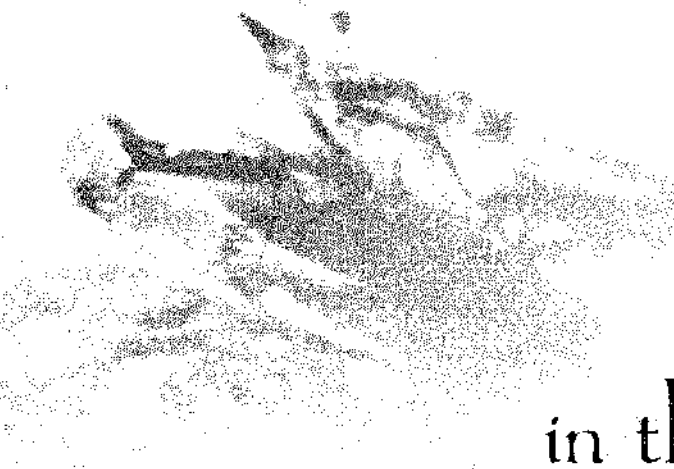


A Plan to Improve the
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Blue Crab
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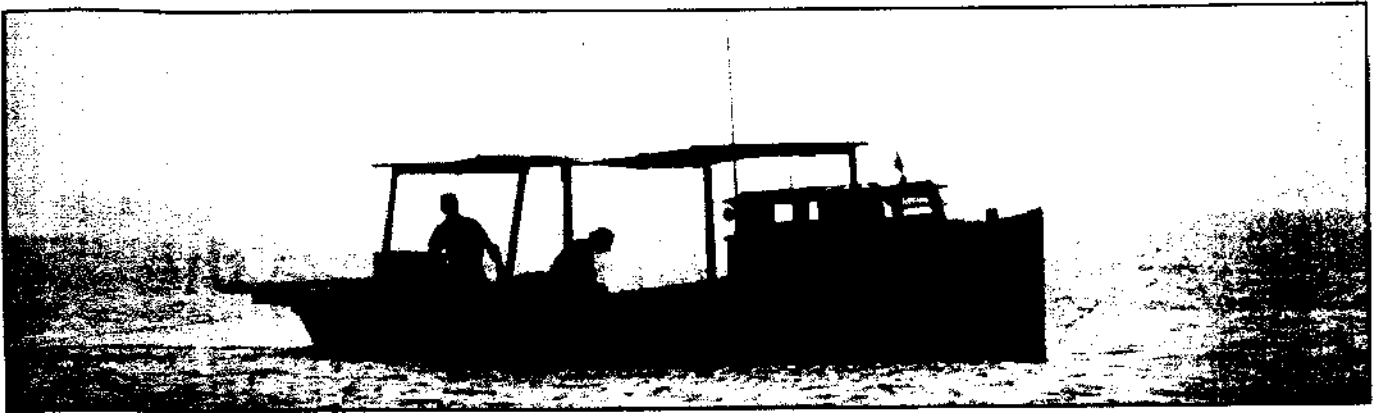
A Plan to Improve the Competitiveness of the Blue Crab Processing Industry and the Quality of Crab Meat Products in the U.S. Marketplace

A document developed by the Sensory Working Group --

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A Plan to Improve the Competitiveness of the Blue Crab Processing Industry and the Quality of Crab Meat Products in the U.S. Marketplace

EXECUTIVE SUMMARY

This document addresses important issues affecting the quality of blue crab (*Callinectes sapidus*) and related swimming crab processing industries. University, government, and industry scientists from the Gulf of Mexico through the mid-Atlantic region of the United States met at the Virginia Seafood Agricultural Research and Extension Center in Hampton, Virginia, to discuss and prioritize issues affecting the competitiveness of the processing sector of this important domestic fishery. This expert panel developed this research guidance document which contains eight broad research areas, priority actions, and specific research needs.

This research document describes a focused integrated and comprehensive research approach for addressing quality issues associated with the Atlantic blue crab processing industry. The purpose of this document is to provide guidance for university, government, and industry personnel as they develop research programs to help improve the competitiveness and viability

of the blue crab processing industry. It will also serve to help improve the overall quality of crab meat products in the U.S. marketplace. This guidance document is

divided into the following eight broad research areas:

- Describe and characterize crab meat sensory profiles of blue crab and related swimming crabs
- Determine consumer acceptance, preference, and diagnostic profiles for crab meat
- Identify and document government and industry minimum quality standards as determined through sensory evaluations
- Describe and characterize biochemical, chemical, and microbiological attributes of blue crab and related species
- Determine the effect of environmental factors, harvest factors, as well as processing technologies on crab meat quality
- Conduct marketing and economic analyses and develop new value-added products
- Develop more effective species identification methods for crab meat products
- Develop education and outreach programs for industry and consumers

Each broad research area can be developed and implemented independently based on regional or state needs with the potential for industry-wide initiatives. Thus, individual states can use this document to help identify and address specific blue crab quality issues important for their state or region. It can also be used to develop a comprehensive regional research program addressing issues of importance from the mid-Atlantic to the Gulf of Mexico.



INTRODUCTION

Background

In 1998, reported United States (U.S.) landings of hard blue crab were 217.9 million pounds (98.8 thousand metric tons) with a dockside value to commercial fishermen of \$149.1 million. Domestic annual production of crab meat has averaged approximately 13 million pounds (5900 metric tons) since 1994. In 1998, production was approximately 12.5 million pounds (5682 metric tons), with a wholesale value of approximately \$111 million, and a retail value in excess of \$174 million.

The blue crab fishery represents an economically important segment of the domestic seafood industry, especially for the mid-Atlantic and Gulf coast regions of the United States. In addition, over 26 million pounds (11.8 thousand metric tons) of fresh and frozen crab meat (warm water species) was imported in 1998 worth an estimated value of \$116 million. In 1998, the U. S. also exported 3.3 million pounds (1500 metric tons) of fresh and frozen crab meat (all species) worth an estimated \$5.6 million.

Although mature and well established, the U.S. blue crab industry is faced with significant constraints on its growth due to variations in supply, unresolved quality issues, and competition from inexpensive imported crab meat. The first two issues are related to increased market demand for basket (live) and frozen (whole) crabs, and factors such as decomposition (i.e., ammonia) in finished crab meat products. The third issue is market driven and will not be addressed directly in this document. Nevertheless, a better understanding of factors affecting the quality of blue crab meat is vitally important for the continued commercial viability of the economically important blue crab processing industry.

Current Status

The current status of the U.S. blue crab industry is affected by several external factors. Fishery management plans under development for Atlantic blue crab will impact the availability of crabs for domestic processors. This will open the market for more imported crab meat, which may ultimately blur the distinction between domestic and imported product. Furthermore, recent

changes in state health regulations allow for the repacking of both domestic and imported blue crab meat in some states. As a result, the blue crab industry must respond to rapid market changes based on the ever-increasing amount of imported crab meat.

Since the mid-1990s, imports have doubled, and the domestic processing industry has experienced a significant loss of market share. Currently, 65% of crab meat produced from warm



water species consumed in the U.S. is imported. Differences in product sensory profiles are known to exist for the wide variety of species, market forms and global sources, but these sensory differences have not been characterized.

The quality of domestic and imported crab meat is determined primarily through the use of sensory analyses in conjunction with selected microbiological and chemical tests. Regulatory agencies such as the Food and Drug Administration (FDA) and the National Marine Fisheries Service (NMFS) in the U.S. and international agencies such as Codex Alimentarius committee on Fish and Fishery Products, and the International Organization for Standardization's Sensory Subcommittee have all recognized the need for trained sensory assessors. These assessors are needed to evaluate products in conjunction with various microbiological and chemical analyses.

The FDA has the authority to detain and/or reject blue crab meat because of filth, decomposition, and other sensory-related problems. Many sensory related problems can be avoided through a better understanding of factors affecting the quality of crab meat products. An expanded database of sensory information disseminated to the industry should result in fewer crab meat product detentions and rejections due to sensory related issues, provide the consumer with higher quality crab meat products, and improve the economic competitiveness of the domestic blue crab processing industry.

RESEARCH APPROACH

This document was drafted by an invited panel of experts and was subsequently reviewed by leading university, government, and industry personnel. It describes a focused, integrated, and comprehensive research approach for addressing quality issues associated with the Atlantic blue crab processing industry, with application to the processing of other related swimming crabs. This document can serve as a guide to identify research needs for funding agencies such as the National Sea Grant Program (NSGP), National Marine Fisheries Service (NMFS), Saltonstall Kennedy Grants (SK), National Coastal Resources and Research and Development Institute (NCRDI), and others. This document contains eight broad research areas, followed by priority actions, and specific research needs:

Research Area #1: Describe and characterize sensory profiles of blue crab and related swimming crabs.

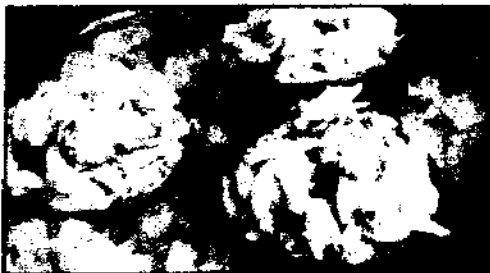
Three priority actions were identified:

- ◆ Harmonize sensory methodologies.
- ◆ Characterize, document, and summarize baseline sensory characteristics of high quality blue crab meat and related worldwide crab species for fresh and pasteurized products.
- ◆ Collect representative existing crab meat products and determine sensory characteristics.

Research Area #2. Determine consumer acceptance, preference, and diagnostic profiles for crab meat products.

Three priority actions were identified:

- ◆ Establish standardized methodologies for consumer studies of crab meat.
- ◆ Conduct studies using diagnostic consumer panel evaluations for crab meat.
- ◆ Use consumer methods for crab meat evaluation to meet overall project goals.



Research Area #3. Identify and document government and industry minimum quality requirements determined through sensory evaluations.

Four priority actions were identified:

- ◆ Identify the current government sensory cut-off point for decomposition of crab meat.
- ◆ Develop a quality standard for blue crab and related species products.
- ◆ Harmonize government inspection personnel to help ensure objective and consistent sensory evaluations of crab meat products.
- ◆ Develop and institute an industry-wide training program to advance the understanding and application of sensory evaluation methods on minimal quality requirements.

Research Area #4. Describe and characterize biochemical, chemical and microbiological attributes of blue crab and related species.

Three priority actions were identified:

- ◆ Evaluate and correlate biochemical analyses with sensory evaluations.
- ◆ Evaluate and correlate chemical analyses with sensory evaluations.
- ◆ Evaluate and correlate microbiological analyses with sensory evaluations.

Research Area #5. Determine the effect of environmental factors, harvest factors, as well as processing technologies on crab meat quality.

Five priority actions were identified:

- ◆ Determine key environmental and harvest factors affecting the physiological condition of crabs at harvest and upon receipt at the processing plant.
- ◆ Design regional studies to demonstrate the effect of environmental and harvest conditions on crab meat sensory quality.
- ◆ Design and test alternative harvest, handling, and distribution techniques to reduce stress levels in live crabs prior to processing.
- ◆ Determine biochemical changes during processing that affect sensory attributes in crab meat products.
- ◆ Identify and evaluate improved process, packaging, and distribution methods to obtain the desired level of quality.

Research Area #6. *Conduct marketing and economic analyses and develop new value added products.*

Three priority actions were identified:

- ◆ Survey current uses of crab meat products.
- ◆ Develop new, innovative products to increase the value of crab meat products.
- ◆ Develop valuable flavoring ingredients, chitosan products, etc., from crab processing wastes.

Research Area #7. *Develop more effective species identification methods for crab meat products.*

Three priority actions were identified:

- ◆ Collect authentic domestic and worldwide whole, raw blue crabs, and related swimming crab species for use as standards for species identification purposes.
- ◆ Improve protein identification methodologies.
- ◆ Develop alternative species identification methodologies.

Research Area #8. *Develop education and outreach programs for industry and consumers.*

One priority action was identified:

- ◆ Translate and disseminate information generated by each research strategy to key user groups (e.g., crab harvesters, the processing industry, and regulatory agencies).



RESEARCH STRATEGY

Overall Goal: To Develop a comprehensive sensory research program for the blue crab processing industry and to improve the quality of crab meat products in the U.S. marketplace.

RESEARCH AREA #1

Describe and Characterize Crab meat Sensory Profiles of Blue Crab and Related Swimming Crabs

Comprehensive baseline information concerning sensory characteristics of blue crab (*Callinectes sapidus*) and related species is lacking. Sensory information is needed for existing domestic and imported commercial crab meat products. This information is essential in order to establish a solid scientific foundation that can enhance the competitiveness of the blue crab processing industry and improve the overall quality of crab meat products in the U.S. marketplace.

Priority Actions:

1. *Harmonize sensory methodologies.*

Establish appropriate sensory training methods for analyzing fresh and pasteurized crab meat products from blue crab and related species. These sensory training methodologies should follow recognized ASTM, CODEX, and ISO procedures.

2. *Characterize, document, and summarize baseline sensory characteristics of fresh and pasteurized product from high quality blue crab and related worldwide crab species.*

Prioritize and collect sufficient authentic representative samples of high quality domestic blue crab and worldwide related crab meat products. Use these samples to generate information on baseline sensory characteristics of blue crab and related crab species for domestic and imported crab meat products. Establish descriptive sensory profiles of imported and domestic blue crab and related crab species, and characterize crab sensory characteristics by species, harvest area, season, etc. Develop sensory terminology specific to blue crab and related crab species meat products.

3. Collect and determine sensory characteristics for representative existing commercial crab meat products.

Establish sensory profiles for representative commercial domestic and imported crab meat products in the U.S. Compare and harmonize current FDA and NMFS sensory terminology with terminology developed from this document.

Research Needs:

Baseline sensory information on blue crab and related crab species is needed to improve the ability of industry, university scientists, and regulatory personnel to better differentiate between crab meat of blue crabs from related species in the marketplace. Research needs include:

- ◆ Establish baseline sensory profiles of authentic high quality commercial domestic and worldwide blue crab and related species products.
- ◆ Characterize sensory profiles of crab species and crab meat by harvest location and season.
- ◆ Characterize sensory profiles of existing commercial crab meat products.



RESEARCH AREA #2

Determine Consumer Acceptance, Preference, and Diagnostic Profiles for Crab meat

The consumer is the ultimate judge and end-user of crab meat products. The development of consumer profile studies is needed in order for the industry to develop new products. Results from consumer profile studies may also have an impact on current regulatory inspection techniques.

Priority Actions:

#1. Establish standardized methodologies for crab meat consumer studies.

Reliable/valid consumer studies require appropriate statistical designs.

#2. Conduct studies using diagnostic consumer panel evaluations for crab meat

Preliminary consumer diagnostics are needed to develop consumer sensory terminology, and to identify how consumers evaluate crab meat products. Conduct a focus group to determine appropriate consumer test procedures and ballots needed to evaluate crab meat products.

#3. Use consumer methods for crab meat evaluation to meet overall project goals.

Correlate consumer sensory tests with other objective instrumental methods to assess crab meat quality. Consumer sensory tests can also be used to evaluate environmental and processing parameters that affect crab meat quality.

Research needs:

Use established sensory procedures and statistical designs for the consumer studies. Use focus groups to establish appropriate procedures and then conduct diagnostic consumer panels to establish parameters and objectives for the studies, including:

- ◆ Use focus groups to establish how consumers evaluate sensory differences between products of varying degrees of freshness and decomposition.
- ◆ Identify numbers, types and quality of samples needed in test products.
- ◆ Develop appropriate questions for sensory evaluations.
- ◆ Develop appropriate terminology.

This preliminary panel work will then be used to evaluate:

- ◆ Consumer thresholds and product acceptability
- ◆ Consumer preferences
- ◆ Regional, environmental, and biological factors
- ◆ Differences due to harvesting/processing conditions

- ◆ Consumer ability to discern species substitution and/or product blending
- ◆ Consumer recognition of crab meat decomposition
- ◆ Value-added products
- ◆ Relationship between consumer and expert evaluations
- ◆ Marketing decisions

RESEARCH AREA #3

Identify and document government and industry minimum quality standards as determined through sensory evaluation.

Domestic and imported product must meet minimum quality standards to comply with regulatory authorities and to satisfy quality agreements between buyer and seller. Quality is determined mainly by sensory analysis. Failure to understand and meet minimum quality standards often causes product detention or rejection.

An unusually high number of sensory variables specific to crab meat, coupled with the presence of naturally occurring background ammonia concentrations may complicate and impact sensory quality decisions. Interested industry parties should form a partnership with government inspection personnel to exchange information, train sensory personnel, and harmonize the application of a common sensory standard.

Priority Actions:

- #1. *Conduct studies to better define the current government cut-off point for decomposition in crab meat.*

During a hands-on workshop, under the supervision of a sensory science professional, review current sensory evaluation practices of U.S. government personnel. The workshop should be limited to those government personnel (a minimum of ten or more individuals) who actually perform product sensory evaluations for their government agencies. The workshop should use crab meat samples that exhibit a full range of quality attributes. Efforts should also be made to identify and quantify those sensory attributes, which are responsible for product rejection. Special attention should be paid to the differences between background ammonia concentrations and ammoniacal odors associated with

decomposition.

- #2. *Develop a quality standard for blue crab and related species.*

Develop a written sensory evaluation standard for blue crab and related species. Develop science-based training methods, including specific terminology and references for inclusion in the standard. The document should be detailed and include qualitative and quantitative sensory descriptions covering the whole range of quality changes found in blue crab and related species. The standards should identify differences between background ammonia odors and those indicative of decomposition.

- #3. *Harmonize training of government inspection personnel to ensure objective and consistent sensory evaluations to facilitate application of a uniform definition for minimal sensory product acceptability.*

Improve consistency of sensory evaluations by inspection personnel from the U.S. and exporting countries. During a hands-on sensory evaluation workshop, conduct training exercises to teach appropriate terminology and sensory evaluation procedures. Training of personnel (a minimum of ten or more individuals) should include techniques to recognize and identify sensory characteristics needed to differentiate quality parameters. Training on use of appropriate statistical procedures for determining the degree of inspector conformity on the application of the standard should also be included.

- #4. *Develop and institute an industry-wide training program to advance the understanding and application of sensory evaluation methods to determine minimal quality requirements.*

Transfer information from government agencies to interested parties in industry and academia. Institute a training program involving government and key industry personnel using a hands-on forum similar to the one described previously. This program should facilitate exchange of information between government and industry, and result in the training of key individuals who can recognize sensory characteristics associated with different quality levels; especially decomposition characteristics.

Research Needs:

Develop and institute a harmonized sensory evaluation approach. Research should be conducted to:

- ◆ Identify the current government sensory cut-off point for minimum quality.
- ◆ Identify and quantify the sensory characteristics indicative of decomposition in these products.
- ◆ Document and summarize findings and develop a written sensory protocol using established ASTM Standards. This standard can be used by industry, academia and government agencies to facilitate the uniform application of sensory evaluations for quality and provide a clear understanding of the cut-off points for decomposition.
- ◆ Harmonize government inspection personnel in the application of the standard.
- ◆ Transfer knowledge to the industry through training workshops designed to teach the application of the quality standards and provide a clear understanding of minimum allowable quality levels for this product.
- ◆ Compare consumer sensory methods to government standards and integrate findings into standards and training.

RESEARCH AREA #4

Describe and characterize biochemical, chemical and microbiological attributes of blue crab and related species.

Live blue crabs are cooked (boiled or retorted) to facilitate the picking process. Picked crab meat is marketed as fresh, frozen, pasteurized, and canned product. Biochemical, chemical, and microbiological changes affect sensory properties of processed blue crab meat, but are poorly understood. Processors face financial losses when processed products are returned because of poor sensory attributes. Future research should focus on determining analytical methodologies to evaluate the sensory properties of blue crab meat and related species products.

Priority Actions:

1. *Evaluation and correlation of biochemical analyses with sensory evaluations.*

Emphasis should be placed on characterizing the profiles of important enzymes responsible for influencing sensory properties (e.g., enzyme activities in harvest through storage).

2. *Evaluation and correlation of chemical analyses with sensory evaluations.*

The chemical factors affecting quality should be evaluated and correlated with sensory studies. Ammonia formation pathways during crab storage should be determined, evaluated, and correlated with sensory evaluations.

3. *Evaluation and correlation of microbiological analyses with sensory evaluations.*

Characterize bacteria responsible for spoilage of blue crab meat and related species products, and correlate, when possible, with sensory evaluation data.

Research Needs:

- ◆ Focus scientific studies on biochemical, chemical, and microbiological parameters, which can significantly influence the quality of crab meat products.
- ◆ Delineate relationships between biochemical, chemical, and microbiological parameters affecting sensory properties.
- ◆ Identify enzymes responsible for production of ammonia and biogenic amines in crab meat products.
- ◆ Correlate changes in concentrations of chemical moieties such as ammonia and biogenic amines with sensory characteristics.
- ◆ Determine macro and micro constituents (e.g., free amino acids, free fatty acids, heavy metal, etc.) influencing sensory attributes as they relate to harvest location, season, and processing parameters.
- ◆ Identify bacteria with deaminase and decarboxylase activity.
- ◆ Correlate biochemical, chemical, and microbiological analyses with sensory data.

RESEARCH AREA #5

Determine the Effect of Environmental and Harvest Factors and Processing Technologies on Crab meat Quality

The ability to deliver consistent, high quality crab meat products at an affordable price is essential for the long-term viability of the blue crab processing industry. In recent years, supply and market conditions for blue crab meat has eroded, although overall consumption of crab meat has increased. The demand for live animals (basket market) and imports of crab meat similar to that of the blue crab and related species has also increased. Research is needed to improve the delivery system for consistent, high quality blue crab meat to ensure the viability and competitiveness of this important domestic fishery and commercial processing industry.

Priority Actions:

- # 1. *Determine key environmental and harvest factors affecting physiological condition of crabs at harvest and receipt.*
 - ◆ Determine how the physiological condition of crabs including factors of sex, size, molt stage, and stress factors including energy reserves, free amino acids, and enzyme activity levels effect sensory attributes of crabs and related species.
 - ◆ Evaluate alternative handling techniques for reducing stress on crabs at harvest and during delivery, and the impact of bait types on sensory qualities of crab meat
- # 2. *Design regional studies to demonstrate environmental and harvest conditions affecting crab meat sensory qualities.*
 - ◆ Evaluate effects of regional and seasonal environmental harvest differences for blue crab and related crab species.
- # 3. *Design and test alternative harvest, handling, and distribution techniques for live crabs to reduce stress levels prior to processing.*
 - ◆ Improve product distribution methods for delivery of high quality live crabs

4. *Determine biochemical changes that occur during current processing techniques that may contribute to sensory attributes in crab meat products.*

- ◆ Evaluate post-harvest biochemical and microbial changes as affected by current processing technologies.
- ◆ Evaluate effects of thermal processing on the biochemical and sensory qualities of cooked crab meat.

5. *Identify and evaluate improved process, packaging and distribution methods for desirable crab meat sensory qualities.*

- ◆ Determine alternate processing and packaging methods for improved product quality.
- ◆ Determine impacts of the HACCP program on sensory qualities of blue crab and related crab species.

Research Needs:

Improve the understanding of various factors affecting quality of blue crab meat products. These include:

- ◆ Identify the effects of environment and harvest methods on crab meat quality.
- ◆ Identify the effect of processing on crab meat quality.



RESEARCH AREA #6

Conduct Marketing and Economic Analyses and Develop New Value-added Products

Currently, the most common blue crab meat products marketed in the U. S. are fresh and pasteurized. Market and consumer demands need to be surveyed for development of alternate value-added ready-to-serve products to

augment the revenues of crab meat processing industries.

Priority Actions:

#1. Survey uses of crab meat products.

Develop a brand name concept based on sensory quality requirements.

#2. Develop new, innovative products to increase the value of crab meat.

Analyze the chemical profiles of different crab meat parts (e.g., lump, claw, and residual body meat). Use innovative techniques to formulate ready-to-serve products. Use advanced packaging systems to achieve portion control, easy opening, and shelf life extension of finished product.

#3. Develop valuable flavoring ingredients, chitosan products, etc., from crab processing wastes.

Use by-products including deboned meat, shells and debris from the effluent.

Research Needs:

Identify unmet needs and current uses of crab meat and develop value-added products for niche market based on sensory quality requirements. Collaborative research is needed to:

- ◆ Establish brand marketing for fresh crab meat
- ◆ Diversify value-added products
- ◆ Use crab processing by-products



RESEARCH AREA #7

Develop More Effective Species Identification Methods for Crab meat Products

Mixing of crab meat species is a common industry practice, and much of the crab meat used in the resulting blends is of imported origin. Substitution of lower value crab meat for higher value species is extremely difficult to detect in crab meat products using conventional analytical techniques, since cooking and subsequent pasteurization procedures denature proteins. Further complicating the issue is the lack of a sufficient number of authentic domestic and foreign blue crab and related species for use as standards.

Priority Actions:

#1. Collect authentic domestic and worldwide blue crab and related swimming crab species for use as authentic standards for species identification purposes.

Collect sufficient numbers of authentic whole, raw, blue crab and related swimming crab species to establish a reliable database for commercial domestic and imported crab meat products. Conduct research to determine the best analytical approach or combination of approaches to identify individual and mixed species of crab meat in commercial products.

#2. Improve protein identification methodologies.

Investigate isoelectric focusing methods in conjunction with ammonia/urea gels, and identify species specific protein marker bands. Identify species specific heat stable parvalbumins for identification purposes. Investigate the use of cyanogen bromide for species identification for pasteurized crab meat products. Develop monoclonal antibodies for identification of domestic and imported blue crab and related blue crab species in mixed crab meat products.

#3. Develop alternative species identification methodologies.

Develop a database of blue crab fatty acid profiles collected from different regions in the U.S. and for related blue crab species collected from major crab supplying countries around the world. Use this fatty acid database to distinguish crab species by region or worldwide harvest location.

Characterize amino acid profiles for authentic standards of commercial domestic and imported crab species and fresh and pasteurized crab meat produced from these species.

Research Needs:

Development of reliable methods for identification of crab species in mixed product is necessary. Key areas needing additional research efforts include:

- ◆ DNA methodologies.
- ◆ Monoclonal antibodies
- ◆ Amino acid and fatty acid profiles
- ◆ Improved isoelectric focusing techniques

RESEARCH AREA #8

Develop Education and Outreach Programs for Industry and Consumers:

The U.S. already has a well established crab meat industry, but is facing several issues that can impact the health of the fishery and the profitability and competitiveness of the industry. Baseline sensory information on blue crab and related swimming crab species can be used to develop a partnership between industry and government inspection personnel to harmonize the application of appropriate sensory standards and develop a training program. Results from consumer acceptance and preference studies will help the industry and regulators to understand market conditions and regional preferences for crab meat products.

Priority Actions:

- #1. *Translate the information generated by each research strategy to user groups (e.g., crab harvesters, the processing industry, and regulatory agencies) into the appropriate form.*

A better understanding of the biochemical pathways, and chemical and microbiological profiles that influence blue crab meat quality and safety will not only improve the products produced but will provide valuable information for developing value-added products. Understanding the unique interactions between the environment, harvesting and processing technologies for improving the quality of crab meat products cannot be understated.

Research Needs:

The overall goal of outreach and education is to create/maintain a two-way information conduit between regulatory agencies, harvesters, the processing industry, and the customer. Communication among these groups is an important component to ensure a strong crab resource and processing industry.

- ◆ Provide technical assistance, technology transfer, and outreach to all sections of the crab meat processing industry.
- ◆ Transfer information to industry, regulatory agencies, and the consumer on: 1). research findings describing and characterizing sensory profiles for crab meat products; 2). consumer profile studies and preferences; 3). minimal quality requirements; 4). chemical and biological profiles of crab meat; and 5). environmental factors, harvesting factors as well as processing factors affecting crab meat quality

Summary

The blue crab processing industry is undergoing tremendous change. Resource availability problems, coupled with a tremendous increase in imported crab meat products are forcing the domestic crab processing industry to reevaluate its business approach. In order for the domestic blue crab processing industry to remain competitive, basic information on factors affecting the sensory characteristics of crab meat products is essential. Such information can help the industry to develop new products, create product brands, and help to better identify its market-place niche for its products. To be successful, this information should be coupled with a sound marketing strategy and consumer education programs.



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