Pacific Fisheries Technologists

54th Annual Meeting

February 24-27, 2002

Silver Legacy Hotel

Reno, Nevada

February 24, 2002

Dear PFT Members,

Welcome to Reno, Nevada and the Silver Legacy Hotel!

We trust the meeting will be informative as well as an enjoyable time of fellowship with seafood technology colleagues and students. I would like to thank Norm Haard, the Program Chairman, for an outstanding job putting together a full program including 47 papers in eight sessions covering Roe Production, Processing and Marketing, Biochemistry of Aquatic Food Products, Use of Chlorine Dioxide, Posters, Regulatory Issues and Aquatic Food Products, By-Products from Aquatic Organisms, Microbiology and Safety of Aquatic Foods, and Processing/Technological Innovation with Aquatic Food Products. Speakers come from Australia, Canada, India, Mexico, Thailand and the United States of America. In addition, fourteen graduate students from nine Universities have entered the Graduate Students Competition for 'Student Travel Awards'.

We have not arranged for any group sightseeing or tour trips this year as we feel there is enough excitement in Reno. Individual excursions may be arranged with the Hotel staff.

A very special thanks not only to Norm Haard, but to Denise DeLeebeeck and Pamela Tom for their guidance, suggestions, and attention to detail during the past year while preparing the agenda for this meeting. Additional thanks to the NFPA staff in Seattle for their help in completing the details and planning before and during the meeting.

A Hospitality Suite, Room 3401, will be available at the Silver Legacy Hotel until 1:00 AM Sunday through Tuesday after the evening's events.

Welcome to Nevada. I am very pleased you could join us here in Reno.

Joe McGrath
President, Pacific Fisheries Technologists

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Pacific Fisheries Technologists, 54th Annual Meeting

All Events for the Annual Meeting are at the Silver Legacy Hotel

Sunday, February 24

5- 7 PM. **Registration**

7- 9 PM. **Presidents Reception, Penthouse Suite, Silver Legacy room 3801**

8:30 PM. **Executive Committeee meeting**

Monday, February 25

7- 9 AM. **Registration**

7:30 AM. **Breakfast on your own.**

8:15 AM. **Welcome and Opening Remarks, Joe McGrath, PFT 2002 President**

Session 1. Roe Production, Processing and Marketing as a Food Product. Co-chairs: Mike Morrissey (Oregon State University) & Barbara Rasco (Washington State University)

8:30 AM. 1. Keynote address. **HISTORY AND MARKETING OF CAVIAR PRODUCTION IN THE PACIFIC NORTHWEST. Mats Engstrom**[1]
[1]Tsar Nicoulai Caviar Inc., San Francisco

9:10 AM. 2. **OVERVIEW OF ROE PRODUCTS. Robert J. Price**[1]
[1]California Seagrant, Cooperative Extension, University of California, Davis

9:30 AM. 3. **REARING OF STURGEON FOR ROE PRODUCTION**. **Serge I. Doroshov**[1]
[1]Department of Animal Science, University of California, Davis

9:50 AM. 4**. OPPORTUNITIES AND PROBLEMS OF CAVIAR FROM FARM RAISED STURGEON. Peter Struffenegger**[1]
[1]Stolt Seafarm California LLC, Elverta, Calif.

10:10 AM. 5. **CAVIAR AND FISH ROE PRODUCTS. Gleyn Bledsoe**[1], Barbara Rasco[2] & Chris Bledsoe[2]
[1]Washington State University, Pullman
[2]Aquatic Foods International

10:30 AM **Break**

10:45 AM. 6. **IKURA (SALMON CAVIAR) - CURRENT PROGRESS IN THE DEVELOPMENT OF CONTINUOUS PROCESSING SYSTEMS**. **Gleyn Bledsoe**[1]
[1]Washington State University, Pullman

11:05 AM. 7. **DEVELOPMENT OF PASTEURIZATION PROCESSES FOR SALMON CAVIAR. Murad Al- Holy**[1,3], Zory Quinde[1], Juming Tang[2], & Barbara Rasco[1]
[1] Washington State University, Pullman
[2] Washington State University, Pullman
[3] **Graduate Students Competition**

11:25 AM. 8. **PORTABLE ATP LUMINOMETRY FOR EVALUATING SALMON ROE PROCESSING FACILITIES. B.H. Himelbloom**, S.M. Vitt & C.A. Crapo[1]
[1] University of Alaska, Kodiak

11:45 AM**.** 9. **HACCP RISK ASSESSMENT FOR THE PROCESS OF KARASUMI-DRIED MULLET ROE. Clare Winkel**[1,2,]
[1] Centre for Food Technology, Hamilton, Australia
[2] **Graduate Students Competition**

12:15 PM. **Lunch, Sterling Room**

Session 2. Biochemistry of Aquatic Foods. Co-chairs: Yi-Cheng Su (Oregon State University) and Ramon Pacheco-Aguilar (Centro de Investigacione en Alimentacion y Desarrollo)

1:30 PM. 10. **QUANTIFICATION AND DISTRIBUTION OF LIPID, MOISTURE, AND FATTY ACIDS WITHIN SIX BODY ZONES OF ALBACORE TUNA (*THUNNUS ALALUNGA*) CAUGHT OFF THE OREGON COAST. S.C. Wheeler**[1,2], & M.T. Morrissey[1],
[1] Seafood Laboratory, Oregon State University, Astoria
[2] **Graduate Students Competition**

1:50 PM. 11. **ZYMOGENS FROM RAINBOW TROUT GASTRIC MUCOSA. Vasana Weerasinghe**[1,2] & N. F. Haard[1]
[1] Institute of Marine Resources, Department of Food Science & Technology, University Of California, Davis
[2] **Graduate Students Competition**

2:10 PM. 12. **PROTEIN SOLUBILITY OF PACIFIC WHITING AT VARIOUS PH AND IONIC STRENGTHS**. **Supawan Thawornchinsombut**[1,2] & Jae W. Park[1]
[1] Seafood Laboratory, Oregon State University, Astoria
[2] **Graduate Students Competition**

13. **EFFECT OF FASTING ONTHE ACTIVITY OF DIGESTIVE ENZYMES OF JUVENILE SEA BASS (*DICENTRARCHUS LABRAX*) Ezquerra-Brauer J.M**.[1], Alarcón-López F.J.[2], Barros A.M.[2], Díaz-López M.[2], & Abellán, E.[3]
[1] Departamento de Investigación y Posgrado en Alimentos, Universidad de Sonora.

P.O.Box 1658. Hermosillo, Sonora. MEXICO.83000
[2] Departamtento de Biología Aplicada, Universidad de Almería, La Cañada de San Urbano s/n, Almería E-04120, Spain.
[3] Instituto Español Oceanografía, Mazarrón, Murcia, Spain

2:50 PM. **14.** ATP DEGRADATION PATTERNS OF SEVERAL FISH SPECIES FROM NORTHWESTERN MEXICO AND CALCULATION OF THE K VALUES
Ramon Pacheco-Aguilar[1], M.E. Lugo-Sanchez[1], V. Ocano-Higuera[1], F.J. Castillo-Yanez[1], E Moran-Palacios[1], E. Marquez-Rios[1], M.A. Mazorra-Manzano[1], E. Diaz-Rojas[1], & M.R. Robles-Burgueno[1]
[1] Centro de Investigacion en Alimentacion y Desarrollo, A.C. Apartado Postal 1735. Hermosillo, Sonora. Mexico. 83000

3:10 PM. **Break**

3:30 PM- 5 PM. **Session 3: Poster Session**

15. **PROTEOLYTIC ACTIVITY OF JUMBO SQUID (*DOSIDICUS GIGAS)* MANTLE AND HEPATOPANCREAS. Jose Luis Cardenas**[1,2] & N. F. Haard[1]
[1] Institute of Marine Resources, Department of Food Science & technology, University of California, Davis
[2] **Graduate Students Competition**

16. **EFFECT OF FEEDS ON COLLAGENASE AND COLLAGEN FROM MUSCLE OF FARMED WHITE SHRIMP (*LITOPENAES VANNAMEI*). Jesus Aaron Salazar-Leyva**[1,2], Josafat Marina Ezquerra Brauer[1], Lorena Bringas Alvarado[2] & Ofelia Rouzaud Sandez[1].
[1] Universidad de Sonora, Hermosillo, Sonora, Mexico.
[2]**Graduate Students Competition**

17. **CALORIMETRIC STUDY OF ICE-STORAGE MUSCLE OF JUMBO SQUID (*Dosidicus gigas*). Rosalina Ramirez-Olivas**[1,4], Josafat M Ezquerra[2], Norman F. Haard[2], Ramon Pacheco[4] & Ofelia Rouzand[2].
[1] Universidad de Sonora, Hermosillo, Sonora, Mexico
[2] Institute of Marine Resources, University of California, Davis
[3] Centro de Investigacion en Alimentacion y Desarrollo, A.C. Hermosillo, Sonora, Mexico
[4] **Graduate Students Competition**

18. **QUANTIFICATION OF INSECTICIDES IN SHRIMP FARMED IN SONORA, MEXICO AND THEIR EFFECT ON SHRIMP'S MUTAGENIC POTENTIAL** C. O. Garcia-Sifuentes[1], M. L. Aldana-Madrid[1], M. M. Meza-Montenegro[2], & **A Burgos-Hernandez**[1].
[1]Universidad de Sonora, Hermosillo, Mexico.
[2] Instituto Tecnologico de Sonora, México.

19. **PURIFICATION AND CHARACTERIZATION OF THE TRYPSIN-FRACTION FROM THE GUT OF MULLET (*Mugil cephalus*) AND EVALUATION OF ITS HYDROLYTIC CAPACITY OVER DURUM WHEAT (*Triticum durum*) GLUTEN. Hermenegildo Olivas-Burrola[1],[2]**, Ofelia Rouzaud-Sandez[1] & Josafat M Ezquerra-Brauer[1].
[1]Universidad de Sonora
[2]Graduate Students Competition

20. **REMOVAL OF FREE FATTY ACIDS FROM CRUDE CATFISH OIL BY ADSORPTION USING CHITOSAN, ACTIVATED CARBON, AND ACTIVATED EARTH. Subramaniam Sathivel[1,3]** & Witoon Prinyawiwatkul[2].
[1] Fishery Industrial Technology Center, University of Alaska Fairbanks, Kodiak
[2] Louisiana State University Agricultural Center, Baton Rouge
[3] **Graduate Students Competition**

21. **CHITIN PRODUCTION FROM SHRIMP SHELL RESIDUE. B.H. Soga[1,3]**, S. Canut[2], T.T. Nguyen[1], & B.K. Simpson[1]
[1] McGill University (Macdonald Campus), Ste Anne-de-Bellevue, Quebec, Canada
[2] Ecole Nationale d'Inginieurs des Techniques des Industries Agro-Alimentaires, B.P.
[3] **Graduate Students Competition**

22. **IMPROVING ACCURACY, PRODUCTIVITY, AND SAFETY IN DOUBLE SEAM MEASUREMENT. William C. (Chuck) Gray[1]** & Peter DuGranrut[2]
[1] WC Gray & Associates, Inc., Lake Grove, OR [2] OneVision Corporation, Westerville, OH

5:30 PM. **Dinner on your own**

Tuesday, February 26

7:00-8:00 AM **Continental Breakfast , Meeting Room**

7:30 - 8 AM **Registration**

Session 4. Regulatory Issues and Aquatic Food Products.

Co-chairs: Denise DeLeebeeck (British Columbia Institute of Technology); Pamela Tom (University of California, Davis)

8:10 AM. 23. **THE NEW BIOTERRORISM BILL. Barbara Rasco[1]**
[1] Washington State University, Pullman

8:30 AM. 24. **THE DEVELOPMENT AND IMPLEMENTATION OF NEW REGIONAL POLICIES FOR THE APPLICATION OF HACCP IN SLDB/SMEs FOR TRADITIONAL FISHERIES PRODUCTS IN ASEAN COUNTRIES. L. G. Limpus[1]**

[1] L. G. Limpus and Associates, Victoria, B.C. Canada

8:50 AM. 25. **OVERVIEW OF FOOD SAFETY ISSUES RELATED TO POTENTIALLY SCOMBROTOXIC FISH. James D. Barnett[1]**
[1] U.S Food and Drug Administration, Pacific Regional Laboratory Northwest

9:10 AM. 26. **VERIFICATION ACTIVITIES ON OVERSEAS SEAFOOD FACILITIES INCLUDING FACILITIES PRODUCING TUNA PROCESSED WITH CARBON MONOXIDE Sam McKeen[1]**
[1] Director, USDOC Seafood Inspection Program, Silver Spring, MD

9:30 AM. 27. **FDA UPDATE ON REGULATORY ISSUES RELATED TO SEAFOOD. Charles M. Breen[1]**
[1] Seattle District Director, Food & Drug Administration, Bothell, WA

9:50 AM. 28**. INDIAN EXPERIENCES IN MEETING REGULATORY REQUIREMENTS OF IMPORTING COUNTRIES FOR MARINE PRODUCTS.** Sashi Sareen & Anaud Kishore[1]
[1]Director, Export Inspection Council of India, New Dehli, India

10:10 AM. **Break**

Session 5. Microbiology and Safety of Foods From Aquatic Organisms.

Co-chairs: Armando Burgos-Hernandez (University of Sonora) and Brian Himelbloom (University of Alaska)

10:30 AM. 29. **BIOTOXINS AND HARMFUL ALGAL BLOOMS (HABS) IN CALIFORNIA: PATTERNS OF TOXICITY AND ONGOING MONITORING EFFORTS FOR THE HABS AND HAB-NOTS**. **Gregg W. Langlois[1]**, Sara Webster[1] & Dunyette Seymore[1]
[1]California Department of Health Services, Berkeley, CA

10:50 AM. 30. **EVALUATION OF MIST ALERT™ IN PARALYTIC SHELLFISH POISON TESTING OF CLAMS AND MOLLUSCS. B.H. Himelbloom[1]**
[1]University of Alaska , Kodiak

11:10 AM. 31. **REFRIGERATED SEA WATER (RSW) MODIFICATIONS TO MAINTAIN FISH QUALITY. Susan M. Vitt[1]**, Charles A. Crapo[1] & Brian H. Himelbloom[1]
[1] University of Alaska, Kodiak

11:30 AM. 32. **AN OVERVIEW OF POSTHARVEST TREATMENTS TO ELIMINATE *VIBRIO* IN OYSTERS. Michael Morrissey**[1], Hakan Calik[1], & Paul Reno[2]
[1] Oregon State University, Seafood Laboratory, Astoria
[2] Department of Microbiology and the Hatfield Marine Science Center of Oregon State University, Newport

11:50 AM**.** 33. **CONTROLLING *LISTERIA MONOCYTOGENES* IN RAW SALMON WITH**

ACIDIFIED SODIUM CHLORITE. Yi-Cheng Su[1] & Michael T. Morrissey[1]
[1] Seafood Laboratory, Coastal Oregon Marine Experiment Station, Oregon State University, Astoria

12:15 **Lunch - Sterling Room**

Session 6. By-Products From Aquatic Organisms. Co-chairs: Benjamin Kofi Simpson (McGill University) and Marina Ezquerra-Brauer (University of Sonora)

1:30 PM. 34. **SEAFOOD WASTEWATER INFORMATION.** Janet Webster[1], **Ed Kolbe**[2] & Larry Schmidt[3]
[1] Oregon State University/Hatfield Marine Science Center, Newport
[2] Oregon State University Food Innovation Center
[3] Emporia State University

1:50 PM. 35. **TRENDS AND APPROACHES TO SEAFOOD WASTEWATER PROCESSING. Larry Schmidt**[1] & Ed Kolbe[2]
[1] Emporia State University
[2] Oregon State University Food Innovation Center, Portland

2:10 PM. 36. **ESTIMATES OF ALASKA FISH PROCESSING WASTE STREAM COMPONENTS.** P. J. Bechtel[1] & **C. A. Crapo**[2]
[1] USDA-ARS Laboratory, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks.
[2] Fishery Industrial Technology Center, University of Alaska, Kodiak

2:30 PM. 37. **FILMOGENIC PROPERTIES OF CRAWFISH CHITOSAN.** Kandasamy Nadarajah[1,2] & **Witoon Prinyawiwatkul**[1]
[1] Louisiana State University Agricultural Center, Baton Rouge
[2] **Graduate Students Competition**

2:50 PM. 38. **UPDATE ON THE ALASKA FISHERIES BY-PRODUCT UTILIZATION PROJECT. Scott Smiley**[1]
[1] UAF-Fishery Industrial Technology Center, Kodiak, AK

Session 7. Panel Discussion (Chair, Claire Egvedt)

3:10 PM. 39. **PANEL DISCUSSION: SHARING SOME PRACTICAL ASPECTS OF USING CHLORINE DIOXIDE AS A SANITIZER**. **Claire Egvedt**[1]
[1]Wards Cove Packing Co., Seattle, WA 98275

3:45 PM **Break**

4:00-4:45 PM. **General Business Meeting**

6:30-7:30 PM. **Social Hour - No Host Bar**

7:30-9:30 PM**. Banquet**

Magic by Vasana Weerasinghe

Wednesday, February 27

7:00-8:00 AM **Continental Breakfast, Meeting Room**

Session 8. Processing and Technical Innovations With Aquatic Food Products. Co-chairs: Bruce Odegaard (National Food Processors Association) and Jae Park (Oregon State University)

8:10 AM. 40. **USE OF PORK PLASMA PROTEIN AS AN ENZYME INHIBITOR IN PACIFIC WHITING (*MERLUCCIUS PRODUCTUS*) SURIMI. Xingqiu Lou**[1], Tein M. Lin[2], & Jae W. Park[3]
[1]Proliant Inc. 2325 North Loop Dr. Ames, Iowa 50010
[2]Pacific Surimi J.V., 450 NE Skipanon Dr. Warrenton, OR 97146
[3]Seafood Lab, 2001 Marine Dr. Astoria, OR 97103

8:30 AM. 41. **PREDICTION OF SODIUM CHLORIDE IN COMMERCIALLY PRODUCED KING AND CHUM SALMON BY SW-NIR.** Mengshi Lin[1] & **Barbara Rasco**[1]
[1] Washington State University, Pullman

8:50 AM. 42. **GELATION PROPERTIES OF FISH PROTEINS AND PENETRATION DEPTH AS AFFECTED BY E-BEAM. J. Jaczynski**[1,2] & J.W. Park[1]
[1] Seafood Lab & Dept of Food Science and Technology, Oregon State UniversityAstoria
[2] **Graduate Students Competition**

9:10 AM. 43. **EFFECTS OF FREEZING PROCESS ON THE QUALITY CHANGES OF TIGER SHRIMP (*PENAEUS MONODON)* FROZEN BY AIR BLAST AND CRYOGENIC FREEZING. Sirintra Boonsumrej**[1,2], Saiwarun Chaiwanichsiri[1] & Sumate Tantratian[1]
[1] Chulalongkorn University, Bangkok, Thailand.
[2] **Graduate Students Competition**

9:30 AM. 44. **GLUCOSE POLYMER AS AN EFFECTIVE CRYOPROTECTANT.** A. Hunt[2], **Jae.W. Park**[1], & C. Jaundoo[2]
[1]Seafood Lab & Dept of Food Science and Technology, Oregon State University, Astoria
[2] Roquette America, Keokuk, IA

9:50 AM. 45. **IMPROVING ACCURACY, PRODUCTIVITY, AND SAFETY IN DOUBLE SEAM MEASUREMENT. William C. (Chuck) Gray**[1] & Peter DuGranrut[2]
[1] WC Gray & Associates, Inc., Lake Grove, OR

[2] OneVision Corporation, Westerville, OH

10:15 AM **Break**

10:30 AM. 46. **GELATION PROPERTIES OF FISH PRODUCTS AT REDUCED IONIC STRENGTH.** M. R. Choi[1], **Jay W. Park[1]** & Herbert O. Hultin[2], Y. Feng[2]
[1] Seafood Lab, Oregon State University, Astoria
[2] University of Massachusetts, Gloucester

10:50 AM. 47. **COMPARISON OF FIVE GROWTH TECHNIQUES FOR GIANT SCALLOP (*PLACOPECTEN MAGELLANICUS*) IN THE GASPE BAY, QUEBEC, CANADA. Marie-Lyne Larrivee[1]** & L. Girault [1]
[1] Centre collegial de transfert de technologie des peches, Centre specialise des peches, Quebec, Canada

11:15 AM. **Denise DeLeebeeck, Graduate Students Competition**

11:45 PM. **Joe McGrath, Closing Remarks**

12:00 PM. **Adjourn**

ABSTRACTS

1. HISTORY AND MARKETING OF CAVIAR PRODUCTION IN THE PACIFIC NORTHWEST

Mats Engstrom[1]
[1]Tsar Nicoulai Caviar Inc., 144 King St., San Francisco, CA 94107

FORM: Oral presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

The speaker has worked with sturgeon fishermen in practically all caviar producing countries in the world. Caviar processing by Tsar Nicoulai Caviar Inc. goes back to the early 70's from Columbia River and the company was first to produce caviar from California sturgeon. The company continues to operate out of China, Caspian Sea as well as here in California. This overview of the NW Pacific sturgeon caviar industry will include history, supply, marketing trends, politics and other issues.

2. OVERVIEW OF ROE PRODUCTS

Robert J. Price[1]
[1]Food Science & Technology, University of California, Davis, CA 95616

FORM: Oral Presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

The use of fish roe as a delicacy has a long history dating to about 2000 BC. About 19 countries produce aquatic roe products. World production of aquatic roe products was about 52,000 metric tons in 1999, down from a record 76,000 metric tons in 1997. Aquatic roe products include whole ovaries and fresh roe, caviar, caviar substitutes, and various processed roe products. Whole ovaries, lobes, and fresh roe are available from numerous aquatic species including herring, shad, sea urchin, lobster, shrimp, and crab. Caviar, lightly salted sturgeon roe, is made primarily from Beluga, Osetra, and Sevruga species of sturgeon. Production of caviar from the roe of other species of sturgeon has increased in volume in recent years, due in part to over-fishing in the Caspian Sea and to the low quality of some caviar products on the market.

Caviar substitutes, lightly salted fish roe, are made from the roe of about 30 other species of fish and serve as sturgeon caviar substitutes or as unique products. Prepared fish roe include smoked, dried, pressed, and other products made from the roe of a variety of fish and shellfish.

3. REARING OF STURGEON FOR ROE PRODUCTION

Serge I. Doroshov[1]

[1]Department of Animal Science, University of California, Davis, CA 95616. U.S.A

FORM: Oral Presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

The decline of sturgeon fisheries in the Caspian Sea has provided impetus for production of roe from farmed sturgeon. Commercial farming of white sturgeon (*Acipenser transmontanus*) began in California and initially pursued production of meat for the restaurant market. After a successful development of domestic broodstock, captive breeding and husbandry, the focus in white sturgeon farming shifted to production of roe bringing higher economic return. In the intensive culture system with controlled environment and artificial feeding, farmed sturgeon exhibit faster growth and sexual maturation compared to wild prototype. Female white sturgeon reaches full sexual maturity at the age 7-8 yr and weight ca. 30 kg. To produce roe, fish are sexed at market size (6-10 kg), males are sold for meat and females are reared to full sexual maturity. The average virgin female produces ca. 3 kg of caviar-grade eggs separated from the ovarian tissue (10% of fish weight). The yield of roe (ovarian eggs in late stage of vitellogenic growth) varies in the individual fish and populations and depends on husbandry (feeding and diet composition, rearing densities), harvest season, thermal regime, and iteroparity (repeated maturation). Genetic factors and broodstock origin might also contribute to a large variation in some traits, such as the size and pigmentation of eggs and the age of first sexual maturity. Sturgeon caviar industry is currently developing into economically viable aquaculture venture. However, the rearing of sturgeon for roe production is still in its infancy and needs the insights and research in food science and technology, as well as in sturgeon genetics, nutrition, and physiology.

4. OPPORTUNITIES AND PROBLEMS OF CAVIAR FROM FARM RAISED STURGEON

Peter Struffenegger[1]

[1]Stolt Seafarm California LLC, 9149 East Levee Rd, Elverta, CA

FORM: Oral presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

Historically, 90-95% of the world's production of caviar has come from the Caspian Sea region of the former USSR and Iran. The methods used in the processing and packaging of caviar is steeped in traditional methods developed over the years. Many of these methods do not lend themselves to the higher level of governmental regulation and marketing environment faced in more modern countries. The sturgeon farming industry is identifying these issues and how to economically deal with them inside the highly regulated food processing industry of the US. Additionally, the taking of caviar from sturgeon caught from the wild was a given, with no opportunity to modify or manage the wild fish before capture with respect to the quality or quantity of caviar it may produce.

With the breakup of the USSR and the rise in level of poaching by organized crime in the Caspian Sea, opportunities for farmed caviar have developed. California farms have been producing caviar from farm-raised sturgeon since 1994. Many differences between wild fish and the characteristics of both the fish and the caviar have been noted when compared to farm raised fish. The traditional objectives of farming fish are for fast growth to production size, good feed conversion rations and high survival of all fish. But these objectives while vital for fish raised for its meat value do not necessarily translate into characteristics of quality or value when measured by the unintended side effects on egg and thus caviar production. Thus much has yet to be learned in how to manage domestic stocks in order to mimic conditions wild sturgeon encounter in order to produce caviar of similar or higher quality and quantity from farm-raised sturgeon as from wild sturgeon.

5. CAVIAR AND FISH ROE PRODUCTS

Gleyn Bledsoe[1], Barbara Rasco[2] and Chris Bledsoe[3]

[1]Department of Biological Systems Engineering, Washington State University, Box 646120, Pullman, WA 99164-6376;

[2]Department of Food Science and Human Nutrition, Box 646376, Washington State University,

Pullman, WA 99164-6376;
[3]Aquatic Foods International, 3235 30th SE, Puyallup, WA 98374
FORM: Oral Presentation
SESSION: 1. Roe Production, Processing and Marketing as Food Products
ABSTRACT:

Fish roe products are extremely valuable and currently enjoy expanding domestic and international markets. Caviars represent the best-known form of fish roe products, however, several other product forms are consumed including whole skeins and formulations with oil and cheese bases. Caviars are made from fish roe after the eggs have been graded, sorted, singled-out, salted or brined and cured. Most caviar is marketed as a refrigerated or frozen food; however, because of food safety concerns, some markets are requiring that these food products be pasteurized. Several types of caviar from different fish species are marketed primarily as shelf-stable products. Market preference for fish roe products with lower salt content has also raised food safety concerns.

Chemical composition, nutritional, microbial and quality attribute data for several fish roe products will be presented in addition to processing technologies for these foods.

6. IKURA (SALMON CAVIAR) - CURRENT PROGRESS IN THE DEVELOPMENT OF CONTINUOUS PROCESSING SYSTEMS.

Gleyn Bledsoe[1]
[1]Department of Biological Systems Engineering, Washington State University, Box 646120, Pullman, WA 99164-6376
FORM: Oral Presentation
SESSION: 1. Roe Production, Processing and Marketing as Food Products
ABSTRACT:

The current progress in the development of continuous ikura processing systems will be updated. Traditional production technologies for ikura are costly, labor intensive and require specially trained technicians to produce a quality product. The processes used also unnecessarily subject the caviar to microbial contamination. As a result of these factors several processors and equipment manufacturing companies have heightened their interest and efforts in developing new methods and technologies for processing ikura.

Principles of safely processing quality ikura will be discussed as well as the challenges faced at each step. Currently available semi-continuous processing systems and/or elements for ikura will be described. This will include the use of both mechanical and enzyme based procedures for the separation of eggs from the connective tissue.

7. DEVELOPMENT OF PASTEURIZATION PROCESSES FOR SALMON CAVIAR

Murad Al- Holy[1, 3], Zory Quinde[1], Juming Tang[2], and Barbara Rasco[1]
[1] Department of Food Science and Human Nutrition, Box 646376, Washington State University, Pullman, WA 99164-6376
[2] Department of Biological Systems Engineering, Box 646120, Washington State University, Pullman, WA 99164-6120.
[3] Graduate Students Competition.
FORM: Oral Presentation
SESSION: 1. Roe Production, Processing and Marketing as Food Products
ABSTRACT:

The development of thermal pasteurization processes for high value products such as caviar have been slow due to difficulties obtaining accurate thermal processing parameters for these food products. There is international market pressure for pasteurized caviar products, but high quality products are not currently available. The objective of this study was to determine the thermal inactivation of *Listeria sp.* in chum salmon (*Onchorhynchus keta*) caviar (2.5% total salt) and to evaluate a newly designed metal thermal death time (TDT) tube which may exhibit improved heat transfer properties compared to conventional glass TDT tubes.

Salmon caviar (2.5% salt) was innoculated with *L. innocua* ATCC 51742 in stationary phase (10^7 CFU/g). Samples (1.0 ± 0.02 g) were transferred to either glass or a novel metal TDT tubes. Thermal processing was conducted in a circulating water bath at 60 - 65° C. Heat treated samples were immersed directly into a crushed ice bath until plated. Samples were diluted in 0.1% peptone water (10^{-2} to10^{-7}). Listeria were enumerated using an overlay method. The initial layer for the overlay method employed TSA agar. Samples were plated onto TSA agar and incubated at 37°C for 2 hr to resuscitate any injured *Listeria sp*. cells. Then, a second layer of PALCAM Listeria selective media containing an antimicrobic supplement

was applied over the TSA layer. Plates were incubated for an additional 22 hr at 37¡C and the distinctive *Listeria sp*. colonies were enumerated.

The thermal inactivation of *L. innocua* ATCC 51742 in novel metal TDT tubes and conventional glass tubes were compared. The come-up time in glass (0 to 60°C) was 155 sec and in metal, 90 sec; [for 0 to 65 °C: 100 sec (metal) and 185 sec (glass)]. The decimal reduction time (D value) at 60 °C was 3.1 min (metal) and 3.4 min (glass). For 65 °C, D values were 18 sec (metal) and 30 sec (glass). The Z value was for metal was 4.9 °C and 5.9 °C for glass.

The come-up time for metal TDT tubes was significantly shorter compared to conventional glass TDT tubes. Also, the D values were generally lower for samples treated in the metal tubes. The Z value was one °C lower for the metal tubes. Because the come-up time is shorter, the thermal inactivation parameters for samples heated in metal tubes are probably more accurate. D and Z values for salmon caviar were comparable to values reported in the literature for other seafood products.

8. PORTABLE ATP LUMINOMETRY FOR EVALUATING SALMON ROE PROCESSING FACILITIES

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FORM: Oral Presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

The adenosine triphosphate (ATP) bioluminescent assay provides data for personnel to immediately detect and respond to sanitation problems in food processing. A need exists for evaluating the performance of simple, portable ATP bioluminescence assays and protein assays under actual seafood processing and post-sanitation operations. Salmon roe processing was the focus since consumers eat this raw product and the seafood has a high economic value. We evaluated a portable ATP bioluminescence assay and a protein assay kit as quick, analytical tools for measuring sanitation effectiveness in seafood processing.

Swab samples, 10 sq. cm, were collected from tables used for sorting, grading, packing and boxing, weighing scales, conveyor belts, baskets and sponges during four visits to two salmon roe processing plants. The ATP bioluminescent assays and protein assays were conducted at the plants. Agar contact plates and swab samples were transported back to the laboratory for further processing and incubation.

Samples taken from surfaces and utensils, during processing at both plants, had moderate to high levels of ATP, bacteria and protein. Post-sanitation sampling at plant A showed a reduction in these levels with the exception of the plastic baskets, used from transferring salmon skeins for further processing, and a conveyor belt seam. Samples taken during post-sanitation at plant B showed extremely low ATP, bacteria and protein levels indicating a higher degree of sanitation was used in comparison to plant A. Processed salmon roe from both plants contained low bacterial populations (~3,000 CFU/g). Common locations for ATP and bacterial contamination were the plastic baskets used for transferring salmon roe between processing steps. Greater attention to difficult-to-clean utensils such as baskets, conveyor belt links and sponges will enhance product quality.

9. HACCP RISK ASSESSMENT FOR THE PROCESS OF KARASUMI-DRIED MULLET ROE.

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[2] Graduate Students Competition

FORM: Oral presentation

SESSION: 1. Roe Production, Processing and Marketing as Food Products

ABSTRACT:

The objective of this work is to design a risk assessment table for the process of Karasumi (dried mullet roe), suitable for use in the development of a HACCP plan within the FPA system (Food Processing Accreditation). FPA is Australia's HACCP based Quality Assurance system for all exported processed foods.

The process of making Karasumi, was observed and the steps flowcharted. These steps were reviewed to identify all potential food safety hazards. Using the definition of a hazard, as listed in Schedule 7 *Export Control (Processed Food) Orders*, those hazards which can be addressed by the application of GMP's (Good Manufacturing Practices) are not to be included in the HACCP plan. Therefore, these hazards have been identified in the risk assessment table and have not been

carried forward to the HACCP plan as CCP's (Critical Control Points). From this review a number of CCP's were identified. The process of Karasumi includes the following types of processes: salting, solar & mechanical drying and vacuum packing.

The risk assessment led to the development of a HACCP plan with the following CCP's:

- Receival
- Gutting
- Cold chain management at all steps
- Cleaning of roe
- Salt concentration at salting and the removal of salt
- Humidity at all drying steps
- Effective sealing during vacuum packing

Water activity at all steps post drying.

10. QUANTIFICATION AND DISTRIBUTION OF LIPID, MOISTURE, AND FATTY ACIDS WITHIN SIX BODY ZONES OF ALBACORE TUNA (*THUNNUS ALALUNGA*) CAUGHT OFF THE OREGON COAST

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FORM: Oral presentation

SESSION: 2. Biochemistry of Aquatic Foods

ABSTRACT:

Lipid content in tuna varies from species to species and within species, as well as within body zones. The intrinsic characteristics of albacore tuna (*Thunnus alalunga*) caught off the Oregon Coast are important as the industry considers renewed efforts at market development beyond the traditional canned product. In addition, a rapid, non-destructive method of lipid estimation is needed to identify fish with high fat content for use in specific alternative markets.

The objectives of this study are to quantify the lipid, moisture, and fatty acid content throughout six designated body zones of albacore tuna and determine the relationship between fat and moisture content across albacore tuna samples.

Eight albacore tuna were caught off the Oregon Coast in September of 2000, and were frozen for ten months at –30°C. Samples were taken from six body zones to evaluate distribution of lipid, moisture, and fatty acid content. The lipids were extracted using a 2:1 chloroform-methanol solvent. A 103°C drying oven was used to determine moisture content. Fatty acid methyl esters were analyzed using a gas chromatograph equipped with an ec-wax column.

The lipid and moisture content ranged from 3.9- 23.3 % and 51.0- 69.7 %, respectively. The distribution of lipids resulted in higher fat content towards the head, and lower fat content towards the tail of the tuna. The belly flaps contained, on average, 170% more fat than the anterior loin area directly behind the head. An inverse relationship with a correlation of .99 was found for fat and moisture content. EPA and DHA content, averaged across all areas of the fish were found to be 9.16% and 22.33%, respectively.

The moisture content of tuna using a simple regression equation can rapidly and non-destructively estimate fat content. Furthermore, omega- 3 content can be used as a marketing tool for West Coast albacore tuna.

11. ZYMOGENS FROM RAINBOW TROUT GASTRIC MUCOSA

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FORM: Oral presentation

SESSION: 2. Biochemistry of Aquatic Foods

ABSTRACT:

Gastric juice of vertebrates contains aspartyl proteinases, which are secreted as zymogens, and undergo conversion to active enzymes in the acidic condition of the gastric environment. The major gastric proteases are pepsin, gastricsin, and chymosin. The classification of gastric proteases from aquatic organisms is not very well understood. Sanchez-Chiang and co workers (1981) reported isolation of gastricsins from hake with similar characteristics as mammalian gastricsin; i.e., pH optima and inability to hydrolyze the synthetic substrate APDT. But these enzymes failed to hydrolyze synthetic substrates specific for mammalian gastricsins. Gildberg (1988) proposed fish pepsins resembles cathepsin D more than mam-

malian pepsins. Zymogens of gastric proteases from rainbow trout and sea-trout stomachs were purified and characterized in order to assess whether they are pepsin-like, gastricsin-like, chymosin-like or cathepsin D-like.

Zymogens were extracted from stomachs of rainbow trout and purified. Enzymes were separated by electrophoresis and assayed by activity staining, after activation in the separating gel, with acid denatured hemoglobin. A PAGE native electrophoresis using a neutral pH system was designed to separate the isoforms. The zymogens were also isolated by standard protein separation techniques. Structural characteristics such as molecular weight by SDS-PAGE, amino acid analysis, N-terminal sequence, peptide mass mapping and some internal sequencing were performed on each of the zymogens as well as the activated enzymes.

Five zymogens (I-V) for gastric proteases were isolated from the stomach lining of rainbow trout. The order of elution from a DEAE column was I, II, IV, V, and III. Based on activity staining, III is the major zymogen followed by II, I, V, and IV. Zymogen I was not retained by DEAE cellulose under the experimental conditions and it's activity was negligible unless the assay solution contained NaCl (e.g. 50 mM). Activity staining or assay with hemoglobin substrate in the presence of pepstatin showed that zymogen V and IV were less sensitive to pepstatin than the other isoforms and mammalian pepsin. The synthetic substrate APDT was scarcely hydrolyzed by the five gastric proteases. Structural homology of trout gastric zymogens with pepsin, gastricsin and chymosin will be discussed.

Zymogens I, II and III appear to be more pepsin-like while zymogens V and IV appeared to be more gastricsin-like.

12. PROTEIN SOLUBILITY OF PACIFIC WHITING AT VARIOUS PH AND IONIC STRENGTHS

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[2] Graduate Students Competition

FORM: Oral Presentation

SESSION: 2. Biochemistry of Aquatic Foods

ABSTRACT:

The pH and ionic strength (IS) of fish proteins have considerable influence on protein solubility. Pacific whiting, which is primarily utilized as a surimi resource, could be more valuable if the solubility characteristics at various pH and IS were clarified.

Our objectives were to evaluate the solubility characteristics of Pacific whiting proteins at various pH and IS. Conformational changes and protein patterns were also investigated.

Pacific whiting mince was homogenized with histidine buffer at a ratio of 1:20 to 1: 150 (w/v), depending on each treatment. The suspension was adjusted to various pH (2-12) and IS (10 - 600 mM). Samples were analyzed for protein solubility, total sulfhydryl content, surface hydrophobicity (S_0) and SDS-PAGE.

At 10 mM and pH 7, protein solubility was low, but increased as pH shifted to either acid or alkali. In contrast, at 600 mM and pH 7 protein solubility significantly improved. The shift of pH to acid decreased protein solubility, but shifting the pH to alkali increased solubility. The high salt concentration caused about a one unit shift of pH to the acid side. At both IS, S_0 increased when pH was shifted to either a low or high value, indicating more exposure of the hydrophobic amino acid residues as a result of protein denaturation. The decrease of total SH content at 10 and 600 mM was observed when the pH increased to the alkali side. This result indicated that at high pH, SH groups attributed to the oxidation of SH, resulting in disulfide linkages. SDS-PAGE at 10 mM showed the degradation of myosin heavy chain (MHC) at acidic pH and the cross linking of MHC at alkaline pH. At neutral pH, more soluble MHC was obtained at 600 mM than at 10 mM. The pH and IS showed a significant effect on protein solubility and protein conformations, particularly with MHC.

13. EFFECT OF FASTING ONTHE ACTIVITY OF DIGESTIVE ENZYMES OF JUVENILE SEA BASS (*DICENTRARCHUS LABRAX*)

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FORM: Oral presentation

SESSION: 2. Biochemistry of Aquatic Foods

ABSTRACT:

Due to their essential role in metabolic processes, enzymes may serve as indicators of the condition of an organism. The effect of fasting over the activity of stomach and intestinal digestive enzymes was examined in Dicentrarchus labrax juveniles during 15 days. Three groups of D. Labrax were examined: 15 days of feeding, 6 and 12 days of fasting. The 15 days feeding group had a better growth rate index, high protease activity, and high trypsin and chymotrypsin activities. The 6 days fasting group had a good recovery in the growth rate index and in the aforementioned enzyme activities after three days of suspension of fasting. The 12 days fasting group had the lowest growth rate index, a very low trypsin and chymotrypsin activities, a dramatical increase of the acid protease activity when the fast was suspended, and its ratio of alkaline phosphatase/leucine aminopeptidase suggested that the development of its intestines was irregular. A significant correlation between trypsin and chymotrypsin activities with growth index was detected (r= 0.77).This result suggest suggests that the activity levels of different proteolytic enzymes, particularly trypsin and chymotrypsin could be a good indicator of the stress by starving condition, whereas the ratio of alkaline phosphatase/leu aminopeptidase could be a good indicator of intestine development, in sea bass juveniles.

14. ATP DEGRADATION PATTERNS OF SEVERAL FISH SPECIES FROM NORTHWESTERN MEXICO AND CALCULATION OF THE K VALUES

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FORM: Oral Presentation

SESSION: 2. Biochemistry of Aquatic Foods

ABSTRACT:

Information about the biochemical post-mortem characteristics of tropical and sub-tropical fish species from Mexican waters is scarce. In the present study 7 species were studied. The ATP degradation patterns of tropical sierra (*Scomberomorus sierra*), Monterey sardine (*Sardinops sagax caerulea*), black skipjack (*Euthtymus lineatus*), finescale triggerfish (*Balistes polylepsis*), giant squid (*Dosidicus gigas*), catarina scallop (*Argopecten ventricosus*) and lion's paw scallop (*Nodipecten subnodosus*) were determined during a 15 - 25 days storage in ice. From the data species were classified into inosine or hypoxanthine formers. Only black skipjack was classified as inosine former while squid as hypoxanthine former. The mathematical models that describe the K values were calculated. Initial ATP and degradation products concentration fluctuate from 12.1 for tropical sierra to 3.2 for giant squid, while K values at day 15 fluctuated from 80% for lion's pawn scallop to 24% for finescale triggerfish. K values for squid did not follow a linear relationship with time.

15. PROTEOLYTIC ACTIVITY OF JUMBO SQUID (*DOSIDICUS GIGAS)* MANTLE AND HEPATOPANCREAS

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[2] Graduate Students Competition

FORM: Poster

SESSION: 3. Poster Session

ABSTRACT:

Squid mantle is becoming a very important export for Northwest Mexico. Jumbo squid (*Dosidicus gigas)* is the most abundant squid in the Sea of Cortez. Squid muscle undergoes very rapid autolysis when it is not chilled rapidly. These enzymes can cause changes in the texture of mantle muscle due to degradation of the myofibrillar structure, leading to poor gelation capacity and this limits the processing capabilities of the mantle.

A protein autolysis study of jumbo squid (*Dosidicus gigas)* mantle extract was done. Proteolysis was maximum at pH values between 3 and 4. The study also revealed a peak of proteolysis between pH 5 and 6, which corresponds to the natural pH range for jumbo squid mantle during storage in ice. This is also the optimum pH range for several cysteine cathepsins and suggests their possible role in autolysis of post-harvest jumbo squid mantle muscle. Proteolytic activity measured in the jumbo squid mantle and the hepatopancreas using BANA substrate and azocasein with specific inhibitors

showed the presence of cysteine proteinases, which was confirmed by SDS-PAGE zymograms done with casein incorporated into the gel matrix. Three cysteine proteinases were identified in gel zymograms of mantle and hepatopancraeas tissues. Studies are underway to purify the major cathepsins from hepatopancreas tissue.
A further study of the proteinases found in mantle muscle is important in elucidating their role in changes in texture and appearance of off flavors and could lead to practices that improve the quality of squid products.

16. EFFECT OF FEEDS ON COLLAGENASE AND COLLAGEN FROM MUSCLE OF FARMED WHITE SHRIMP (*LITOPENAES VANNAMEI*).

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FORM: Poster

SESSION: **3. Poster Session**

ABSTRACT:

Feeds containing three source of protein (commercial, medium quality fish flour and squid flour) were fed to white shrimp (*Litopenaeus vannamei*) for 50 days. Growth rate, collagenase activity of muscle extracts, and muscle texture, were determined. Molecular weight (SDS-PAGE) and thermal properties by differential scanning calorimetry (DSC) of collagen from abdominal muscular tissue from each group, extracted by limited pepsin digestion, also were established. Shrimp fed on commercial protein feed showed the highest growth rate and collagenase activity. The muscle texture was not affected by the source of protein. Collagen obtained after each treatment showed similar molecular weight to that from collagen type I after SDS-PAGE. Denaturation thermograms by DSC of each shrimp-collagen showed a transition peak about 47C, whereas the collagen type I at 65C. The lowest enthalpy of transition was detected in collagen from shrimp fed on squid. The results suggests that the source of protein does not have an influenced on texture at the end of the culture period, but does affect the growth rate, collagenase activity and the enthalpy of transition of collagen present in shrimp muscle. During a storage period this could induce the development of mushiness in shrimp tail

17. CALORIMETRIC STUDY OF ICE-STORAGE MUSCLE OF JUMBO SQUID (*Dosidicus gigas*)

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[5] Graduate Students Competition

FORM: Poster

SESSION: **3. Poster Session**

ABSTRACT:

The thermal behavior of jumbo squid (*Dosidicus gigas*) was measured throughout 15 day of ice-storage. Scanning rate and temperature range used were 10C/min and 26-124C, respectively using air as reference. Thermograms at 0, 5, and 15 days of storage were obtained, along with enthalpies (J/g) and maximum transition temperatures of proteins from jumbo squid muscle. Thermograms obtained at day 0 showed 4 transition states. The first 3 transition states were endothermic and

they were found within 50C and 79C, which base on previous studies correspond to myosin (50C), sarcoplasmic proteins (69C) and actin (79C). The fourth transition state was exothermic at 107C, probably associated to protein aggregation or the presence of some type of collagen in jumbo squid muscle. The thermal behavior of the muscle at days 5 and 15 showed a general trend to decrease in temperatures and enthalpies of transition of myosin and actin along the storage period. SDS-PAGE analysis showed a decrease in the number of bands corresponding to high molecular weight protein fractions, together with DSC study, the results suggest a partial denaturation of these proteins.

18. QUANTIFICATION OF INSECTICIDES IN SHRIMP FARMED IN SONORA, MEXICO AND THEIR EFFECT ON SHRIMP'S MUTAGENIC POTENTIAL

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FORM: Poster

SESSION: 3. Poster Session

ABSTRACT:

The inadequate use of pesticides in Mexico has caused that these chemicals can be found widely distributed in food. Farmed shrimp is not the exception. In this study, cultured shrimp, from 4 shrimp farms from the southern Sonora, M?xico was sampled within the month of August to December 2000 and the concentration of different insecticides was determined by gas chromatography. In addition, insecticide content from water and sediments were also analyzed. The mutagenic potential of shrimp samples that resulted with the highest insecticide concentrations was determined using the Ames test. The highest levels (ppb) of insecticides in shrimp were found for 4'4-DDE, 4'4-DDT, 4'4-DDD, endrin, dieldrin, endosulfan II, malathion y parathion. Concentrations of all of the insecticides detected in this study were below the action level. None of the farmed shrimp samples were mutagenic to *Salmonella* tester strains TA98 and TA100.

19. PURIFICATION AND CHARACTERIZATION OF THE TRYPSIN-FRACTION FROM THE GUT OF MULLET (*Mugil cephalus*) AND EVALUATION OF ITS HYDROLYTIC CAPACITY OVER DURUM WHEAT (*Triticum durum*) GLUTEN

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FORM: Poster

SESSION: **3. Poster Session**

ABSTRACT:

A trypsin-fraction was purified from the gut of mullet (*Mugil cephalus*) by $(NH_4)_2SO_4$ fractionation and affinity chromatography. The isolated enzyme had specific activity of 0.24 U/mg protein and showed three bands on SDS-PAGE with molecular weights of 27 kDa, 72 kDa and 75 kDa. The three enzymes were inhibited by SBTI, SBTQI, TLCK and PMSF, on SDS-PAGE activity-gel using casein as a substrate. The inhibition of trypsin- fraction in tube was 64%, 97%, 86% and 59%, for PMSF, SBTI, TLCK and EDTA salt, respectively. The trypsin-fraction was stable at pH 4, 7 and 9 during 30 min at 25C, and its maximum activity against L-BAPNA was between pH 8-10. The trypsin-fraction was stable at 0C, 40C and 60C during 30 min at pH 7.8. Maximum activities against BAPNA were found at 40 and 60C. The hydrolytic capacity of the trypsin-fraction over gluten from two durum wheat and one bread wheat varieties was also evaluated. Durum and bread wheat gluten were hydrolyzed by trypsin-fraction from mullet. The trypsin-fraction from the gut showed potential to be used in the breadmaking industry.

20. REMOVAL OF FREE FATTY ACIDS FROM CRUDE CATFISH OIL BY ADSORPTION USING CHITOSAN, ACTIVATED CARBON, AND ACTIVATED EARTH

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FORM: Poster

SESSION: **3. Poster Session**

ABSTRACT:

Free fatty acids (FFAs) in fish oils are precipitated as soaps and removed during the neutralization step. Use of chitosan, activated carbon, or activated earth may be an alternative approach for effective removal of FFAs in fish oils.

This study evaluated feasibility of using adsorbents (activated carbon, activated earth, or chitosan) to remove FFAs from crude catfish oil by a batch or continuous adsorption, and determined efficiency, breakthrough curve, and optimal length of a fixed-bed adsorption column for removal of FFAs from catfish oil.

For a batch adsorption study, crude oil was mixed with an adsorbent in a sealed vial at 25C. Samples were drawn after 1, 2, 3, 4, and 5 hours of mixing for analyses of FFAs (as mg oleic acid/ g oil). Adsorption kinetics was studied. For a fixed-bed adsorption study, a glass column was packed with an adsorbent up to 17 cm. Crude oil was fed through the column at 21.93g/hour and the discharged oil was collected every hour for up to 8 hours, and FFAs were analyzed. Triplicate experiments were conducted.

Removal of FFAs increased with increased batch-adsorption time. The flow rate of FFAs was 0.016 g/cm^2.h. The ideal adsorption time from a vertical breakthrough curve (C/Co = 0.5) was 7.5 hours for chitosan and 5.1 hours for activated carbon. The break-point time (C/Co = 0.05) was 5.93 hours for chitosan and 2.0 hours for activated carbon. 79% and 39%, respectively, of the fixed-bed capacity of the chitosan and activated carbon column was utilized. Chitosan adsorbed more FFAs than activated carbon and activated earth for both batch and continuous adsorption.

This study showed that chitosan can be used to effectively remove free fatty acids from crude catfish oil, thus the neutralization step may be unnecessary during oil purification process.

21. CHITIN PRODUCTION FROM SHRIMP SHELL RESIDUE

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FORM: Poster

SESSION: **3. Poster Session**

ABSTRACT:

Chitin, a natural polymer of N-acetyl-D-glucosamine, is an abundant natural polymer that bears structural resemblance to cellulose. Crustacean shells form the major source of commercial chitin, where it is found in association with proteins and minerals. The production of uniform materials with specific physical and chemical properties for high value biochemical applications require the use of mild treatments for the removal of some components of the shell to yield chitin with more consistent physicochemical properties.

Shrimp shell residue was treated successively with various concentrations of citric acid, EDTA and papain to evaluate their effects on the yield, total nitrogen and reduce ash content of chitin production to cut cost.

ANOVA test of the resulting data with Statgraphics statistical software on the various responses indicates that all factors and their interactive effects significantly influenced the yield (P 2 0.05), but not the ash and total nitrogen contents. The interactive effects of enzyme and citrate concentration had significant influence on the yield upon multiple regression analysis of data (P = 0.0048) and the optimal enzyme concentration of 0,17% (w:w) was established from response surface plot. The Duncan multiple range test indicate that the most economic conditions gave yields the range of 36-38%, ash content; 0.08-0.14% and total nitrogen content; 53.3-53.8 mg/g.

22. IMPROVING ACCURACY, PRODUCTIVITY, AND SAFETY IN DOUBLE SEAM MEASUREMENT

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FORM: Poster
SESSION: **3. Poster Session**
ABSTRACT:

The objective of this presentation is to define two approaches for improving double seam management. The first is a minimum cost approach utilizing, largely, current practices. The second is more fully automated and requires more vendor-supplied equipment.

Analytical systems are in use in salmon canning and numerous other low acid canning operations. Observations regarding the performance of these systems under processing conditions are made. The system's use of charts, graphs, statistical evaluation, and the ergonomic equipment design is evaluated.

The described systems and methods have proven effective in improving double seam measurement in the areas of accuracy, productivity, and safety.

Double seam management can be improved through the use of analytical software, hardware, and support equipment. Improvements may be done in stages to accomplish the most desired benefits first.

23. THE NEW BIOTERRORISM BILL

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FORM: Oral Presentation
SESSION: 4. Regulatory Issues and Aquatic Food Products
ABSTRACT:

House Bill 3448 "Public Health Security and Bioterrorism Response Act of 2001" passed to the Senate on December 18, 2001. The key provisions of this bill provide for a coordinated national preparedness program for bioterrorism including improved protection for food and water supplies.

Analysis of provisions in the bill and current provisions under the Federal Food Drug and Cosmetic Act were conducted. Case studies involving food processors and importers who would face the greatest possible impact were developed.

Key terms within the bill such as "credible information" and "threat" of serious adverse health consequences are not defined and do not neatly mesh with our current understanding of requirements under regulations for food recalls (Class I). The economic impact of this bill upon companies involved with the production or import of aquatic food products could be significant.

This bill will significantly impact importers and small businesses involved with aquatic food products. The proposed notice, product detention and record keeping provisions may have a major impact on firms of this type.

24. THE DEVELOPMENT AND IMPLEMENTATION OF NEW REGIONAL POLICIES FOR THE APPLICATION OF HACCP IN SLDB/SMEs FOR TRADITIONAL FISHERIES PRODUCTS IN ASEAN COUNTRIES.

L. G. Limpus[1]
[1] L. G. Limpus and Associates, 1564 Charlton Rd, Victoria B.C. Canada V9E 2C8
FORM: Oral Presentation
SESSION: 4. Regulatory Issues and Aquatic Food Products
ABSTRACT:

New development of ASEAN regional fisheries policy and work programs for improvement for traditional fish products and their control systems is presented. The methods Singapore will use in applying HACCP for SLDB/SMEs is outlined. The new Codex guidelines on HACCP for SLDBs (SMEs) will be discussed.

25. OVERVIEW OF FOOD SAFETY ISSUES RELATED TO POTENTIALLY SCOMBROTOXIC FISH

James D. Barnett[1]
[1] U.S Food and Drug Administration, Pacific Regional Laboratory Northwest, Bothell, WA 98021

FORM: Oral Presentation

SESSION: 4. Regulatory Issues and Aquatic Food Products

ABSTRACT:

Consumer illnesses due to scombroid poisonings have been a constant problem in the U.S. for many years. The intoxications are due to the ingestion of fishery products which have undergone time/temperature abuse. Three of the top ten consumed seafood species at restaurants have the potential to form histamine, the second leading cause of seafood illness in the U.S. The FDA HACCP Seafood Regulation requires that both domestic seafood processors and importers ensure that scombrotoxic fish are not offered for sale in the U.S. FDA has seen a increase during the past three years of imported frozen tuna which has been treated with Carbon Monoxide or Tasteless/Odorless smoke to retain color. This treatment has also been observed in a variety of species other than tuna.

26. VERIFICATION ACTIVITIES ON OVERSEAS SEAFOOD FACILITIES INCLUDING FACILITIES PRODUCING TUNA PROCESSED WITH CARBON MONOXIDE.

Sam McKeen[1]

[1] USDOC Seafood Inspection Program, Silver Spring, MD

FORM: Oral presentation

SESSION: 4. Regulatory Issues and Aquatic Food Products

ABSTRACT:

This is a status report regarding the USDC Seafood Inspection Program's role in auditing, validating, and verifying seafood facilities based outside of the United States. Topic points will include issues relative to 21 CFR 123, the verification process, and verification activities for facilities processing frozen tuna with filtered wood smoke or carbon monoxide to retain the red color during frozen storage. The Inspection Program is also sponsoring a study to evaluate the effect of the process on the color and sensory characteristics of decomposed tuna.

27. FDA UPDATE ON REGULATORY ISSUES RELATED TO SEAFOOD

Charles M. Breen[1]

[1] Seattle District, Food & Drug Administration, 22201 23rd Dr. SE, Bothell, WA 98021

FORM: Oral Presentation

SESSION: 4. Regulatory Issues and Aquatic Food Products

ABSTRACT:

Director Breen with present an informal update of current issues and regulations of the Food & Drug Administration that impact the marketing and processing of seafood.

28. INDIAN EXPERIENCES IN MEETING REGULATORY REQUIREMENTS OF IMPORTING COUNTRIES FOR MARINE PRODUCTS.

Sashi Sareen & Anaud Kishore[1]

[1]Export Inspection Council of India, New Dehli, India

FORM: Oral presentation

SESSION: 4. Regulatory Issues and Aquatic Food Products

ABSTRACT:

With establishment of the WHO, the international scenario has changed rapidly with opportuniuties being available to all countries to benefit from greater access to world markets. Quality issueshave become important and with that the role of standards and legislation, especially those relating to safety and health. Empasis on food safety and implementation of sanitary and phytosanitary measures by importing countries has increased. Important safety issues in the marine sector include microbial contaminats, heavy metals, pesticide residues, toxins, antibiotic residues as well as additives including preservatives, emulsifiers, cryoprotectants and coloring material.

The SPS Agreement also permits member countries to impose measures to protect the health and safety of their population. However, such measures may be imposed within certain rules. Within these rules, member countries are free to install import control systems and also have an obligation to recognize the export certification of their trading partners provided it is equivalent to their own import control systems.

In the marine sector, India through the Export Inspection Council, has been implementing export control systems based on international Codex guidelines for the design, operation, assessment and accreditation of food import and export inspection and certification systems as well as Codex HACCP and hygiene standards. However, during the course of

implementation, various issues and problems have been encountered some of which have been satisfactorily resolved and in case of others attempts are on to resolve these through dialoque with the importing country.

In this paper, India's experiences in meeting regulatory requirements of importing countries will be highlighted which would bring to focus the problems requiring attention and also help other countries to address such issues.

29. BIOTOXINS AND HARMFUL ALGAL BLOOMS (HABS) IN CALIFORNIA: PATTERNS OF TOXICITY AND ONGOING MONITORING EFFORTS FOR THE HABS AND HAB-NOTS

Gregg W Langlois[1], Sara Webster[1] & Dunyette Seymore[1]

[1]California Department of Health Services, 2151 Berkeley Way Room 118, Berkeley, CA. 94704

FORM: Oral Presentation

SESSION: 5. Microbiology and Safety of Foods From Aquatic Organisms

ABSTRACT:

Marine biotoxins are naturally occurring organic compounds associated with a small number of phytoplankton species. California has a long history of experience with the marine biotoxins (saxitoxin and its numerous analogs) responsible for the human health syndrome referred to as paralytic shellfish poisoning (PSP). Approximately 10 years ago a "new" biotoxin, the amnesic shellfish poisoning (ASP)-causing domoic acid, was identified in Monterey Bay. Bivalve shellfish (e.g., mussels, oysters, clams, and scallops), omnivores such as Dungeness crab, and small planktivorous finfish (e.g., anchovy, sardine) that consume toxigenic phytoplankton can concentrate marine biotoxins, increasing the danger to the next level of consumers (seabirds, marine mammals, humans).

All shellfish-producing states in the U.S. including California have traditionally relied on the frequent monitoring of shellfish for the early detection of toxins. A review of the shellfish toxicity data collected along the California coast over the past 12 years supports the earlier determinations regarding basic patterns of distribution and magnitude of PSP toxicity. Additionally, analysis of this toxicity data in conjunction with remote sensing information and observations of phytoplankton distribution and abundance provides interesting new insight into potential environmental cues for toxigenic blooms.

The Marin coast has long been the focal point for PSP toxicity along the California coast, with the frequency and magnitude of toxicity decreasing both northward and southward. The occurrence of dangerous levels of toxicity is sporadic and varies greatly from year to year. An examination of the seasonality of PSP toxicity reveals a bimodal pattern, with increases in the late spring and again in late summer. These increases roughly coincide with decreases in coastal upwelling. A comparison of advanced very high resolution radiometry (AVHRR) images of sea surface temperatures (provided by the NOAA Coast Watch Program) and our toxicity data reveals a pattern of toxicity increase during periods of upwelling relaxation. Verification of this possible pattern involves the collection and analysis of phytoplankton samples to better understand the relationships between phytoplankton community structure and these major environmental events.

Due to the need for a different assay method for each possible toxin, and the associated cost, it is desirable to find more efficient methods of analysis and more cost-effective ways to predict harmful algal blooms before they impact shellfish resources and human health. CDHS has supplemented its traditional monitoring efforts with a program to detect toxin-producing phytoplankton and is investigating the environmental phenomena associated with these blooms. Examination of thousands of phytoplankton samples over the past eight years, in conjunction with sea surface temperature data, has supported the concept of a general relationship between phytoplankton community structure and physical events related to the process of upwelling.

30. EVALUATION OF MIST ALERT™ IN PARALYTIC SHELLFISH POISON TESTING OF CLAMS AND MOLLUSCS

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FORM: Oral Presentation

SESSION: 5. Microbiology and Safety of Foods From Aquatic Organisms

ABSTRACT:

Incidences of paralytic shellfish poison (PSP) are associated with harmful algal blooms (HAB) occurring in the waters offshore of many countries. In Alaska, the number of reportable cases has ranged from 1 to 24 per year over the past 14 years, during which two people died from PSP on Kodiak Island. Shellfish testing for saxitoxin requires the standard mouse bioassay (SMB) or sophisticated techniques such as high performance liquid chromatography and tissue culture assays. The latest technique, developed commercially, is an antibody-based PSP detection kit.

The objective was to conduct a comparative study between the Maritime In-Vitro Shellfish Toxin (MIST) Alert™ and the mouse bioassay for clams and molluscs collected at recreational harvesting sites.

Ninety-seven samples of several types of molluscan shellfish were collected from five locations in the Kodiak Archipelago during the summer of 2000. Shucked samples were ground, divided and prepared for testing using the MIST Alert. The remaining sample pairs were frozen and sent to the state's testing lab for the SMB.

The MIST Alert detected toxin in 72 samples and the relative levels of toxicity paralleled a trend of increasing saxitoxin levels using the SMB. The 25 samples, which contained none to very low levels of saxitoxin, corresponded to non-toxic levels (<40 µg/100 g of shellfish tissue) by the SMB. All sampling sites had toxin-positive shellfish with butter clams and blue mussels comprising the highest percentage of toxin-containing species. The MIST Alert detected a sharp increase in toxin contamination, confirmed quantitatively using the SMB. This event occurred after a heavy rainfall following a sunny dry period during August.

The MIST Alert was more sensitive to saxitoxin detection than the SMB. This quick test could serve as an early warning that a HAB has occurred by indicating unsafe levels of PSP are present in molluscan shellfish.

31. REFRIGERATED SEA WATER (RSW) MODIFICATIONS TO MAINTAIN FISH QUALITY

Susan M. Vitt[1], Charles A. Crapo[1], Brian H. Himelbloom[1]

[1] Fishery Industrial Technology Center, University of Alaska, 118 Trident Way, Kodiak, AK 99615-7401

FORM: Oral Presentation

SESSION: 5. Microbiology and Safety of Foods From Aquatic Organisms

ABSTRACT:

Quality is an important issue in Alaskan fisheries, especially concerning today's competition with certain farmed fish. Maintaining the highest level of quality from the first critical point, the handling and chilling of fish at the fishing grounds, is the initial goal. Refrigerated sea water (RSW) in the holds of boats generally maintains top quality fish for one to two days, but then bacterial loads increase enough to rapidly degrade fish. This study attempts to maintain the quality of the fish by focusing on modifications to the RSW system. The modifications used in this study were partial water replacement, slime removal and the addition of chlorine or acidified sodium chlorite (ASC).

Swabs were taken in duplicate from the fish at daily or every other day intervals for microbial analysis. Water samples were taken to analyze the pH, absorbance and microbial load along with the swab samples.

Replacing water and sliming had no effect on the microbial load, but ASC and chlorine both decreased the count by over one log on the surface of the fish over a period of 6-8 days. Treatment with ASC delayed spoilage microflora by four days, thereby extending the quality of the fish. Of six different experiments, chlorine and ASC suppressed microbial growth and spoilage of the fish the best.

32. AN OVERVIEW OF POSTHARVEST TREATMENTS TO ELIMINATE *VIBRIO* IN OYSTERS

Michael Morrissey[1], Hakan Calik[1], & Paul Reno[2]

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[2] Department of Microbiology and the Hatfield Marine Science Center of Oregon State University, Newport, Oregon.

FORM: Oral presentation

SESSION: 5. Microbiology and Safety of Foods From Aquatic Organisms

ABSTRACT:

Vibrio species are natural habitants of oysters and their numbers can increase rapidly if oysters are mishandled at postharvest or during distribution. Several cases of severe gastroenteritis outbreaks in the U.S. have been linked to the consumption of raw oysters containing the *Vibrio* bacteria. It remains a challenge for the oyster industry to develop postharvest processes that would reduce or eliminate *Vibrio* while maintaining the flavor and texture of raw oysters. This paper will review different methods such as depuration, chilling/freezing, acidic marinade, pasteurization, the Ameripure process, irradiation, and high pressure processing, which were shown to reduce pathogens in oysters. The effects of these postharvest treatments on *Vibrio* and their effects of the sensory attributes of raw oysters will be discussed.

33. CONTROLLING *LISTERIA MONOCYTOGENES* IN RAW SALMON WITH ACIDI-

FIED SODIUM CHLORITE

Yi-Cheng Su[1] and Michael T. Morrissey[1]

[1] Seafood Laboratory, Coastal Oregon Marine Experiment Station, Oregon State University, Astoria, OR 97103-3427

FORM: Oral Presentation

SESSION: 5. Microbiology and Safety of Foods From Aquatic Organisms

ABSTRACT:

Contamination of *Listeria monocytogenes* in ready-to-eat seafood, particularly in cold-smoked fish products, is a great safety concern for consumers and the seafood industry. Cold-smoked fish are generally produced without intense heat treatment. Contaminated *Listeria* can survive the process and multiply in finished products during refrigerated storage. Acidified sodium chlorite (ASC) solution at concentrations between 40 to 50 ppm of sodium chlorite was recently approved by the Food and Drug Administration for use as an antimicrobial agent in water and ice to rinse, wash or store seafood. Application of ASC to raw salmon may reduce microbial contamination and improve shelf-life and safety of cold-smoked salmon products.

The objective was to evaluate effects of ASC on reducing *Listeria monocytogenes* and overall bacteria populations in contaminated raw salmon.

Salmon filets inoculated with *Listeria monocytogenes* (1.1×10^4 cfu/g) were washed with ASC (50 ppm) for 1 minute and stored in regular or ASC ice for 7 days. Aerobic plate counts (APC) and *Listeria* populations in salmon were determined on days 0, 1, 3, 5 and 7.

ASC wash reduced initial APC of salmon from 7.8×10^2 cfu/g to 4.3×10^2 cfu/g (0.26 log reduction). Less increase in APC was observed in ASC-treated than non-treated salmon during ice storage. The APC in ASC washed salmon was 0.61-log lower after 7 days of storage. *Listeria* in salmon was reduced by 0.52 log after ASC wash. Growth of *Listeria* was retarded in salmon stored in ASC ice. By day 7, *Listeria* populations were 0.25–log lower in salmon stored in ASC ice and 0.62-log lower in ASC washed salmon and stored in ASC ice.

In conclusion, washing salmon with ASC reduced initial bacterial and *Listeria* contamination. The antimicrobial activity of ASC was enhanced when salmon was washed with ASC solution and stored in ASC ice.

34. **SEAFOOD WASTEWATER INFORMATION**

Janet Webster[1], Ed Kolbe[2] & Larry Schmidt[3]

[1] Head Librarian, Marilyn Potts Guin Library, Oregon State University/Hatfield Marine Science Center, 2030 Marine Science Drive, Newport, OR 97365 USA

[2] Oregon State University Food Innovation Center, Portland

[3] MLS Student, Emporia State University

FORM: Oral Presentation

SESSION: 6. By-Products From Aquatic Organisms

ABSTRACT:

The Seafood Wastewater Bibliography evolved from a larger conceptual one dealing with the disappearance of information on seafood technology and the perceived problem of getting relevant but not necessarily contemporary information to users in the seafood industry. Rather than tackle the large universe of seafood technology, we decided to focus on a hot topic as a pilot project. The people working in the seafood industry in the West Coast of the United State and Canada face pressure to handle the wastewater issue better. We decided to explore providing those people direct access to current thinking on best practices. These are very busy, working people with good online access but little time to find information and often little access to current scientific information. This is a selective bibliography of over 100 citations and attempts to collect information that would give a user a basic understanding of the processes and the issues of seafood wastewater. We included some with more specific information addressing a particular species or treatment technique. Most of the material has been published since 1970. We included older material if still relevant. While the Pacific Northwest and Alaska are the geographic areas of most interest, often material from other parts of the world are useful. The Seafood Wastewater Bibliography is the first of what we hope will be a series of information tools for the seafood industry.

35. **TRENDS AND APPROACHES TO SEAFOOD WASTEWATER PROCESSING**

Larry Schmidt[1] & Ed Kolbe[2]

[1] MLS Student, Emporia State University

[2] Oregon State University Food Innovation Center, Portland

FORM: Oral Presentation

SESSION: 6. By-Products From Aquatic Organisms

ABSTRACT:

The West Coast seafood processing industry faces challenges daily. Changing international markets, continuing demands for quality, diminishing volumes of traditional species, and new products from previously underutilized species offer opportunities. At the same time, the industry is being hit by more regulation, declining water supplies, and costlier wastewater treatment and disposal prices. Wastewater characteristics from seafood processing are conditioned by a diversity of raw material, type of facility and the point of generation within the factory. This diversity of waste and wastewater production predisposes the industry with a variety of treatment requirements and methods. New regulation and requirements today all point to three important wastewater treatment trends: the minimization of water use through water conservation, water recycling and water reuse; the utilization of waste using a variety of techniques that depend on the seafood source, type of processing, facility, and product; and the use of new treatment technologies or treatment methods not historically practiced by the seafood industry including anaerobic treatment, biological filters and ultrafiltration. These trends were identified while compiling the Seafood Wastewater Bibliography, a tool providing better access to current practices and new technologies for seafood technologists and extension agents.

36. ESTIMATES OF ALASKA FISH PROCESSING WASTE STREAM COMPONENTS

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FORM: Oral Presentation

SESSION: 6. By-Products From Aquatic Organisms

ABSTRACT:

Over 65% of the total fish harvested for human consumption in the USA come from Alaskan waters. This creates large amounts of processing wastes which can be utilized for a number of products. At present, there is scant information on the amounts, types, locations, uses, etc. of the seafood processing wastes in Alaska.

The objectives of this study were to estimate the amount of fish processing wastes generated from the fish harvest in Alaska waters as a function of 1) species, 2) amount of individual waste components (heads, viscera, frames, skin), 3) region, and 4) processing sector.

Calculations were made from National Marine Fisheries Service 2000 harvest statistics for ground fish, Alaska Department of Fish and Game 2000 harvest statistics for salmon and herring, and contacts with industry personnel. Percent heads, frames, viscera, skin and filets were obtained from published values.

The marine fin fish 2000 harvest was approximately 1,900,000 metric tons (MT) of which 1,070,000, 73,000 11,000 MT was processed at shoreside, catcher-processor and motherships, respectively. Approximately 70% fo the harvest was from the Bering Aleutian region. Total fish processing waste was approximately 1,000,000 metric tons consisting of heads, viscera, frames and skins. Fish processing wastes from pollock, cod and salmon account for over 85% of the total fish waste produced. FY 2000 estimates of total fish meal and oil production in Alaska were 83,000 MT.

A lot of seafood processing waste produced in Alaska which is underutilized. This translates into opportunity to produce products from individual waste stream components such as heads, viscera, frames and skins or combinations of these components.

37. FILMOGENIC PROPERTIES OF CRAWFISH CHITOSAN

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[2] Graduate Students Competition

FORM: Oral presentation

SESSION: 6. By-Products From Aquatic Organisms

ABSTRACT:

Along with the consumption of edible crawfish tailmeat, about 85 million pounds of peeling waste is generated in Louisiana annually. This processing waste represents a significant inexpensive source of chitin and its deacetylated form, chitosan. Crawfish chitosan may be utilized to produce edible film similar to those conventionally produced from polysaccharide-based or protein-based materials and other crustacean shell wastes. The filmogenic properties of crawfish chitosan and their film properties have not been investigated.

This study was intended to investigate the film forming ability of crawfish chitosan, to characterize resultant film properties, and to investigate effects of degree of deacetylation of chitosan and concentration of plasticizer on film properties.

Chitosans with different degree of deacetylation were prepared from crawfish shell by varying time during deacetylation process. Degree of deacetylation (DD), molecular weight (Mw), and viscosity of chitosans were determined. Chitosans were dissolved in 1% acetic acid at 1% w/v and cast with glycerin as a plasticizer at the ratio of 1:0.1, 1:0.2, 1:0.3, 1:0.4 and 1:0.5 (chitosan:glycerin, w/w). Films were evaluated for their color, tensile strength (TS), and moisture adsorption properties.

Chitosan with Mw of 4.6×10^4 and 92% DD yielded a transparent and flexible film that closely resembled plastic films. Chitosans with lower DD values failed to form film or formed opaque films with higher TS. Films with higher glycerin content exhibited higher moisture content indicating greater hydrophilicity, lower TS and greater elongation. No significant difference in color was observed in chitosan films with different glycerin content. Compared with films made from shrimp chitosan, the film made from 92% DD crawfish chitosan showed more hygroscopic nature and was very transparent and almost colorless.

This study demonstrated that chitosan from crawfish shell waste could be used as a material for production of film which has potential for multiple industrial applications.

38. **UPDATE ON THE ALASKA FISHERIES BY-PRODUCT UTILIZATION PROJECT.**

Scott Smiley[1]

[1] UAF-Fishery Industrial Technology Center, Kodiak, AK

FORM: Oral Presentation

SESSION: 6. By-Products From Aquatic Organisms

ABSTRACT:

Funded by the Agricultural Research Service at USDA, the project began in 1999 and involves scientists at the Fish Tech Center in Kodiak, School of Fisheries and Ocean Sciences in Fairbanks, University of Idaho Hagerman Fish Culture Experiment Station, Oceanic Institute in Hawaii, National Marine Fisheries Service REUT division and the Agricultural Research Service. To date we have chemically and nutritionally characterized the major secondary products made in handling the byproducts of fish processing, namely fish meal, fish oil, bone meal and stickwater. We have also analyzed existing fish meals made in Alaska. We have added stickwater back to whitefish meals and characterized these supplemented meals as well. We have made salmon meals and characterized them. Our newest efforts are in analyzing the applicability of hydrolysis processes in handling fish waste. We will present current and future research plans.

39. **SHARING SOME PRACTICAL ASPECTS OF USING CHLORINE DIOXIDE AS A SANITIZER**. Claire Egvedt[1]

[1]Wards Cove Packing Co., Seattle, WA 98275

FORM: Panel Discussion

SESSION: 7.Panel Discussion

ABSTRACT:

An informal discussion of some early practical experience using activated and other forms of chlorine dioxide as a sanitizer. Topics such as types of application, gas-off in ice houses and means of introducing sanitizers will be discussed by represetatives of the seafood industry and ingredients suppliers.

40. **USE OF PORK PLASMA PROTEIN AS AN ENZYME INHIBITOR IN PACIFIC WHITING (*MERLUCCIUS PRODUCTUS*) SURIMI**

Xingqiu Lou[1], Tein M. Lin[2], and Jae W. Park[3]

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

Pacific whiting (*Merluccius productus*) is the most abundant fish resource off the West Coast of United States. However, due to its heat-activated proteolytic enzymes, the commercial scale utilization of Pacific whiting for surimi manufacturing was limited until the discovery of beef plasma protein as an effective enzyme inhibitor in 1991. The recent occurrence of BSE (bovine spongeform encephalopathy) has caused a general rejection of using beef plasma proteins in

surimi in spite of the fact that blood protein is not considered to be a specified risk material**.** Other commercially available enzyme inhibitors, such as egg white and whey proteins all have inferior inhibitory effects on protease activity as compared to beef plasma proteins and are not economically viable options for the processors. This study was to evaluate the feasibility of using pork plasma protein in substituting beef plasma protein as an enzyme inhibitor for Pacific whiting surimi.

A commercial A-grade frozen Pacific whiting surimi with 5% sorbitol, 4% sugar, and 0.24% sodium polyphosphate was used in this study. Five pork plasma samples were evaluated against two beef plasma samples on their protease inhibition and gel strengths. The degradation of proteins was evaluated by SDS-PAGE method and the protein profiles of pork and beef plasma samples were also studied by HPLC analysis.

The results indicated that pork plasma proteins possessed higher protease inhibition activity as compared to beef plasma proteins. The gel forming ability of beef plasma proteins were higher than that of pork plasma. When the commercial cooking procedures were followed (90°C, 30 min), the gel strengths of surimi with 1% pork plasma proteins were comparable to those with 1% beef plasma proteins. These results were consistent with the patterns of myosin and actin degradation revealed from the SDS-PAGE studies. The results of HPLC analysis showed that there were some differences in protein profiles of pork and beef plasma proteins.

41. PREDICTION OF SODIUM CHLORIDE IN COMMERCIALLY PRODUCED KING AND CHUM SALMON BY SW-NIR

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

Water phase salt is a critical food safety parameter for smoked salmon products. Salt and moisture models using short wavelength near-infrared reflectance spectroscopy (SW-NIR) on experimentally produced smoked and cured Atlantic salmon (*Salmo salar*) products have been conducted. However, there have been no reported studies on how well this technology works with commercially processed smoked Pacific salmon products and whether calibration models developed for Atlantic salmon are transferrable to Pacific salmon.

Hot smoked king (8 - 16 oz) (*Oncorhynchus tshawytscha*) and chum (*O. keta*) salmon (5 - 12 oz) produced commercially were tested (N > 100). The salt content ranged from 2.4-4.9% and moisture from 66.3-71.1%. SW-NIR measurements were taken in the diffuse reflectance mode at least two positions on each piece of fish. Chemometric models for salt were constructed using a linear partial least squares regression method (PLS).

Salt content could vary by more than 1% at different locations on each fish portion depending upon brining method used. PLS models for Atlantic salmon had lower prediction values than ones developed specifically for each specie. A PLS model with 10 latent variables for king salmon (R^2 = 0.89, RMS = 0.49) and 11 latent variables for chum salmon (R^2 = 0.87; RMS = 0.49) were developed.

42. GELATION PROPERTIES OF FISH PROTEINS AND PENETRATION DEPTH AS AFFECTED BY E-BEAM

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[2] Graduate Students Competition

FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

Unlike gamma radiation, which utilizes radioactive isotopes, e-beam generates electrons from electricity. Accelerated electrons are scanned through the food, killing bacteria. E-beam is a source of ionizing energy. Therefore, e-beam possesses great potential to affect physicochemical properties of fish proteins. Whether it is related to microbiological or physicochemical characteristics, a degree of electron penetration is likely to affect the effectiveness.

Our objective was to determine fracture texture properties of surimi gels under various e-beam dosages. Attempts were made to elucidate protein interactions in gels and uncooked fish proteins. In addition, dose mapping was conducted to determine electron penetration.

Alaska pollock surimi gels containing 2% salt and 78% moisture were prepared at 90¡C for 15 min. Gels and raw surimi were subjected to various e-beam treatments. Two empirical (W-B shear and punch) and one fundamental method

(torsion) were used to measure gel texture. Surface hydrophobicity, and total and reactive SH were conducted to determine the conformational changes of proteins. Protein degradation and/or polymerization was determined by SDS-PAGE. To obtain dose map, dosimeters were placed in gel samples. Following e-beam treatment, dosimeters were read by spectrophotometer (605 nm), resulting in dose absorbed. Plot of distance from dosimeters to sample surface vs. dose absorbed resulted in dose map.

Gel strength increased proportionally to e-beam dose up to 8 kGy, then decreased. Gel cohesiveness was less affected by e-beam. SH concentration and surface hydrophobicity of surimi seafood gels increased as the dosage increased to 6 kGy, then decreased gradually for SH and rapidly for hydrophobicity. SDS-PAGE revealed that there was degradation of myosin heavy chain (MHC) at 25 kGy. The dose absorbed increased up to 2 cm, then decreased. At 5 cm, there was no absorption. The data suggests that double-sided e-beam could efficiently penetrate 8 cm of surimi gels.

43. EFFECTS OF FREEZING PROCESS ON THE QUALITY CHANGES OF TIGER SHRIMP(*PENAEUS MONODON)* FROZEN BY AIR BLAST AND CRYOGENIC FREEZING

Sirintra Boonsumrej[1,2], Saiwarun Chaiwanichsiri[1] & Sumate Tantratian[1]

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[2] Graduate Students Competition

FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

The effects of freezing by air-blast freezer and cryogenic freezer, as well as the thawing methods and freeze-thaw cycles on the physical and chemical changes of the tiger shrimp (*Penaeus monodon)* were investigated. The air-blast freezing was done at temperature of -28 $\pm$ 2 ^{0}C and the air velocity of 4-8 m/s while the cryogenic freezing was done at the temperature of -70 ^{0} - (-100) ^{0}C. The optimum conditions for both freezing methods were considered from the freezing rate, % freezing loss (%FL) and cutting force (CF) of thawed samples. The samples frozen under the selected conditions were thawed under microwave at the power of 560 watt and under the refrigerator (~5 ^{0}C). The freeze-thaw effect was studied up to 4 cycles and the changes in chemical and physical properties, i.e. thiobarbituric acid number (TBA), salt-soluble protein content (SSP), % thawing loss (%TL) and cutting force (CF) were measured. The results showed that freezing by the air-blast freezer gave the freezing rate of 6.85-7.42 cm/h while using the cryogenic freezer gave 11.82-24.98 cm/h. Samples frozen at the air velocity of 6 m/s had the least %FL and similar CF to the fresh samples. All temperatures used for cryogenic freezing showed no effect on %FL with the samples frozen at –70 ^{0}C had the similar CF as the fresh samples. For the shrimps frozen by the selected conditions of both freezing methods, it was found that thawing method did not affect SSP and CF. Samples thawed under the microwave thawing had the higher TBA than those thawed under refrigerator temperature which may be due to the high energy generating under the microwave thawing activated the lipid oxidation in the shrimps. Increasing the number of freeze-thaw cycles increased the TBA and CF values but decreased the SSP. The combined effect of thawing method and freeze-thaw cycles showed to affect %TL only. From the results, it shows that it is important to prevent temperature fluctuations during freezing process and transportation to avoid the freezing and thawing effect and thus to maintain the quality of the frozen shrimps.

44. GLUCOSE POLYMER AS AN EFFECTIVE CRYOPROTECTANT

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

Cryoprotection of surimi proteins is a primary concern in maintaining the quality of surimi during freezing and frozen storage. Currently, a mixture of 4% sucrose and 5% sorbitol is used in conjunction with phosphate to cryoprotect surimi proteins. In order to improve quality, new alternatives for cryoprotection are continually being explored. New glucose polymers have shown promise as prospective cryoprotectants that could economically replace sorbitol in surimi production.

Our objective was to determine the effects of two new glucose polymer cryoprotectants, LD and SD on the functional and biochemical properties of fish proteins in Pacific whiting surimi during frozen storage compared to sorbitol.

The samples were: Control (5% sorbitol, 4% sucrose, 0.3% phosphate), LD (5% LD, 4% sucrose, 0.3% phos-

phate), and SD (5% SD, 4% sucrose, 0.3% phosphate). All surimi samples were prepared with cryoprotectant and provided by Roquette America. Frozen blocks were cut into smaller (~1000g) blocks, individually vacuum-packed and stored at -absorption. The data suggests that double-sided e-beam could efficiently penetrate 8 cm of surimi gels.

45. IMPROVING ACCURACY, PRODUCTIVITY, AND SAFETY IN DOUBLE SEAM MEASUREMENT

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

(See Abstract # 22)

46. GELATION PROPERTIES OF FISH PRODUCTS AT REDUCED IONIC STRENGTH

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

Muscle foods prepared using 2-3% salt utilizes only 20-45% of proteins that are solubilized. However, the literature suggested that more than 95% of proteins could be solubilized when the ionic strength approaches near zero at an appropriate pH. If the ionic strength of the protein solution can be reduced to an extremely low level, low or no no-sodium muscle protein gel products can be developed at a relatively low protein concentration. Our objectives were to determine gelation properties of fish proteins as aqffected by ionic strength and pH, and further to evaluate physicochemical properties of gels.

Alaska pollock surimi containing no phosphate was washed three times at 1:5 ratio with cold tap water. Samples continued to be washed using de-ionized water to near zero ionic strength (0.008 mM). To facilitate effective washing, the samples were adjusted to pH 5.5 during the washings. Protein recovery at each washing was measured. Texture properties, color, and water retention ability were determined. SDS-PAGE was used to determine the protein patterns as affected by washing and dewatering.

With three washings, ionic strength reduced from 37 mM to 0.63 mM. When the pH was adjusted to 5.5 at the first washing, 0.63 mM ionic strength was more effectively obtained and the protein recovery was the highest. Optimum pH for gel formation was 11.0-11.4 depending on ionic strength (0.63-0.94 mM). However, when the ionic strength approaches near zero at pH 10.3, gels containing 90% moisture were strong and deformable. Acid-treated gels with low salt were soft, while alkali-treated gelks showed high deformation values. Good gels at 0.63 mM were obtained at 86-90% moisture content. This development suggested that good gels can be made at 10-15% higher moisture content (> 70% increase of the original weight) than the conventional gels.

47. COMPARISON OF FIVE GROWTH TECHNIQUES FOR GIANT SCALLOP (*PLACOPECTEN MAGELLANICUS*) IN THE GASP*ƒ* BAY, QUEBEC, CANADA.

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FORM: Oral Presentation

SESSION: 8. Processing and Technical Innovations With Aquatic Food Products

ABSTRACT:

The giant scallop is an indigenous species of the Gaspe Peninsula that presents a high commercial value, therefore potentially interesting, and several entrepreneurs wish to launch commercial growths. For that reason, they need accurate estimations of mortalities and yields to build more reliable business plans. Several techniques for growth are available and

it is preferable to determine which is the most adapted to the particular conditions of the Gaspe Bay before undertaking a commercial culture.

Juveniles were therefore transferred from Magdalene Islands, in June and in October 2001. They were immersed in five kinds of devices: pearl nets, earrings, Savoury cages, Wang-Joncas lanterns and oyster tables. Pearl nets, Wang-Joncas lanterns and earrings were distributed in the water column to evaluate the effect of depth on measured parameters. Three replications of each device were set for each studied depth. Scallop growth rates, mortalities and the impact of predators, competitors and fouling will be analysed until 2004, according to the depth, the method and the season of transfer.

The first evaluations on scallops transferred in June 2001 were undertaken in August and in October 2001. They revealed an important mortality from 50 to 70% according to devices. The survivors presented equal or superior growth rates compared to normal values measured elsewhere in Quebec, that is 0.16 mm . day $^{-1}$ for the 1 & 1/2 year old scallops and 0.11 mm . day $^{-1}$ for the 2 & 1/2 years old. These results confirm the scallop culture potential of the Gaspe Bay.

It is however too early to undertake convincing comparisons with regard to performances concerning the techniques used. Following of the ulterior seasons would allow one to specify the observed trends for 2001 and to clarify the influence of the different studied factors on the final output of the experimental growth.