through NOAA Award #NA09NMF4720414

Final Project Report

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Executive Summary

The project “Supporting the Full Use of an Underutilized Species in the Northeast: Initial Work to Develop a Cost Effective Processing Technique for Scup (*Stenotomus chrysops*)” (funded through NOAA Award #NA09NMF4720414) focused on investigating the most appropriate and cost effective means of machine filleting scup (*Stenotomus chrysops*), an underutilized species in the southern New England/Mid-Atlantic region. The work was carried out by the Commercial Fisheries Research Foundation (CFRF), in collaboration with three local Rhode Island processing companies, Seafreeze, Ltd, Sea Fresh USA, Inc., and The TownDock, and a manufacturing company, Pisces Fish Machinery Inc., based in Wells, Michigan. Shipments of fresh and frozen scup were sent to Pisces to test on machinery being used to process similar size and shaped fresh water species. Findings indicated that Pisces Fish Machinery, Inc. was able to produce a machinery lineup capable of filleting scup. This included de-scaling, heading, gutting, filleting from the central skeletal rack, and removing the pin bone. Trials using fresh scup showed an acceptable, marketable product (4-6 ounce fillets) with yields ranging from 30-35% depending on the initial size of the scup. The quality of the scup resulting from the frozen scup processing trials was also satisfactory provided that the scup was thawed to a point of 31-32 degrees F. Retaining some degree of frozen rigidity was necessary to prevent tearing of the flesh. Some potential obstacles to utilizing this machinery in RI uncovered during the study included limited waste water disposal capacity, relatively low yield especially for smaller scup, low market demand, and the logistics involved in processing large quantities of scup at certain times of the year, requiring intermediate freezing and storage. Further marketing baseline research is needed to determine if investment in this type of processing equipment is justified.

Project Description

The following report summarizes the work accomplished under the project entitled “Supporting the Full Use of an Underutilized Species in the Northeast: Initial Work to Develop a Cost Effective Processing Technique for Scup (*Stenotomus chrysops*)” funded through NOAA Award #NA09NMF4720414.¹ The project was carried out by the Commercial Fisheries Research Foundation (CFRF), in collaboration with three local Rhode Island processing companies, Seafreeze, Ltd, Sea Fresh USA, Inc., and The TownDock, and a manufacturing company, Pisces Fish Machinery Inc., based in Wells, Michigan. The primary goal of the project was to conduct background research needed to support the full use of scup (*Stenotomus chrysops*), an underutilized species in the southern New England/Mid-Atlantic region. Specifically the research focused on investigating the most appropriate and cost effective means of machine filleting this hard to work with species in order to produce enough yield in the form needed to be marketable.

Background

As groundfish fisheries and other traditionally targeted commercial species have become limited in the northeast region, and fishermen seek to maximize their opportunities in other fisheries, one of the underutilized species that is continually discussed in the southern New England/Mid-Atlantic areas is scup. Fishermen report that it is readily available year round, with offshore access typically from November through April, and inshore access typically from May through October. This species could offer a much needed option for fishermen as they are forced to shift effort away from overfished groundfish species, especially if the market demand and price justify the effort to land them.

Scup was previously under a stock rebuilding strategy but was declared rebuilt in 2009. ² Based on the July 2012 stock assessment update, the scup stock was deemed not overfished and overfishing was not occurring in 2011 relative to biological reference points. ³ The Commercial Annual Catch Limit (ACL) in 2014 was 28.07 million lbs. but the actual Commercial Landings for

¹ This project was approved by NOAA NMFS as part of an extension of the original NOAA Award NA09NMF4720414 issued in 2009, and was aimed at addressing one of the primary goals of the Southern New England Collaborative Research Initiative (SNECRI): creating new business opportunities and enhancing existing ones for the southern New England commercial fishing industry.

² June 2014. Scup Advisory Panel Information Document, page 1. See: <http://www.mafmc.org/sf-s-bsb/>

³ June 2014. Scup Advisory Panel Information Document, page 2.

that year were only 15.93 million lbs.⁴ indicating there is room for additional effort in landing this species.

The narrow market demand, which is at times coupled with large amounts of landings, contributes to a relatively low average price per pound. (This situation could become magnified if displaced groundfish fishing vessels from the northern regions of New England also begin to target and land scup.) For example, the mean price/lb in 1998 was \$1.46 (\$2.41 in 2014 dollars). In 2013 the mean price/lb was reported as \$0.55.⁵ More recent market prices (February – May 2015 time frame) for scup are as follows: \$0.10 - \$0.15 for medium size scup (0.50 -0.75 lb.); \$0.20 - \$0.30 for large scup (0.75-1.25 lb.); \$0.40 - \$0.50 for jumbo scup (> 1.25 lb.).⁶ There is a relatively small market for whole scup but this is limited. This factor, together with previous processing difficulties, have resulted in an underdeveloped market demand for this species.

Pt. Judith, RI is currently the leading port for scup landings with 5.9 million lbs. landed in 2014 (36.9% of total commercial scup landings)⁷ and is poised to serve as a regional hub for the processing of this species. Pt. Judith processors estimate an additional 50-60 jobs, along with more diversity for the fishing fleet in the region, could be added if scup was realized as a more marketable fish species.⁸ The potential exists for Pt. Judith to develop into a processing destination for this species, receiving product shipped from Virginia to Massachusetts, in the same way that it currently serves as a landing and processing center for squid.⁹ Coast wide, as many as 150 fishing vessels could be impacted.¹⁰

Investigation of scup as a more marketable fish species is also propelled by a perception that there is a growing demand for local, healthy, and sustainable seafood that is not imported and/or farm raised. In response, local processors are seeking to secure more steady and predictable supplies of fish to process to meet this demand. It is recognized that a species such as scup has a potential place in markets, and could fill a consumer demand (both domestic and foreign) for simple, white flesh fish fillets that can be easily prepared. The waste products from

⁴ June 2015. MAFMC. Scup Fishery Information Document, Table 1, page 4.

⁵ June 2015. MAFMC. Scup Fishery Information Document, page 10. See: <http://www.mafmc.org/sf-s-bsb/>

⁶ Personal communication with representatives of SeaFreeze. Ltd and TownDock (Pt. Judith processing companies), October 2015.

⁷ June 2015. MAMFC. Scup Fishery Information Document, Dealer data, Table 7, page 12.

⁸ Personal communication, Glen Goodwin, SeaFreeze, Ltd and Ryan Clark, TownDock.

⁹ Note: This would include landings from ports such as Hampton Rd. and Norfolk, VA; Cape May, Pt. Pleasant, Barnegat Inlet, NJ; Shinnecock, Montauk, NY; Stonington, CT; Pt. Judith, Newport, RI; and New Bedford, MA.

¹⁰ Personal communication, Fred Mattera, former owner/captain F/V Travis & Natalie

processing this fish also have the potential to be converted into fish meal, cat food filler, or lobster bait.¹¹

Goals and Objectives

One of the major challenges with increasing the marketability of scup is the difficulty involved in processing it into fillet form. It is a relatively boney fish with a large pin bone that is difficult to remove, making it time consuming to fillet by hand. Beginning in February, 2014 the CFRF Principal Investigators began working with a group of representatives from Rhode Island based processing companies to investigate if existing seafood processing machinery exists that might be able to process scup into boneless, skinless fillets efficiently and cost effectively. The work centered on achieving the overall goals of the project: to determine if scup could be processed into a fillet form by machine, and if so, determine if the yield and final product could be of a high enough quality to support further marketing efforts. The specific objectives of the study, then, were to:

- Work with manufacturers of seafood processing machinery and local Rhode Island processing companies to identify or develop an appropriate line of processing machinery that can produce large quantities of scup fillets efficiently and cost effectively;
- Determine the approximate yield/fish and evaluate the quality of the fillet product;
- Identify any challenges to utilizing such machinery in the Rhode Island seafood processing sector;
- Share the general information uncovered with those with interests in the commercial fishing industry, including harvesters, processors, economic development planners/investors, and food policy analysts in Rhode Island and beyond.

In support of achieving these overall goals and objectives, the project investigation centered on answering the following research questions:

1. Is there a manufacturing company of seafood processing machinery that either has an existing line of machinery or is willing to develop one capable of producing boneless scup fillets?
2. How does such a line of machinery work and what does it cost?
3. How well does the line of machinery work? Can it produce a final scup product that is marketable?
4. What is the approximate yield and quality of the processed scup?

¹¹ Personal communication, Ryan Clark, Town Dock, Pt. Judith, RI.

5. What are the potential obstacles for utilizing this type of machinery in Rhode Island from the perspective of the three major processing companies involved in the study?

Methodology

Efforts to answer the research questions identified above and communicate findings followed a series of steps that together comprised the project methodology. A summary of these major steps is as follows:

1. *Outreach and continued communication with representatives of three major local processing companies*– The first step in initiating the project was to communicate with representatives of the three major local processing companies in Rhode Island (Seafreeze, Ltd, Sea Fresh USA, Inc., and The TownDock) and establish working partnerships. Ongoing communication was carried out throughout the project via individual or small group meetings, e-mails, and phone conversations. As the project progressed, these communications focused on updating representatives of all three companies on what manufacturing companies were available to work with the project team on the scup processing challenge, how to coordinate shipments of scup for evaluation purposes, and results from processing trials.
2. *Search for manufacturing companies willing to work on the scup processing challenge* – A list of companies that manufacture seafood processing machinery was compiled through an internet search and participation in the Boston International Fish Show in April 2014. Follow up communications were conducted via e-mail and phone conferences to determine what companies were willing to work with the project team to address the scup processing challenge.
3. *Shipment of scup to manufacturing companies for evaluation* – The search for manufacturing companies identified two companies willing to evaluate scup. Shipments were then sent directly from Rhode Island to these companies by partner local processing companies.
4. *Evaluation of scup by manufacturing companies and follow up communications* – Following the shipments, the two manufacturing companies responded, and follow up communications were conducted. From this effort, one company continued to work with the project team to test its machinery. A series of trials followed using more shipments of scup from Rhode Island, both fresh and frozen.
5. *Meetings with manufacturing company representative and local processing company representatives to present and discuss results* – After several trials, a representative of the Pisces manufacturing company traveled to RI to participate in a series of meetings with representatives of the major local processing companies over the course of 1.5 days. These meeting were used to present and discuss the trials results, answer

questions, and provide an opportunity for the Pisces representative to tour each processing facility.

Findings

Findings from preliminary work:

The search for manufacturing companies that develop and build seafood processing machinery produced the following list of potential companies that might have been able to work on the scup processing challenge:

- Baader (North America Corp.)
- Coastline Equipment Company (Bellingham, Washington)
- Trifisk Manufacturing (Canada)
- Marel Manufacturing (Iceland)
- Pisces Inc. (Michigan, USA)

Of this list, just two companies, Baader (North America Corp.) and Pisces Inc. conveyed that they would be willing to discuss the topic further and possibly work with the project team. The other companies replied that they were either unable to devote the resources necessary for the research and development needed, or might only be able to assist with one part of the processing process such as de-scaling. One company did not reply.

Through a conference call with officials at Baader (North America Corp.), it was determined that the company might have an existing machine (Model #151) that is effective in processing redfish that could possibly be adjusted to work with scup. It was agreed to ship frozen scup from Rhode Island to the Baader facility in Iceland where they could be manually filleted and the bone structure evaluated. This step was completed in April 2014.

The Baader staff in Iceland did run the scup through machinery that was available to them through a customer processing large redfish (Model #151). They concluded that the scup were much too small for the machine, and because it was a customer's machine, they were reluctant to make adjustments for further testing. They also concluded that if scup were to be processed on an existing Baader machine, it would be on Model #153 which might be able to handle smaller fish. There was no access to Model #153 in Iceland, so the Iceland trials were ended.¹²

¹² It was noted that two companies in New Bedford, MA were processing redfish through a Model #153 and one of them might be willing to experiment with scup on their machine.

A spokesperson for Baader based in Seattle, Washington subsequently conveyed that Baader no longer manufactures Model #153, and it would be a challenge for them to resume manufacturing them.¹³ They would need to complete a new engineering phase to redesign them for new standards, and they would need to see a minimum of 5-10 machines ordered before they would consider investing in that. The final estimated cost for a revised Model #153 machine to produce two fillets of scup with the skin on would be \$400,000, and an additional attachment would be needed to remove the pin bone (although it was noted that removal of the pin bone could result in significant yield loss).

Communications were begun with a company representative of Pisces Fish Machinery, Inc. at the Boston International Fish Show in April 2014. The skeletal structure of scup was discussed and compared to tilapia, a fish the company had developed machinery to process. There was a consensus that the skeletal structure of tilapia is very similar to scup, and it was worth initiating trials with scup. This was followed up with a shipment of scup from Pt. Judith to the Pisces facility in Michigan. The scup were processed to the point of removing the flesh from the central rack (skeleton) and shipped back to Pt. Judith for evaluation. It was determined that the skeletal frames had been very cleanly filleted, although the pin bone had not been removed. Figure 1 shows an image of scup that was returned after this first trial.

¹³ The Model #153 were originally sold in Canada in the 1980's and used to process redfish. Old ones can sometimes be found and purchased via the internet but they often need to be refurbished or rebuilt. Baader can refurbish them if the customer buys them. If Baader buys them, they need to go through a redesign process to be brought up to new standards because of liability issues. Personal communication, B. McBride, Baader, Seattle, Washington.



Figure 1. Scup fillets from first trials (CFRF, April 2014)

The results from the initial scup processing by Pisces indicated that further investigation was warranted, and the machinery used showed promise. Subsequent shipments of scup were made to Pisces facility in Michigan to test the yield and quality of the following:

- Production of fillets from the skeletal frames with the pin bone also removed
- Production of fillets from frozen scup.

The results from these subsequent trials, which comprise the major findings of this work, are described below.

Specific Findings:

Upon completion of the subsequent trials (scup being shipped to Pisces facility in Michigan and back to RI Processing companies for evaluation), Matt Wastell, Pisces Vice-President traveled to Rhode Island in November 2014 to participate in a series of small group meetings with representatives of the local processing companies to present and discuss results. Videos and photos were used to show how the scup had been processed through a line of Pisces

manufactured machinery and questions concerning the processing of frozen scup vs. fresh scup, yield, water usage, and cost were addressed.

Processing Line Up –

Figure 2 shows the complete line up of machinery suggested by the Pisces representative to complete the scup filleting. It encompasses an L formation utilizing about 23.5 feet in width to accommodate a feed conveyor and a length of 53 feet. Height clearance is about 15.5 feet. Major components include a drum scaler, header cutting machine, filleting machine, and skinning machine, with conveyor belts and an intermediate storage unit in between. The whole processing line might take between 10-12 people to operate, and the rate of scup processed is about 30 fish/minute.¹⁴

The estimated cost of this complete line up was quoted at approximately \$350,000, and the estimated water usage was 12-15 gallons/minute. Information was not available from the manufacturer of the BOD level of the waste water coming off of the machinery¹⁵. There is some potential for water re-use. The scaling, which takes place at the beginning of the line, entails putting a volume of fish in the hopper device. There they rub against each other as water is forcefully sprayed on them. The effluent from this part of the process includes both water and scales. The scales can be screened out and used to make Kosher gelatin, and the water could potentially be re-used for the rest of the process.¹⁶ At least 200 lbs. of fish are needed to run through a scaler (it would be about half full). The scaler is the most water intense part of the process requiring about 5-6 gallons per minute to operate.¹⁷

Results of Processing Fresh Scup –

The first set of trials included the shipment of fresh scup to the Pisces facility in Michigan to determine if the fish flesh could be cleanly removed from the central skeleton (rack), producing two fillets per fish. The manufacturer utilized nearby machinery at a customer's facility being used to process a similar shaped Great Lakes perch fish, and found that the scup could be processed this way. The resultant fillets (with the skin still on and the pin bone not yet removed) were shipped back to RI, along with the central skeleton for each fish for evaluation. Figures 3 show the results.

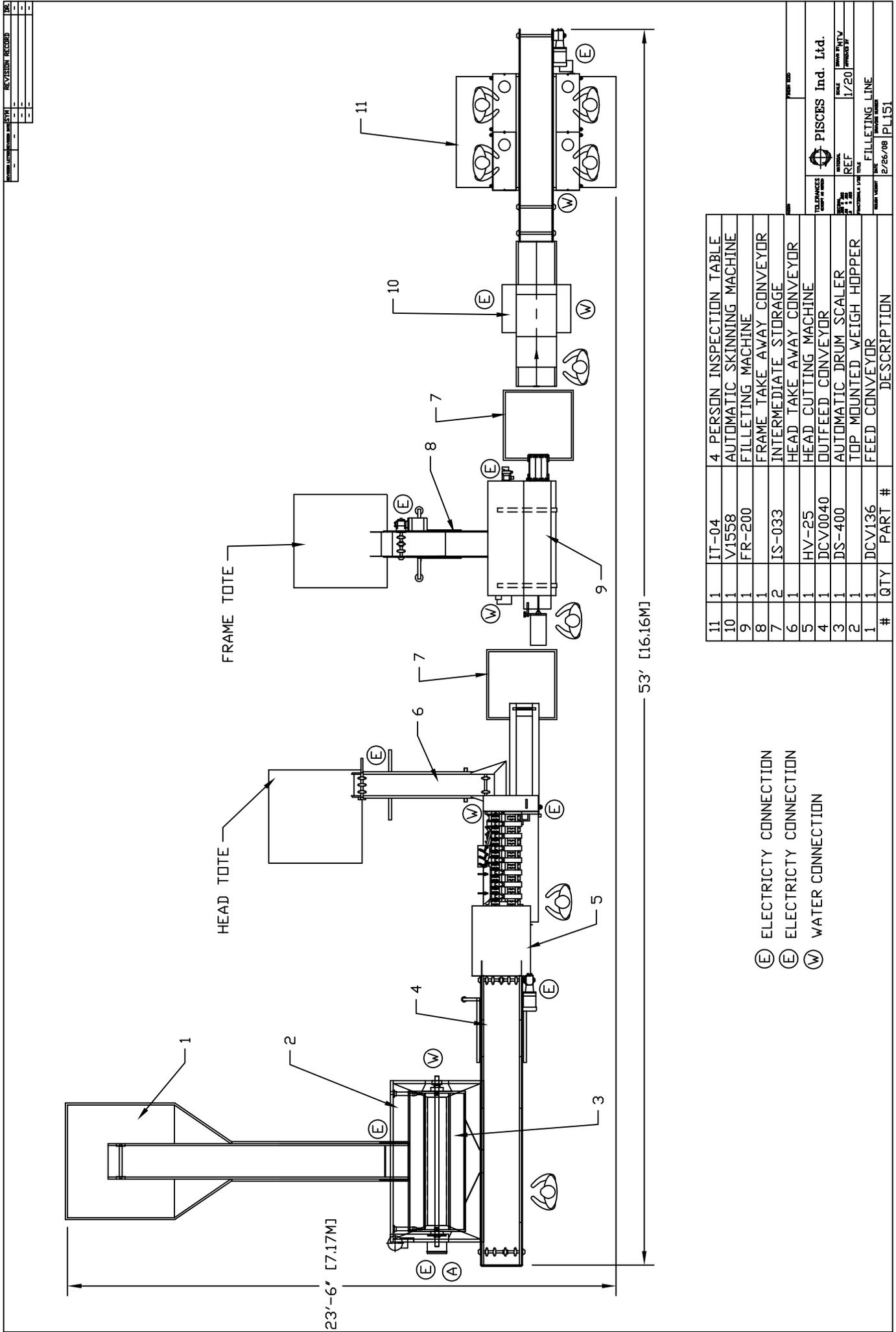
¹⁴ Comment by M. Wastell, Pisces representative in meeting at SeaFesh in North Kingstown, RI on Nov. 19, 2014.

¹⁵ When asked about the BOD levels, the Pisces representative conveyed that he felt the BOD levels would be high enough that it would be classified as waste water needing proper treatment before disposal but likely not concentrated enough to be of value as a by-product such as a water based fertilizer.

¹⁶ It was noted that it is uncertain whether RI Department of Health would allow the re-use of the water from the scaler.

¹⁷ Comments by M. Wastrell, Pisces representative in meeting at TownDock, in Narragansett, RI on Nov. 20, 2014.

Figure 2. Line up of scup processing machinery (Pisces Ltd)



#	QTY	PART #	DESCRIPTION
11	1	IT-04	4 PERSON INSPECTION TABLE
10	1	V1558	AUTOMATIC SKINNING MACHINE
9	1	FR-200	FILLETING MACHINE
8	1	FR-200	FRAME TAKE AWAY CONVEYOR
7	2	IS-033	INTERMEDIATE STORAGE
6	1	HV-25	HEAD TAKE AWAY CONVEYOR
5	1	DCV0040	HEAD CUTTING MACHINE
4	1	DCV0040	OUTFEED CONVEYOR
3	1	DS-400	AUTOMATIC DRUM SCALER
2	1	DCV136	TOP MOUNTED WEIGH HOPPER
1	1	DCV136	FEED CONVEYOR

- (E) ELECTRICITY CONNECTION
- (W) WATER CONNECTION
- (A) AIR CONNECTION


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Figure 3 - Scup Fillets from second trials (CFRF, June 2014)

Direct evaluations were made by company representatives from SeaFreeze, the Pt. Judith processing company that the scup were shipped back to, and photographs were shared with representatives of the other companies. All agreed the fish fillets appeared to be of high quality i.e. the flesh had not been mangled in the machinery and it had been removed from the central skeleton or rack cleanly. There was interest in determining if the pin bone could also be removed by machine.

Another shipment of scup was sent back to the Pisces facility in Michigan, and this time the Pisces representative added an additional step to the process – removal of the pin bone utilizing machinery that removes similar pin bones from salmon. Again, the processed fresh scup were shipped back to RI for evaluation. Direct evaluations were made by company representatives from The TownDock, the Pt. Judith facility that the scup were shipped back to and photographs were taken and shared. The pin bone had for the most part been removed (with some minor fragments remaining that could easily be cleaned up by hand). During follow

meetings. The Pisces representative noted that scup have very big, long pin bones. These were able to be removed with relatively little removal of flesh, and without a large V-notch. He also noted though that quality control is still needed after this part of the process.¹⁸

Results of Processing Frozen Scup –

Processing companies in RI were also interested in determining the quality of the scup processed after the scup had been frozen. Another shipment of scup was made by the third processing company involved, SeaFresh, but this time the scup was sent frozen. The Pisces representative did conduct trials with the frozen scup, and shipped the resultant processed scup back to RI for evaluation. Unfortunately, this shipment was lost enroute to RI due to weather storms, so direct observation of the quality of the previously frozen scup that had been filleted and de-boned by machine could not be made. During follow up meetings between representatives of the RI processing companies and the Pisces representative, the Pisces representative relayed that he was able to run the frozen scup through the machinery and fillet and de-bone them but they had to be thawed (“slacked off”) to a point where they still retained some frozen rigidity, close to being thawed (kept at a freezing temperature of 31-32 degrees F) but not completely, in order to retain high quality fillets. If they were thawed completely before being run through the machinery, the quality of the resultant flesh was not as good.

Estimated Yields –

Scup that are landed are classified into major size categories: medium, large, and jumbo. A variety of size categories of scup were used in the trials.

The Pisces representative was asked to weigh the scup before and after processing to determine an approximate yield per fish. This entailed the combined total weight of groups of fish in the different size categories before processing and the fillets after processing (fillets off the central skeleton but with the skin still on one side of each fillet). The reported results are in Tables 1 and 2.

Table 1: Yield results from Fresh Scup Trials

	*12 Small/Large		**3 Jumbo Fish	
	Fish (lb.)	% Yield	(lb.)	% Yield
Round Fish	7.645	100.00%	5.195	100.00%
Scaled Fish	7.29	95.36%	4.985	95.96%
Head-off Scaled	5.02	65.66%	3.465	66.70%
Fillets Ex-Machine	4.21	55.07%	2.285	43.98%

¹⁸ Comments by M. Wastell, Pisces representative in meeting at SeaFesh in North Kingstown, RI on Nov. 19, 2014.

Average Yield 49.53%

* Average: 0.80 lb.
 ** Average: 1.70 lb.

Table 2: Yield results from Frozen Scup Trials

	*6 Small/Jumbo		** 12 Small/Large	
	Fish (lb.)	% Yield	Fish (lb.)	% Yield
Round Fish	8.125	100.00%	9.65	100.00%
Scaled Fish	7.78	95.75%	9.22	95.54%
Head-off Scaled	5.156	63.46%	6.15	63.73%
Fillets Ex-Machine	3.375	41.54%	4.79	49.64%

* Average: 1.35 lb.
 ** Average: 0.80 lb.

	*12 Large Fish		** 20 Medium	
	(lb.)	% Yield	Fish (lb.)	% Yield
Round Fish	11.8	100.00%	12.045	100.00%
Scaled Fish	11.38	96.44%	11.595	96.26%
Head-off Scaled	7.56	64.07%	7.775	64.55%
Fillets Ex-Machine	4.87	41.27%	4.79	39.77%

Average Yield 43.05%

* Average: 0.98 lb.
 ** Average: 0.60 lb.

[Note: Size ranges of scup categories are as follows: Small: < 0.50 lb.; Medium: 0.50 – 0.75 lb.; Large: 0.75 – 1.25 lb.; Jumbo – > 1.25 lb.]

When asked about the average yield per fish when processed to a boneless, skinless fillet form, the Pisces representative said it ranged from 30-35 %, depending on the initial size of the scup, resulting on 4-6 ounce fillets. Removing the skin results in about a 3% loss in yield and removing the pin bone results in a 1-2 % loss in yield.¹⁹

¹⁹ Notes from meeting discussion, Nov. 19, 2014 at SeaFresh, Quonset Pt., RI. Numbers quoted by M. Wastell, Pisces representative.

Quality of Product –

RI processors determined that the quality of the scup fillets resulting from the fresh scup processing trials was satisfactory. The Pisces representative relayed that the quality of the scup resulting from the frozen scup processing trials was also satisfactory provided that the scup was thawed to a point of 31-32 degrees F. Retaining some degree of frozen rigidity was necessary to prevent tearing of the flesh.

It was also noted that there is a purpose for the scales removed from the scup. They can be used to produce Kosher gelatin. In addition, the racks or central skeletons of the fish and the heads would be available for use as lobster bait.

Discussion about other marketable forms of scup revealed that it is difficult to gut fish with the head still on. This is an important factor given that some existing markets for large scup require the whole fish that have been scaled and gutted. To gut the fish mechanically would require taking the head off. Another method might be to scale the fish whole, and open the gut cavity mechanically, and then remove the guts with a wand.

Potential for Mechanical Processing of Scup in Rhode Island:

Based on the findings of the trials explained above, and the reactions and perspectives of the representatives of the three major processing companies based in Rhode Island participating in the project, the potential does exist to engage in mechanical processing of scup. It was concluded that the lineup of machinery developed by Pisces to produce boneless, skinless fillets from scup is effective. It can readily be used for fresh scup, and for frozen scup if the temperature of the fish (degree of thawing) entering the machinery is strictly controlled, with a resultant high quality product. However, additional challenges remain. These include the following:

1. *Waste water disposal* – Over the course of this project investigation, the problem of waste water disposal issues became apparent in both the Quonset Pt. and Pt. Judith settings for some of the companies. The machinery lineup presented by Pisces is water intensive. While water supply did not appear to be an issue, disposal of the water coming off of the machinery was identified as a possible problem.
2. *Low yield* – The weight of the fillets from scup, once all bones, skin, heads, guts, etc. are removed may be low, especially for small scup.
3. *Difficulty involved in processing frozen scup* – When large landings of scup are realized at the dock, there will be a need to freeze the fish for later processing. The logistics of handling the fish appropriately so they are the right temperature for entering the machinery to prevent tearing of the flesh may be a challenge to accomplish.

4. *Low market demand for scup* – The current imbalance between the availability of this species and market demand for it is a potential obstacle in moving forward with investments in scup processing machinery. The current low market demand for scup results in relatively low and inconsistent prices, providing little incentive for fishermen to target them and processors to invest in the processing equipment.

Summary of Outreach Efforts

Beginning in the spring of 2015, the CFRF staff began to compile and present the project findings. This was done through a various mechanisms including a verbal presentation as part of the 2015 RI Seafood Challenge (focused on scup) at Johnson & Wales University held in April 2015²⁰, local media articles including an article the Providence Journal on the RI Seafood Challenge and a session of the Rhode Island Public Network Morning Edition Program, the CFRF newsletter distributed to its contact database, discussions with staff of state agencies such as the RI Commerce Corporation and the RI Department of Environmental Management and with members of the RI Food Policy Council and staff of the RI Sea Grant Program, and this final report posted on the CFRF website and submitted to the funding agency, NOAA NMFS.

Observations/Conclusions

Through this phase of work which focused on the processing challenges for scup, the project team was able to answer the key research questions originally identified. In terms of finding a manufacturing company of seafood processing machinery capable of providing a line of machinery to produce boneless scup fillets, Pisces based in Michigan, U.S. proved to be capable. Their machinery lineup of a de-scaler, fillet machine, pin bone removal machine, skinner, and interwoven conveyer belts did work to produce scup fillets, with an estimated cost of \$350,000. The evaluations conducted in RI once the processed scup were returned indicated that the quality of the scup fillets was acceptable, and the final scup product would be marketable. Estimated yield was in the range of 30-35% depending on the scup size with large fresh scup giving the highest yield (55.07 %). Processing of fresh scup produced a quality product, and the processing of frozen scup could also produce a high quality end product if the temperature of the fish being fed into the machinery lineup was kept in the 31-32 degree F range. Potential obstacles for utilizing this type of processing machinery in RI included limited waste water disposal capacity in both Quonset Pt. and Pt. Judith Rhode Island, relatively low yield especially for small scup, low market demand, and the logistics involved in processing

²⁰ The CFRF partnered with Johnson & Wales University and the RI Sea Grant Program to sponsor this event. Planning began in the fall of 2014 and culminated with the event held on April 10, 2015. The CFRF supplied the scup prepared in the competition and used the opportunity to explain the work and findings of this project, as well as provide an general education to participants about the history and availability of this underutilized species.

large quantities of scup at certain times of the year, requiring intermediate freezing and storage.

Over the course of the project and the discussion between the representatives of the three major RI processing companies and Pisces, additional questions surfaced that may warrant further investigation. These included the following:

1. Is it possible to fillet the scup with the scales still on the fish, assuming the skin will ultimately be removed, or will the scales foul the machinery too much?
2. What are the combined energy requirements of all the elements of the processing line up and what are the exact numbers on water consumption?
3. What is the BOD level of the waste water coming off the machinery when scup are processed?
4. Can any of the waste water be re-used in the line up?
5. What is the quality of the end product with just a portion of the line up in operation e.g. scaler, header, and guts removed?
6. Can markets be developed to justify this kind of investment in the machinery?

In summary, the project team would offer these final observations and conclusions:

- The results of this project revealed that machinery does exist to process scup fillets efficiently, producing a marketable product but considerable consumer education needs to follow in order to increase awareness and demand for this local fish. In addition, infrastructure needs associated with waste water disposal need to be addressed.
- Working with chefs and students in the Culinary Department of Johnson & Wales University during the RI Seafood Challenge (Scup – 2015), and through activities leading up to the event indicated that this is an important partnership, and such events will be essential to raising awareness and testing the markets for scup fillets.
- Rhode Island state agencies, and local town and regional entities need to communicate and work with local seafood processing companies to address infrastructure needs to support this type of fish processing.
- A co-op approach might be beneficial to jumpstarting the processing of scup in Rhode Island. Grant funding to purchase 1-2 line ups of the type of machinery tested during this study could help alleviate the initial financial investment burden and risk for individual processing companies, and be instrumental in enabling them to have access to this type of processing within RI so they could produce small quantities of machine processed scup and begin to develop new markets. Having at least one line up of this type of machinery physically located within RI and accessible by a number of interested companies may be necessary in order to conduct more trials as described above and make the final machine produced scup fillet product available for evaluation by

potential customers. It should be noted that during this study, it was at times difficult for the Pisces representative to conduct the desired test trials because the company did not have a lineup of this machinery readily available in house and he had to rely on customers within driving distance that were amenable to their machinery being used for the tests.

- Scup continues to be an underutilized but high quality fish available in the southern New England/Mid-Atlantic region. Work needs to continue to assist industry with basic information that may enable them to make informed decisions about how to make better use of this species.

Summary of Major Findings

The major findings of this project are as follows:

- Pisces Fish Machinery, Inc based in Wells, Michigan was able to produce a machinery lineup capable of filleting scup. This included de-scaling, heading, gutting, filleting from the central skeletal rack, and removing the pin bone.
- Evaluations of the resultant fillets produced from fresh scup inserted into this lineup indicated that the quality of the scup fillets was acceptable, and the final scup product would be marketable.
- Reports from the Pisces representative indicated that the quality of the scup resulting from the frozen scup processing trials was also satisfactory provided that the scup was thawed to a point of 31-32 degrees F. Retaining some degree of frozen rigidity was necessary to prevent tearing of the flesh.
- Yields ranged from 30-35 %, depending on the initial size of the scup, resulting on 4-6 ounce fillets. Removing the skin results in about a 3% loss in yield and removing the pin bone results in a 1-2 % loss in yield. Larger scup produced a higher yield per fish. [Note: Yields might improve if line up of machinery were to be specifically adjusted and fine-tuned to process scup.]
- Potential obstacles for utilizing this type of processing machinery in RI included limited waste water disposal capacity in both Quonset Pt. and Pt. Judith Rhode Island, relatively low yield especially for small scup, low market demand, and the logistics involved in processing large quantities of scup at certain times of the year, requiring intermediate freezing and storage.
- Further work is needed to determine if portions of the complete lineup and be used effectively (e.g. running fish through a fillet machine without de-scaling them first in order to decrease water usage), the level of BOD in the water coming off of the machinery lineup, possible uses for the waste stream generated by the processing,

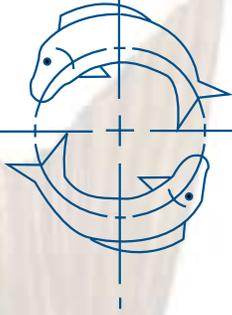
waste water disposal options, product requirement needs from potential buyers and consumers.

- It could be very beneficial for RI processing companies to form a cooperative approach to sharing at least one lineup of this machinery in Rhode Island for the initial stages of investing production logistics and marketing potential.

Appendices:

- **Appendix A – Additional PISCES documents on machinery**
- **Appendix B – Additional photographs of test results**

Appendix A – Additional Documents on Pisces Machinery



PISCES VMK, Inc.

DS Series Drum Scaling Machines



The DS-series drum scaling machines scale the fish by gently spinning them in a metal mesh drum. The rotating action and friction between the fish and the mesh removes the scales. The fish are scaled for a predetermined length of time controlled by an automatic adjustable timer. This ensures that the fish are scaled without any damage to the eyes or gill plate.

The DS-300 and DS-150 drum scalers are available with the following options: feed hopper, scale basket, removable panels, take-away conveyor and top holding hopper with optional load cell mounting for a controlled weight feed to the scaler.



DS-400 PLC Controlled Drum Scaler

The DS-400 is a drum scaler fitted with a PLC for controlled positioning of the drum.

The PLC enables the drum to return to a load or unload position with the touch of a button. The cycle time between loads is greatly reduced as the need to manually jog the drum into the desired position is eliminated. The drum is positioned using sensors and a PLC controller. The operator simply pushes a button and the drum returns to the desired location.





PISCES FISH MACHINERY, Inc.

Headcutting Machines

HS-10 and HS-20 *Straight Cut Machine*

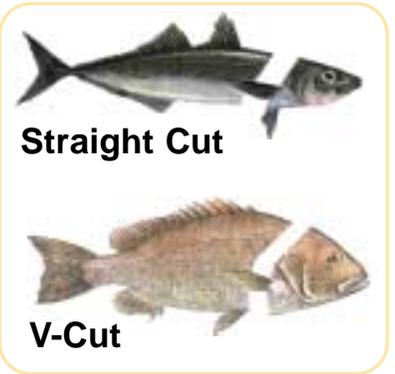
The HS-10 and HS-20 have a single blade to produce a straight head cut at an angle adjustable to suit specific fish species.

These machines provide high-yield, high-speed head removal from a large variety of fish species, each fish being automatically positioned for maximum yield irrespective of size.

The HS-10 is suitable for all fish in the size range of 4 oz. (113 grams) to 16

oz. (454 grams) depending on species. Species handling capabilities include Perch, Herring, Trout, Croaker, and Bass.

The HS-20 is suitable for fish in the size range of 12 oz. (340 grams) to 6 lbs. (2.7 Kg.) depending upon species. Species handling capabilities include Trout, Whitefish, Mackerel, Walleye, Bass, Redfish, Large Perch, Mullet, Drum, Croaker, and similar species.



HV-25 and HV-30 *V-Cut Machine*

The HV-25 and HV-30 series of machines are designed for fish species where structure is such that a double cut is required to achieve maximum meat recovery. The relevant angle of the two blades is varied to individual species requirements, each fish being automatically positioned for maximum yield irrespective of size. The HV-25 is suitable for fish in the size range of 12 oz. (340 grams) to 6 lbs. (2.7 Kgs.) depending on species.

Species handling capabilities include Tilapia, Catfish, Bass, Orange Roughy and similar species with considerable meat above the gill plate.

Method of operation An operator places fish belly-down and head-first into the transport trays which are moving towards the cutting blades. The machine automatically locates on gill plate or fins, aligning and securing the fish in the optimum cutting position for maximum meat recovery. The fish then passes first the bottom blade and then then the top blade. The relevant angle of these blades are adjusted to provide maximum meat recovery.

After headcutting, the body of the fish is delivered by conveyor to the next processing station, the head being ejected separately.

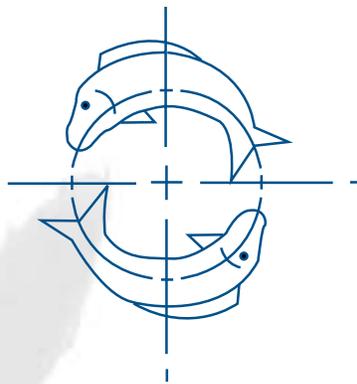


HS-10 with optional conveyor



HS-10 and HS-20 depicted with vacuum extension

- **Easy to maintain**
- **Simple to operate**
- **Ergonomic design**
- **Individual treatment for high yield**



PISCES FISH MACHINERY, Inc.

FR-150 and FR-200 *Filleting Machines*



The Pisces FR-150 and FR-200 are reliable, versatile, high-speed filleting units specially designed for the production of single fillets free of backbone and ribs. Only minor adjustments are required to process a wide variety of fish species and sizes due to the machines' unique location method that utilizes the internal bone structure of the fish.

Method of Operation An operator places the head-off fish onto the feed system between the feed rollers which carry the fish into the drive belts. (Infeed systems for either eviscerated or non-eviscerated fish are available.)

The drive belts then transport the fish over the belly cutting blades and belly cleaning wheel and past the backbone removal blades.

The backbone and offal are ejected into the waste chute and the two separate halves of the fish are located onto rib guides for transportation past the rib removal blades. The ribs are then removed and ejected into the waste chute, and the two fillets are placed skin-down onto a discharge conveyor.

The FR-150 is specially designed to accommodate fish in the size range of 3 oz. to 16 oz., such as Lake Perch, Bass, Trout, Bream and Garfish.

The FR-200 is suitable for a variety of fish in the size range of 12 oz. to 4 lbs., including Trout, Ocean Perch, Lake Perch, Redfish, Whitefish, Walleye, Tilapia, Mullet, Salmon, Mackerel, Bass, Sea Bass and Sea Bream.



- **High speed**
- **One operator**
- **Versatile design**
- **Simple to operate**
- **Easy to maintain**
- **Low operating cost**



UFT Pin Bone Remover model 350 Double



The UFT Pine Bone Remover 350 double can be used for smoked as well as fresh salmon and trout fillets.

The UFT pin bone remover 350 is our basic machine. This machine is smaller than the others, it has a more simple construction and it is very suitable for smaller processing plants.

After pin boning the fillets pass a table for manually inspection by two operators.

The machine is constructed so that it can work in a one-way flow with automatic in-feed after the UFT Trimming line. Regardless of the fillet has been pre-handled in the Baader 200 filleting machine or they are hand made, the pine bone machine removes 90-95% of all the pin bones.

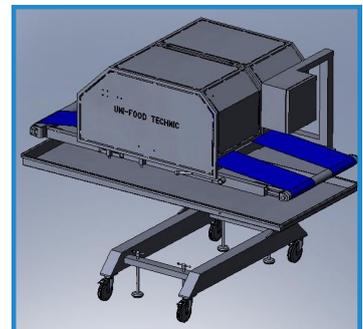


UFT Pin Bone Remover model 350 double er velegnet til både røget såvel som ferske lakse og ørred fileter.

UFT 350 er vores basis maskine. Denne maskine er mindre end de andre, den er mere enkel, og den er derfor velegnet til mindre producenter.

Efter pin boning passerer fileterne to operatører, som foretager manuel kontrol.

Maskinen er konstrueret således, at den kan arbejde i et one-way flow med automatisk indfødnig efter UFT Trimmelinie. Den fjerner 90-95% nerveben fra fileter som både er forarbejdet i Baader 200 filetmaskine eller manuelt bearbejdet.



Product advantages

- The machine is extremely efficient
- It is gentle to the fillets
- It minimizes production costs
- You need fewer workers
- The machine has a speedy pay back time

Produktfordele

- Maskinen er utrolig effektiv
- Den er skånsom mod fileterne
- Produktionsomkostningerne sænkes
- Der er behov for færre medarbejdere
- Maskinen har en hurtig „pay-back“ tid

QUALITY PROCESSING EQUIPMENT



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PRODUCT INFORMATION



After pin boning the fillets pass two workers for manual control. We have obtained optimum utilisation by using the machine for salmon and mackerel 18-24 hours after slaughtering depending on the structure of the fillet. Hereby we minimize gaping issues and problems with broken pin bones.

On fresh fillet, water is used for cleaning of roller and knife.

On smoked fillet, air is used for cleaning of roller and knife.

The standard machine is supplied with water cleaning, but it can be delivered with both water and air connection, so that it can be used for both kind of products. The machine is built as a strong stainless steel construction. All parts used are made in FDA approved materials.

Technical information:

- Adjustment of the pressure on the fillet is made by spring pressure.
- Tooth roller with built-in water/air nozzles for automatic cleaning of the roller and knife
- Adjustable knife holder.
- Fine adjustment of belt angle to obtain a bend on the fish to visualize the pin bones before removal. Adjustment depends on the thickness of the fillets.
- Quick-release for removal of conveyor belt for cleaning. When the belt is removed the machine is open for cleaning. The belt can then be put into a disinfecting bath.
- Waterproof cabinet for motor and electrical parts. The electrical parts are protected in an extra box inside the cabinet.
- The knife and roller have a width of 230 and 350 mm. The width of the knife makes in-feed precision less important.
The machine can therefore also easily be placed after an automatic infeeding machine.

Options to the pin bone remover 350:

- Bone raise roller that automatically raises and lowers depending on the fish size.
- Underlying gathering tray.



Efter pin boning passerer fileterne 2 operatører, som foretager manuel kontrol. Vi har opnået optimal udnyttelse af maskinen på laks og makrel ved at pinbone 18-24 timer efter slagtning afhængig af strukturen på fileten. Herved minimeres gabe problemer samt problemer med brækkede nerveben.

På fersk filet anvendes vand til rengøring af valse og kniv.

På røget filet anvendes luft til rengøring af valse og kniv.

Som standard er maskinen forsynet med vand til rengøring, men maskinen kan også forsynes med både vand- og lufttilslutning, således at den kan anvendes til begge produkttyper. Maskinen er opbygget som en kraftigt rustfrit stål konstruktion og alle anvendte materialer er FDA godkendte.

Tekniske informationer:

- Justering af pres på fileten foregår via fjedertryk.
- Tandvalse med indbygget vand/luft til automatisk rengøring af valse og kniv.
- Justerbar knivholder.
- Finjustering af båndvinkel for herved at få et knæk på fileten, som får benene til at rejse sig inden udtagning. Justeringen er afhængig af filettykkelse.
- Quick-release til aftagning af bånd ved rengøring. Båndet kan eventuelt lægges i et desinficerende bad natten over.
- Vandtæt kabinet til motor- og el-dele. El-skabet er dobbelt beskyttet i et ekstra skab.
- Maskinen har en kniv- og valsebredde på 230 og 350 mm. Knivenes bredde bevirker, at fisken ikke behøver at blive placeret med så stor nøjagtighed, når den skal ind i maskinen.
Maskinen kan, af samme grund, derfor let placeres efter en automatisk indfødemaskine.

Tilbehør til pin bone remover 350:

- Benrejser valse, der automatisk bevæger sig i forhold til fileten tykkelse.
- Underliggende drypbakke

Model	UFT 350 Single	UFT 350 Double
Capacity	10-20 fillets/min.	25-40 fillets/min.
L x W x H	1518 x 915 x 1470	2000 x 1300 x 1520
Power	220/230 V	220/230 V
Weight	200 kg	400 Kg



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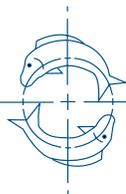
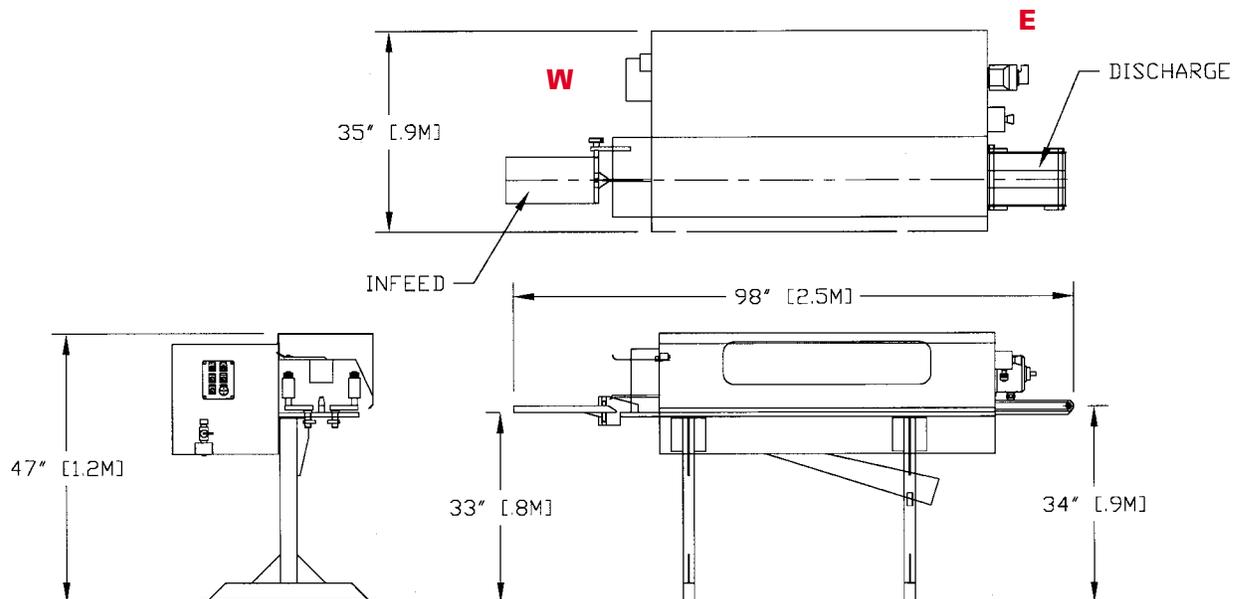
FR-150 and FR-200 Filleting Machines

Technical Specifications

Water Connections	Standard garden hose connection 1/2"	
Water Usage	3 US gallons per minute or 12 liters per minute	
Belt Speed	60 feet per minute	
Electrical	Per Customer Specifications	
Power	12.4 amps full load, @ 220 v, 3 Kw	
Operators	One	
Net Weight	FR 150 - 740 Lbs. (336 Kg)	FR 200 - 840 Lbs. (331Kg)
Weight Export Crated	FR 150 - 890 Lbs. (404Kg)	FR 200 - 990 Lbs. (450 Kg)
Crate Volume	42"Width x 75"Length x 48"Height (107cm x 191cm x 122cm)	

Specifications subject to change without notice • This machine is subject to U.S. and International patents and meets all CE machine directives.

W= Water connection • **E**= Electrical connection • **A**= Air connection



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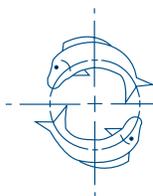
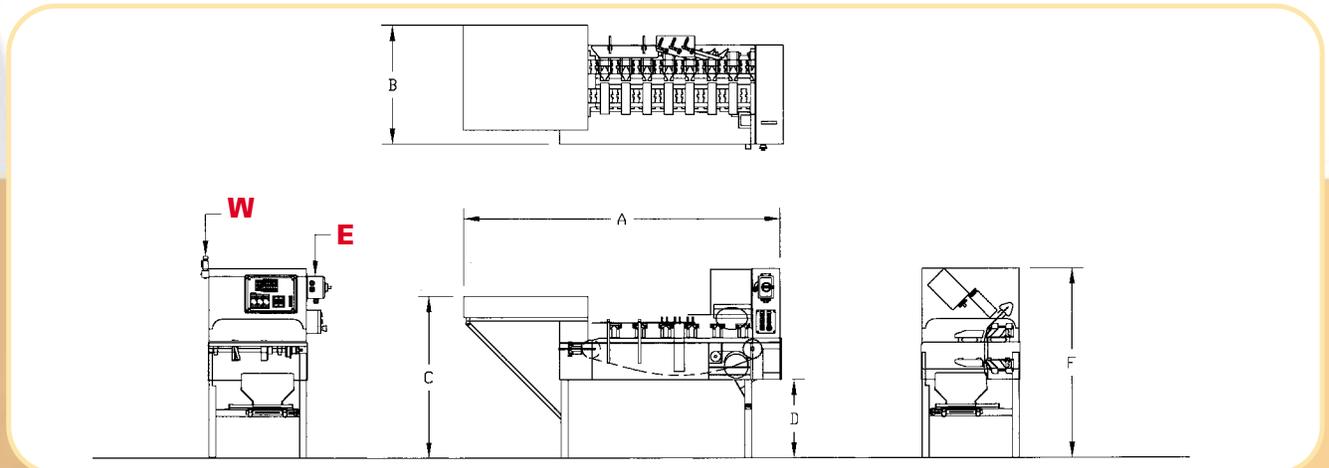
HS-10 and HS-20 *Straight Cut Machine* HV-25 and HV-30 *V-Cut Machine*

Technical Specifications

HEADCUTTING MACHINES				
	HS-10	HS-20	HV-25	HV-30
Length A	92" (234 cm)	92" (234 cm)	92" (234 cm)	92" (234 cm)
Width B	34" (86 cm)	34" (86 cm)	42" (107 cm)	44" (112 cm)
Height C - Infeed	56" (142 cm)	56" (142 cm)	56" (142 cm)	56" (142 cm)
Height D - Discharge	34" (86 cm)	34" (86 cm)	34" (86 cm)	34" (86 cm)
Height F	47" (119 cm)	47" (119 cm)	47" (119 cm)	66" (168 cm)
Water Connections	Standard garden hose connection 1/2"			
Water Usage	2 US gallons (7.6 liter) per minute			
Electrical	3 phase standard, 60 Hz			
Power	7.0 amps full load 1.3 Kw	7.0 amps full load 1.3 Kw	10 amps full load 1.9 Kw	10 amps full load 1.9 Kw
Belt Speed	60 trays per minute	55 trays per minute	55 trays per minute	55 trays per minute
Operators	One	One	One	One
Net Weight	700 lbs. (318 Kg)	725 lbs. (330 Kg)	750 lbs. (341 Kg)	800 lbs. (364 Kg)
Weight Export Crated	850 lbs. (386 Kg)	875 lbs. (397 Kg)	900 lbs. (409 Kg)	1000 lbs. (455 Kg)
Crate Volume	48"Width x 68"Length x 60" Height (122 cm x 173 cm x 152 cm)			

All Pisces headcutting units can be fitted with vacuum evisceration systems whereby the deheaded fish pass by a vacuum port synchronized to the fish movement. Vacuum evisceration on the headcutting machine makes for clean, hygienic further processing • Specifications subject to change without notice • This machine is subject to U.S. and International patents and meets all CE machine directives.

W= Water connection • **E**= Electrical connection • **A**= Air connection



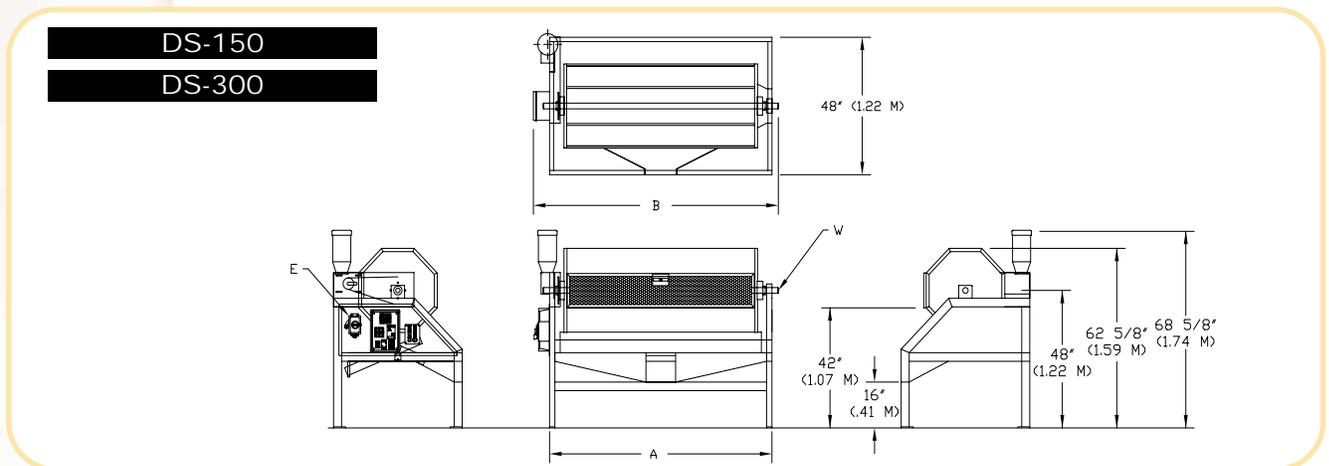
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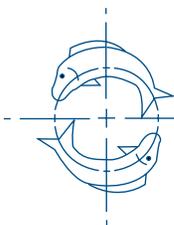
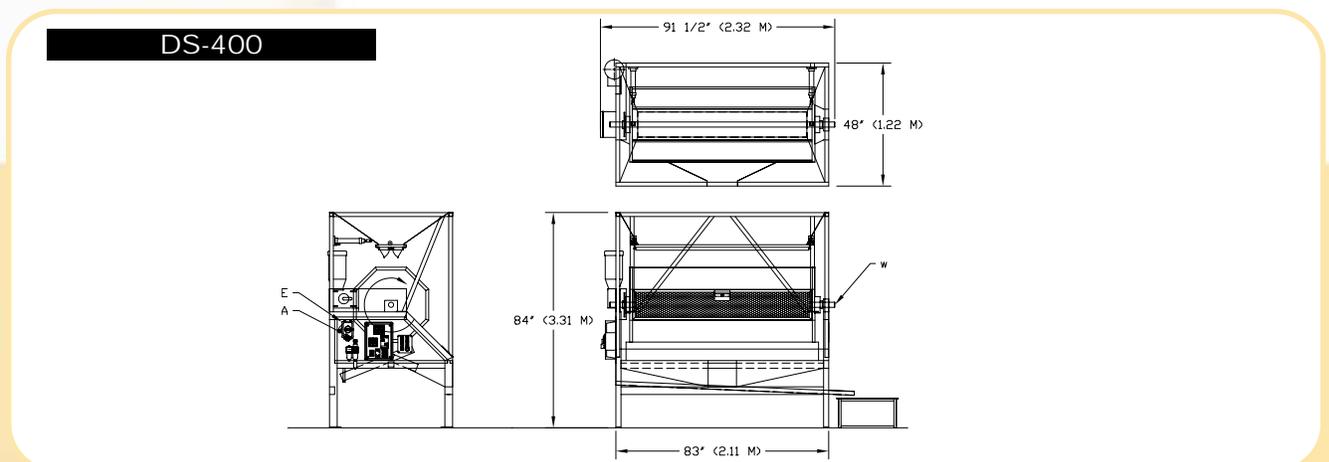
DS Series Drum Scaling Machines

Technical Specifications

	DS-150	DS-300	DS-400
Length A	47" (119 cm)	83" (211 cm)	83" (211 cm)
Length B	56" (141 cm)	92" (232 cm)	92" (232 cm)
Capacity / Batch	150 lbs (69 kg)	300 lbs (137 kg)	300 lbs (137 kg)
Power	2HP (1.5 KW)	2HP (1.5 KW)	2HP (1.5 KW)
Compressed Air	no	no	yes
Water usage / minute	up to 10 gal (38 liters)	up to 20 gal (76 liters)	up to 20 gal (76 liters)
Operators	one	one	one



DS-300 and DS-400 drum scalers can be fitted with the following options; infeed hopper, top-holding hopper, take-away conveyor and weighting unit for the top hopper. Specifications subject to change without notice. These machines are subject to U.S. and International patents and meet all CE machine directives.



PISCES VMK, Inc.

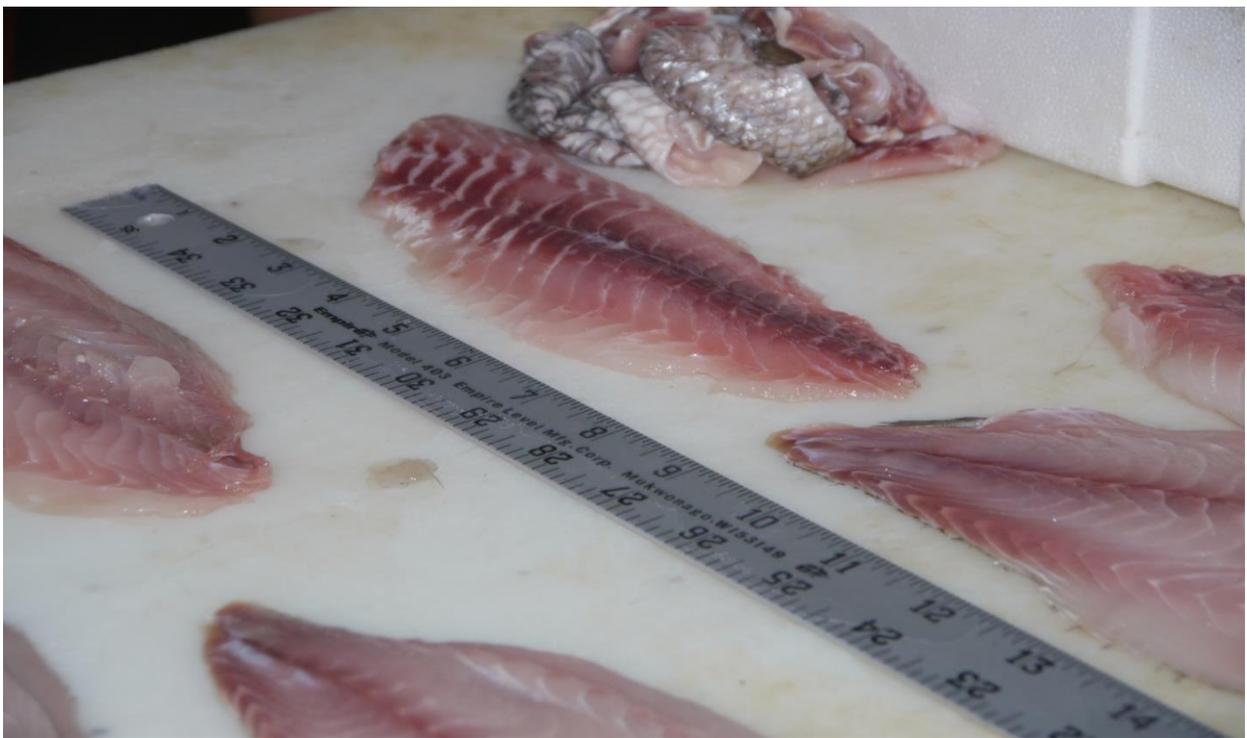
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Appendix B – Additional photographs from scup trials

1. First Scup Trial Results – Fresh Scup (CFRF, April 2014)



2. Second Scup Trial Results – Fresh Scup (CFRF, June 2014)





3. Photographs of Pisces operations (Pisces, November 2014)







4. Images from frozen scup trials (Pisces, November 2014)



