Pacific Fisheries Technologists

57th Annual Meeting

March 5th - 8th, 2006

The Hotel Captain Cook
Anchorage, Alaska
www.pftinfo.org

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PACIFIC FISHERIES TECHNOLOGISTS - 57th ANNUAL MEETING

March 5th-8th, 2006 - The Hotel Captain Cook, Anchorage, Alaska

www.pftinfo.org

WELCOME

Welcome to Anchorage, Alaska, and the 57th Annual Meeting of the Pacific Fisheries Technologists.

We are proud to host the 2006 PFT conference, as seafood is a renewable resource and a vital part of Alaska's economy. Alaska seafood products play a major role in the national and international marketplace.

The program developed by the Organizing Committee should have plenty to pique your interest, with sessions that focus on producing the highest quality seafood products that are nutritious and safe for the consumer. Sessions consist of aquaculture and feed, seafood microbiology, seafood biochemistry, seafood processing and engineering, waste byproducts, regulatory issues, and there will also be a panel session on new issues on salmon canning and a poster session with many research projects being displayed.

There should be sessions to stimulate your interest whether you are attending the conference from an academic, environmental, harvesting, processing, or governmental background, with all of the topics having relevance to seafood quality, safety and the environment.

For those that want to learn how to tell good fish from bad fish, or those that just want a refresher, we are offering a half day organoleptic training course on Wednesday afternoon. We want to a special thanks to the U.S. Food and Drug Administration for their support by providing their national sensory expert Mr. Jim Barnett.

A tour of the new Alaska Environmental Health Laboratory is also being offered on Wednesday afternoon, and we want to thank the Alaska Department of Environmental Conservation for opening up the lab for a tour and making the facility available for the organoleptic training.

Our deepest thanks to all of our sponsors who have helped make this a most successful conference.

Enjoy the conference!

Manny Soares
2006 PFT President

Organizing Committee Members

Subramaniam
Sathivel
PFT 2006

Don Kramer
PFT 2006
Program Area Rep

Geri Culwell
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Keynote Speaker

Rick Steiner, Professor
Alaska Sea Grant Marine Advisory Program
UAF, School of Fisheries and Ocean Sciences

Rick Steiner is a Professor and Conservation Specialist for the University of Alaska Marine Advisory Program, based in Anchorage, Alaska. He has been a faculty member at the university since 1980, stationed primarily in remote areas of Alaska. Today, he is the only University of Alaska faculty member with primary responsibility for providing conservation and sustainability extension outreach. His specialty is ecological conservation, and he has worked internationally on conservation and sustainable development issues - including in Russia, central Asia, south Asia, Japan, Korea, Europe, South America, Central America, Africa, and Indonesia.

As the University of Alaska's marine advisor for the Prince William Sound region of Alaska from 1983 - 1997, he was directly involved in oil / environment issues, and provided leadership in response to the Exxon Valdez Oil Spill in 1989. His work regarding the Exxon Valdez spill - leadership in emergency response, proposing establishment of the Regional Citizens Advisory Councils, helping to craft the Oil Pollution Act of 1990, and his proposal that the governments and Exxon settle their damage claims that lead to the $1 billion settlement used largely to protect coastal habitat - received international recognition. He has been producer/host of the *Alaska Resource Issues Forum* public television series since its inception in 1986, and is co-founder of The Coastal Coalition, an environmental NGO in Alaska. His work centers on science-based conservation outreach in Alaska, the U.S., Pacific Rim nations, and the world, by connecting lessons and experiences.

He has published on a broad array of conservation topics – oceans, fisheries, forests, macro-economic policy, endangered species conservation, maritime issues, oil revenues, citizen involvement / environmental democracy, global warming, the global environment, oil spill prevention, and so on.

Guest Speaker

FRAN ULMER, DIRECTOR
Institute of Social and Economic Research
University of Alaska Anchorage

Fran Ulmer became ISER's director in February 2005, bringing with her 30 years' experience in public service, dealing with Alaska public policy issues. She served as Lieutenant Governor of Alaska from 1994 to 2002, a member of the Alaska House of Representatives from 1986 to 1994, and mayor of Juneau, Alaska in the early 1980s. Most recently, she was a fellow at the Institute of Politics at Harvard University's Kennedy School of Government and a Distinguished Visiting Professor of Public Policy at ISER.

The primary responsibility of the Lieutenant Governor is overseeing elections, and under her watch many improvements and programs were implemented. In 1998 Alaska became the first state in the nation to replace the punch card system with an optical scanning ballot counting system on a statewide basis.

She also strongly believes in educating young people about government and politics, and as lieutenant governor created the Alaska Democracy Project to expand civics education in Alaska schools to help young people develop the knowledge and skills needed to be active citizens. Increased public access to elections information improvements included a youth outreach page on the internet.

She has a strong interest in Alaska fisheries, and was appointed to the four-nation North Pacific Anadromous Fish Commission in 1994 by President Bill Clinton. Ulmer served on this international board with representatives from Japan, Russia, Canada and the United States until 2005.

Education
B.A., Political Science and Economics, University of Wisconsin
J.D., University of Wisconsin Law School

2006 PFT SPONSORS

We offer our Thanks to you!

It is your generousity that makes this event possible!

AGENDA

SUNDAY, March 5th

3:00 pm – 6:00 pm	Registration
5:00 pm – 5:45 pm	PFT Executive Meeting
6:00 pm – 9:00 pm	President's Reception

MONDAY, March 6th

8:00 am – 8:20 am	Welcome
8:20 am – 8:40 am	Opening Remarks
8:40 am – 10:00 am	Aquaculture and Feed Session
10:00 am – 10:20 am	Break
10:20 am – 11:00 am	Aquaculture and Feed Session Continued
11:00 am – 12:00 pm	Seafood Microbiology Session
12:00 pm – 1:00 pm	Lunch
1:00 pm – 3:00 pm	Seafood Biochemistry Session
2:40 pm – 3:00 pm	Tea Break
3:00 pm – 4:40 pm	Seafood Processing and Engineering Session

TUESDAY, March 7th

8:00 am – 9:20 am	Seafood Processing and Engineering Session
9:20 am – 10:20 am	Panel session: New Issues on Salmon Canning Session
10:20 am – 10:40 am	Break
10:40 am – 12:00 pm	Waste/Byproducts Session
12:00 pm – 1:00 pm	Lunch
1:00 pm – 2:20 pm	Waste/Byproducts Session Continued
2:20 pm – 2:40 pm	Tea Break
2:40 pm – 4:00 pm	Poster Session
4:00 pm – 4:40 pm	PFT General Business Meeting *(All members)*
6:00 pm – 9:00 pm	Annual Banquet

WEDNESDAY, March 8th

8:00 am – 9:40 am	Current Regulatory Issues Session
9:40 am – 10:00 am	Break
10:00 am – 11:45 am	Current Regulatory Issues Session Continued
11:45 am	Closing Remarks

PROGRAM

MONDAY, March 6th

8:00 am – 8:20 am **Welcome PFT 2006 President: Manny Soares**

8:20 am – 8:40 am **Opening Remarks**
Keynote Speaker: Professor Rick Steiner, Conservation Specialist, Alaska Sea Grant Marine Advisory Program, School of Fisheries and Ocean Science, UAF.

8:40 am – 11:00 am **Aquaculture and Feed**
Session Moderator: Raymond RaLonde

8:40 am – 9:00 am Vibrio parahaemolyticus - Alaska '04-'06 outbreak and monitoring program. MIKE OSTASZ*.

9:00 am – 9:20 am Quality of Alaskan maricultured oysters (Crassostrea gigas): A one-year survey. RAYMOND RALONDE*, A.C.M. Oliveira, B. Himelbloom , C.A. Crapo, Q. Fong, and C. Vorholt.

9:20 am – 9:40 am Cadmium levels in pacific oysters (Crassostrea gigas). ROSALEE S. RASMUSSEN* and Michael T. Morrissey.

9:40 am – 10:00 am Effect of dietary canola oil level on growth, osmoregulation, exercise performance and health of spring chinook salmon parr (oncorhynchus tshawytscha). S.Y. HUANG*, S. Balfry, D. Higgs, R. Devlin, P. Schulte and C. J. Brauner.

10:00 am – 10:20 am **Break**

10:20 am – 10:40 am Shellfish toxins: Improvements in detection methods and management strategies. SHERWOOD HALL*, Stacey Etheridge, Jon Deeds, and Steve Conrad Laurel, Maryland.

10:40 am – 11:00 am Vibrio parahaemolyticus in Alaska: A response to a potential crisis in the shellfish aquaculture industry. RAYMOND RALONDE*.

11:00 am – 12:00 pm **Seafood Microbiology**
Session Moderator: Brian Himelbloom

11:00 am – 11:20 am Spoilage bacterial flora development in marine fishes commercially harvested from the Gulf of Alaska: Evaluation of the biolog microbial identification system. B.H. Himelbloom, T.S. SHETTY*, and A.C.M. Oliveira.

11:20 am – 11:40 am- Evaluation of electrolyzed water as a post-harvest treatment for inactivating Vibrio in oysters. Tingting Ren and YI-CHENG SU*.

11:40 am – 12:00 pm	Tracking the progression of pink salmon spoilage through rapid bacterial species identification via cell wall fatty acid analysis. A. MOREY*, B.H. Himelbloom and A.C.M. Oliveira.
12:00 pm – 1:00 pm	**Lunch**
1:00 pm – 3:00 pm	**Seafood Biochemistry** **Session Moderator**: Benjamin K. Simpson
1:00 pm – 1:20 pm	Change in proximate composition and fatty acid profile of snow crab, Chionoecetes opilio, embryos during development. KERMIT D. REPPOND*, Louis Rugolo, and Alexandra C. M. de Oliveira.
1:20 pm – 1:40 pm	Effects of fumonisin B1 addition to feed on immune response, hepatopancreas and muscle proteins in white shrimp (Litopenaeus vannamei). J.M. EZQUERRA-BRAUER*, A.L. Mexia-Salazar, A. Burgos-Hernández, M.O. Cortez-Rocha, R. Castro-Longoria , and J.Hernández-López .
1:40 pm – 2:00 pm	Detection and partial isolation of chemopreventive fractions present in extracts from shrimp and octopus. A. BURGOS-HERNÁNDEZ*, G. Wilson-Sánchez, Juárez, E, C. A. Velázquez-Contreras, J. M. Ezquerra-Brauer, and M. L. Aldana-Madrid.
2:00 pm – 2:20 pm	Characteristics of a digestive protease from the pyloric ceca of hoki. Changying Shi and BENJAMIN K. SIMPSON*.
2:20 pm – 2:40 pm	Principles and applications of liquid chromatography mass spectrometry (LCMS) for seafood science and technology. HAEJUNG AN*, Stan Louie, Pamela Tom, Cheng-i Wei, Keith Gates, and Jon Bell.
2:40 pm – 3:00 pm	**Tea Break**
3:00 pm – 4:40 pm	**Seafood Processing and Engineering** **Session Moderator:** Subramaniam Sathivel
3:00 pm – 3:20 pm	Non-thermal antilisterial treatments for cold smoked fish. CLAUDIO BITTENCOURT* and Ross, T.
3:20 pm – 3:40 pm	Developing and using thin bladed kramer cell and computer vision system to determine tenderness and color of fish muscle. FANBIN KONG*, Juming Tang, Barbara Rasco, Chuck Crapo, and Scott Smiley.
3:40 pm – 4:00 pm	Optimum transport temperatures for live New Zealand littleneck clams (Autrovenus stutchburyi). GRAHAM C FLETCHER*, Joseph F. Youssef and Simon Brown.
4:00 pm – 4:20 pm	Best practices for successful shipments. ELIZABETH DARRAGH*.
4:20 pm – 4:40 pm	Inactivation of Listeria monocytogenes in greenshell™ mussels by high pressure processing. GRAHAM C FLETCHER*, Joseph F. Youssef, and Sravani Gupta.

PROGRAM

TUESDAY, March 7th

8:00 am – 9:20 am **Seafood Processing and Engineering**
Session Moderator: Geri Culwell

8:00 am – 8:20 am Radio Frequency Identification- How it will transform packaging, distribution, & handling of Alaska seafood. STEPHEN T. GRABACKI*.

8:20 am – 8:50 am Good fish, bad fish: Understanding risks/benefits in seafood consumption. MICHAEL T. MORRISSEY*.

8:50 am – 9:20 am California sea grant seafood internet outreach and resources for industry. PAMELA TOM*.

9:20 am – 10:20 am **A panel session: New Issues on Salmon Canning**.
JOHN OSSMAN*
Session Moderator: Randy Rice

10:20 am – 10:40 am **Break**

10:40 am – 12:00 pm **Waste/Byproducts**
Session Moderator: Peter J. Bechtel

10:40 am – 11:00 am Estimates of Alaska fish processing waste stream components. P.J. BECHTEL*, C.K. Bower and C.A. Crapo.

11:00 am – 11:20 am Recovery and characterization of lipids from enzymatic digestion of fish eye tissue. KERMIT D. REPPOND*, Alexandra C. M. de Oliveira, and Peter J. Bechtel.

11:20 am – 11:40 am Converting Alaska fish by-products into high protein liquid concentrates. C.K. BOWER* and P.J. Bechtel.

11:40 am – 12:00 pm Physical properties and glucosamine and chondroitin contents of red salmon heads. CHERRY SEIME*, Subramaniam Sathivel, and P.J. Bechtel.

12:00 pm – 1:00 pm **Lunch**

1:00 pm – 2:20 pm **Waste/Byproducts**
Session Moderator: Peter J. Bechtel

1:00 pm – 1:20 pm Lipids and contaminants in fish oils from Alaska seafood processing byproducts. SCOTT SMILEY*, Alexandra C.M. Oliveira, David A.J. Stone, Sebastien Plante, Peter J. Bechtel, and Ronald W. Hardy.

1:20 pm – 1:40 pm Oil from fish processing byproducts as a viable renewable resource for biodiesel production. SUBRAMANIAM SATHIVEL*.

1:40 pm – 2:00 pm Gasification. Can it work for small seafood processors? CHRISTINA DEWITT*, Cynthia Bower, Liz Brown, Sunny Rice, and Tim Bowser,

2:00 pm – 2:20 pm Wastewater bacterial limits: Are they coming to Alaska? ALAN ISMOND*.

2:20 pm – 2:40 pm **Tea Break**

2:40 pm – 4:00 pm **Poster Session**
Session Moderator: Don Kramer

Hydrolysis of wheat gluten proteins by trypsin from sierra (Scomberomorus concolor) guts. Estimation of kinetic parameters.
F. CABRERA-CHÁVEZ*, J.L. Cárdenas-López , J.M. Ezquerra-Brauer, and O. Rouzaud-Sández.

Temperature and pH stability of cathepsin L from jumbo squid (Dosidicus gigas) hepatopancreas.
CARDENAS-LOPEZ, J. L.*and Haard, N. F.

Protein concentrates produced by various drying processes from shrimp by-catch. JULIO HUMBERTO CÓRDOVA MURUETA*, Fernando García-Carreño, and M. de los Angeles Navarrete.

Jumbo squid protein hydrolysates.
DE LA FUENTE-BETANCOURT, M. GABRIELA*, Navarrete-del Toro, M. Angeles, Córdova-Murueta, Julio, and García-Carreño L. Fernando.

Potential for jumbo squid protein hydrolysates.
M. GABRIELA DE LA FUENTE-BETANCOURT*, M. de los Angeles Navarrete del Toro, Julio Córdova-Murueta, Fernando L. García-Carreño.

Recovery of jumbo squid muscle protein by acid and alkaline processes.
HUGO PALAFOX-CARLOS* and Fernando L. García-Carreño.

Evaluation of gasification as a value-added process for handling meat processing byproducts.
Bowser, T.J., Weckler, P.R., Patil, K.N., Rao, B.R., and DEWITT, C*.

Ontogenetic changes in digestive enzyme activity of larval whiteleg shrimp (Penaeus vannamei).
CRISALEJANDRA RIVERA-PÉREZ * and F. L. García-Carreño.

Molecular and virulence characteristics of pathogenic Vibrio parahaemolyticus isolated from Oregon and Washington coastal environments. JINGYUN DUAN*, Tsai-Hsin Chiu, Jingyun Duan, and Yi-Cheng Su.

Antimicrobial activity of wine against Vibrio parahaemolyticus. JINGYUN DUAN*, Ruiying Chen and Yi-Cheng Su.

A complementary centrifugation and pH shift treatment of stickwater as an alternative process to generate better quality effluents and solids recovery. GARCÍA-SIFUENTES, C*., Pacheco-Aguilar, R., Goycoolea-Valencia, F., Hernández-Martínez, J., Torrescano-Urrutia, G., and Carvallo-Ruiz, M. G.

Physico-chemical study of fish meal produced in the state of Sonora, Mexico.
L. BRINGAS-ALVARADO*, J.O. Córdova-Castillo, G. Navarro-García, J. Ortega-García, and M.L. González-Félix.

Composition of vacuum packaged wild pink salmon (Oncorhynchus gorbuscha) jerkies stored at 20oC and 40oC. A. MOREY*, A. Ambardekar, C. A. Crapo, A. C. M. Oliveira and B. H. Himelbloom.

Structural comparison for differences in monterey sardine (Sardinops sagax caeruleus) trypsin and bovine trypsin by circular dichroism spectroscopy. Martha Félix-López, FRANCISCO JAVIER CASTILLO-YÁÑEZ*, Karina D. García-Orozco, Enrique F. Velázquez-Contreras, Ramón Pacheco-Aguilar and
Rogelio R.

Freezing and cooking studies of three species of wild shrimp from the Gulf of California. GUERRERO-MANJARREZ GRISEL*, Cardenas-Lopez Jose Luis and Ezquerra- Brauer Josafat Marina.

Effect of the cooking process on a connective tissue extract from jumbo squid (Dosidicus gigas). VALENCIA-PÉREZ, A. Z.* , García-Morales, M. H., Cárdenas-López, J. L., Herrera-Urbina, R. and Ezquerra-Brauer, J. M.

Production of omega-3 polyunsaturated fatty acid concentrate from sardine oil by immobilized Candida rugosa lipase in alginate-chitosan-CaCl2 hydrogel.
TOMOKO OKADA* and Michael T. Morrissey.

Effect of freezing process on collagen extracted from jumbo squid (Dosidicus gigas) Mantle. GARCÌA-MORALES, M-H*, Valencia-Pérez, A.Z., Herrera-Urbina R. Cardenas-Lopez J.L., and Ezquerra-Brauer J.M.

Cloning and expression of the genes encoding an antibacterial peptide salmine in Escherichia coli BL21. Jianzhang Lu, CHUNXIAO WANG*, Chengchu Liu, and Jingjing Liu.

Properties of pollock skin hydrolysates and their effects as glazing ingredients on the quality of pink salmon (Oncorhynchus gorbuscha) fillets during frozen storage.
JIAQI HUANG*, Subramaniam Sathivel, and P. J. Bechtel.

Changes in quality parameters of monterey sardine (Sardinops sagax caerulea) during the canning process. Uriarte-Montoya, Mario Hiram; Pacheco-Aguilar, Ramon; Villalba-Villalba, Ana Gloria; Garcia-Sanchez, Guillermina; Lugo-Sanchez, Maria Elena, Carvallo-Ruiz, Maria Gisela, and CELIA OLIVIA GARCIA SIFUENTES*.

4:00 pm – 4:40 pm PFT General Business Meeting *(All members)*

6:00 pm – 9:00 pm Annual Banquet
Guest Speaker: Fran Ulmer

PROGRAM

WEDNESDAY, March 8th

8:00am – 12:00 pm **Current Regulatory Issues**
Session Moderator: Manny Soares

8:00 am – 8:20 am – CHARLES BREEN*, FDA District Director Seattle
8:20 am – 8:40 am – BRIAN VAUBEL*, USDC, Supervisory Consumer Safety Officer
8:40 am – 9:00 am – WILL SATAK*, Washington Dept. of Agriculture
9:00 am – 9:20 am – DAWN SMITH*, Oregon Dept. of Agriculture
9:20 am – 9:40 am – RON KLEIN*, Alaska Dept. of Environmental Conservation

9:40 am – 10:00 am **Break**

10:00 am – 10:20 am Emerging Issues: The application of risk/benefit evaluation to contaminants in seafood. PHILIP SPILLER*.

10:20 am – 10:40 am Partnership agreements: A new approach to seafood regulation of foreign
produced products. TIMOTHY HANSEN*.

10:40 am – 11:00 am Common mistakes in HACCP. LIZ BROWN*.

11:00 am – 11:20 am CODEX and National Collaboration.
DOMINIC CHEUNG*.

11:20 am – 11:45 am FDA Perspective on import products. JIM BARNETT*.

11:45 am **Closing Remarks**

ABSTRACTS

MONDAY, March 6th

8:40 am – 11:00 am – Aquaculture and Feed

Vibrio parahaemolyticus - Alaska '04-'06 outbreak and monitoring program.
MIKE OSTASZ*.

Vibrio parahaemolyticus (Vp) outbreak in 2004 in Alaska was the third largest (62 cases) in the USA. Alaska implemented a water temperature monitoring and weekly oyster sampling program product in 2005 for Vp at two different sites in Prince William Sound. Trigger for initiating sampling is water temperature dependent. A first ever time trial event by both growers was practiced by voluntarily lowering oyster propagation gear to deeper locations in anticipating of staying away from warmer Vp waters. Thirty days holding time for retention of relocated oysters was in effect before any sales. For 2006, a monthly oysters sampling program for Vp will be in effect with changes in the retention/sales of time with deeper water oysters. Monthly Vp product sampling follows the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish.

Quality of Alaskan maricultured oysters (*Crassostrea gigas*): A one-year survey
R RaLonde[1*], ACM Oliveira [2], B Himelbloom [2], CA Crapo [1, 2], Q Fong [1, 2] and C Vorholt [2].
[1] Marine Advisory Program. University of Alaska Fairbanks, Anchorage, AK 99501 and
[2]Fishery Industrial Technology Center, University of Alaska Fairbanks, Kodiak, AK 99615.

In 1994 the first shellfish hatchery was established in the city of Seward (AK), and oyster farming became a growing enterprise for Alaska's coastal economy. The driving force behind the interests and entry into shellfish farming in the state can be attributed to the increasing demand and trade of shellfish domestically and internationally. From 1990 to 1997, farmed Pacific oyster production in Alaska increased from 224,283 to 1,176,581 oysters, an increase of more than 400%. Concomitantly, sales income increased from $73,000 to $353,770 while farmers experienced over 30% increase in price received for their oysters. As the industry continues to grow, farmers are forming cooperative marketing relationships that will require development of quality standards and best management practices to assure product uniformity.

The objective of this initial study was to provide relevant information to Alaska shellfish growers regarding the intrinsic quality of their farmed oysters. A one year study was conducted to determine the condition indices, proximate composition, fatty acid profile and microbial load of commercially harvested oysters from three different mariculture regions in Alaska. Oysters from farms located in the regions of Prince William Sound, Kachemak Bay and Southeast Alaska were sampled according to farmer's harvest schedules.

Our results suggest that Alaskan maricultured oysters have slight seasonal and regional

differences. The determined condition indices were high throughout the year, indicating an excellent quality product. The chemical composition and fatty acid profile of *C. gigas* from Alaska waters was in agreement with the values reported for mariculture oysters of same species from different parts of the world. The microbial content varied widely between oyster shipments. Thus, the ranges of microbial content for each geographic region were large and overlapped. Notwithstanding, in this study the microbial content could not be correlated to either harvest time or transit time.

Cadmium levels in Pacific oysters (*Crassostrea gigas*) from the U.S. Pacific Northwest

ROSALEE S. RASMUSSEN* and Michael T. Morrissey, Oregon State University Dept. of Food Science and Technology, Oregon State University Seafood Laboratory
2001 Marine Drive, Rm 253, Astoria, OR 97103.

Cadmium (Cd) is a human health concern due to its ability to damage soft tissues such as the liver and kidneys. It is known to bioaccumulate in shellfish such as oysters, which have high levels of the metal-binding protein metallothionein. Recently, several shipments of Pacific oysters (*Crassostrea gigas*) from the U.S. Pacific Northwest have been rejected by Hong Kong because they exceeded the 2.0 ppm import standard. In this study, the effects of age, tissue weight and processing techniques on cadmium levels in farmed, Washington-raised Pacific oysters were investigated.

In order to study the effects of age, 240 oysters from 4 age groups (1-, 2-, 3-, and 4-year-olds) were collected, shucked, homogenized in composites of 20 and measured for cadmium. In the tissue weights study, 25 oysters from each age group were collected, shucked and measured for cadmium individually. In the processing study, the effects of washing, high pressure treatment, jarring, and storage on cadmium levels in oysters were investigated using 3-year-old oysters in composites of 20.

The 1-year-old oysters (0.75 ppm Cd) were significantly lower in cadmium than the other three age groups, which all had concentrations above 1 ppm. Correlations were found between tissue weights and cadmium concentrations during the first 2 years of growth, with no correlation after 4 years. Oysters lost some cadmium as a result of washing and jarring; washing, high pressure processing, and jarring; and storage of processed, jarred oysters for 5 days.

Results of these studies show that oysters tend to accumulate cadmium during the first two years of their lives, after which point concentrations seem to level off. Processing appears to cause the release of some cadmium from oyster tissue, resulting in lower Cd concentrations in processed and stored oysters.

Effect of dietary canola oil level on growth, osmoregulation, exercise performance and health of spring chinook salmon parr (*Oncorhynchus tshawytscha)*

S.Y. Huang[*, 1], S. Balfry[2], D. Higgs[2], R. Devlin[2], P. Schulte[1] and C. J. Brauner[1]
[1]Department of Zoology, University of British Columbia; [2]Centre of Aquaculture and Environmental Research, Fisheries and Oceans Canada.

Fish oils have been used as the main lipid sources in commercial salmon feeds because they are rich sources of essential fatty acids required by salmonids for growth and health. However, their rising costs, finite global supply, and increased levels of lipophilic contaminants (e.g., PCBs and dioxins) have resulted in increased interest in using alternate dietary lipids of plant and/or animal origin. To date, no study has assessed the merits of including canola oil in the diet of spring Chinook salmon.

A 30-week feeding trial was conducted to evaluate the growth and physiological effects of partial replacement of dietary fish oil (anchovy oil) with canola oil on pre-smolt spring Chinook salmon. Groups of 320 fry were fed one of four isoenergetic and isonitrogenous steam pelleted dry diets (conducted in triplicate) in which the canola oil furnished 0%, 25%, 50%, or 75% of the total dietary lipid content by replacement of the respective amount of supplemental anchovy oil. Physiological assessments were conducted every 5 weeks by measuring the following: (1) growth (2) osmoregulatory ability (3) aerobic swimming capacity and (4) health and immunological status. The nutritive value of supplemental oil was assessed on the basis of: (1) fish proximate composition, (2) whole body fatty acid composition and (3) dietary organic matter, protein and energy digestibility. In general, none of the diets resulted in significant differences in any of the performance measures conducted over this 30 week, trial indicating the potential for replacement of fish oil with canola oil in the diet of pre-smolt Chinook salmon.

Shellfish toxins: Improvements in detection methods and management strategies.

SHERWOOD HALL*, Stacey Etheridge, Jon Deeds, and Steve Conrad Laurel, Maryland.

Potent natural toxins can accumulate in shellfish, putting consumers at risk and impeding the profitable utilization of shellfish resources. The saxitoxins, which cause paralytic shellfish poisoning (PSP), are the best known among these and have long been managed by sampling and detection with the mouse bioassay. Such programs have been reasonably satisfactory for PSP, but leave much to be desired and are quite inadequate for many of the toxins now known to occur. Detection methods now available for PSP include a receptor binding assay (rba), with very high throughput and sensitivity much better than that of the mouse bioassay, and a commercial immunoassay that can be used in the field.

The sensitivity of the rba may allow more efficient management of PSP, since it is able to detect increases in toxicity well below the regulatory limit. Numerous other families of seafood toxins, many lipophilic and lacking chromophores, may best be determined by high performance liquid chromatography coupled with mass spectrometric detector (LC/MS). While LC/MS is relatively expensive and technically demanding, it may be the most cost effective approach for dealing with the profusion of lipophilic toxins. But regardless of the

detection method, sampling of shellfish for toxicity testing is in itself expensive and implies a time delay that may be large with respect to the optimal time from water to table and the rate at which toxicity can increase. Management strategies based solely on sampling and toxicity testing therefore have intrinsic limits on cost effectiveness. The use of other information, particularly field plankton observations, to anticipate increases in toxicity and focus toxicity testing, can significantly improve the effectiveness and reduce the cost of a marine biotoxin management program.

Vibrio parahaemolyticus in Alaska: A response to a potential crisis in the shellfish aquaculture industry.

RAYMOND RALONDE*. University of Alaska, Sea Grant Marine Advisory Program
1007 W. 3rd Ave #100, Anchorage, Alaska 99501.

Oyster farmers in Prince William Sound, during the summer of 2004, were devastated by an outbreak of human illness caused *Vibrio parahaemolyticus* (Vp). With 63 confirmed cases, the outbreak was the second largest recorded in the United States history.

The United States Food and Drug Administration (FDA) is concerned about the Prince William Sound outbreak. The first serious problem is that the O6:K18 serotype , while similar to an isolate from the state of Washington, is extremely virulent, causing illness in concentrations as low as 3.5 bacteria per gram. In addition, over 76% of the environmental samples, tested positive for pathogenic *Vp*, while the worldwide historical averages less than 1%. Both of these factors indicate an unprecedented event that may have nationwide implications in further development of seafood safety standards.

As a follow-up to the 2004 outbreak, a statewide investigation involving the industry, Alaska Department of Environmental Conservation, FDA Gulf Coast Shellfish Laboratory, and the University of Alaska Sea Grant Program was implemented during the summer of 2005. The objectives of the study were to determine the extent of *Vp* in environmental samples in Prince William Sound, determine if *Vp* was present at oyster farms outside of Prince William Sound, and to test changes in aquaculture practices as preventative measures against *Vp* accumulation. Preliminary results indicate that Vp is broadly distributed in environmental samples in Prince William Sound, and prompt intervention and temperature control was affective in preventing *Vp* illness from culture Pacific oysters.

11:00 am – 12:00 pm – Seafood Microbiology

Spoilage bacterial flora development in marine fishes commercially harvested from the Gulf of Alaska: Evaluation of the biolog microbial identification system.

B.H. Himelbloom, T.S. SHETTY*, and A.C.M. Oliveira. Fishery Industrial Technology Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Kodiak, AK 99615-7401

The Biolog Microbial Identification System (BMIS) is a rapid taxonomic method used widely in clinical and environmental microbiology. It tests the ability of an isolated microorganism to metabolize up to 95 carbon sources in a microtiter plate.

The objective of this study was to evaluate BMIS for correctness in identification of marine fish spoilage bacteria.

Fresh, locally-obtained pink salmon, sockeye salmon, rex sole and Pacific Ocean perch (POP) were processed into fillets (skinless or skin-on) or only headed and gutted. Processed raw fish were allowed to spoil during 13-16 days in ice. At selected intervals, samples were diluted, spread-plated on plate count agar containing 0.5% NaCl and incubated at 25°C for 48-72 h before determining total aerobic plate counts (TPC). For the initial and final sampling days, 10-13 colonies were selected randomly, preliminary bacterial classification tests were done on pure cultures and the isolates were identified using BMIS. Correct identifications of these isolates were compared to reference bacterial strains.

In the salmon and POP fillets, a week-long lag phase was followed by the TPC increasing exponentially to overt fish spoilage (10^6 - 10^7 colony-forming units per gram or cm^2). There was no lag phase for the skin bacterial flora of sole. A dominance of specific spoilage bacteria, Pseudomonas species and Shewanella putrefaciens, was observed. A high proportion of Psychrobacter immobilis in the spoiled fillets was also notable. About 13% (11 of 84) of the bacterial isolates were unable to grow under the manufacturer's culture protocols or were not identified correctly (similarity index <0.5).

The BMIS showed potential application in rapid taxonomy of seafood bacteria and may contribute to quality evaluation of raw commercial fish products.

Evaluation of electrolyzed water as a post-harvest treatment for inactivating *Vibrio* in Oysters.

Tingting Ren and YI-CHENG SU*. OSU Seafood Laboratory, Oregon State University, 2001 Marine Drive, Room 253, Astoria, OR 97103.

Vibrio parahaemolyticus and *Vibrio vulnificus* occur naturally in the marine environments and are commonly found in oysters. Consumption of raw oysters contaminated with these pathogens may lead to development of foodborne infections and is a food safety concern. This study investigated electrolyzed oxidizing (EO) water as a potential post-harvest treatment for reducing *V. parahaemolyticus* and *V. vulnificus* in oysters. Shell stock oysters were inoculated with *V. parahaemolyticus* or *V. vulnificus* to yield a contamination level of 10^4 MPN/g. Inoculated oysters were treated with EO water containing 1% NaCl at room temperature. Populations of *Vibrio* in oysters were determined at 0, 2, 4, 6, and 8 h. EO water exhibited strong antibacterial activity against *V. parahaemolyticus* and *V. vulnificus* in broth cultures. Populations of *V. parahaemolyticus* and *V. vulnificus* decreased quickly in EO water from approximate 7.9 log CFU/ml to non-detectable levels (<10 CFU/ml) within 15 s. Treatment of oysters with EO water containing 1% NaCl resulted in significant reductions of *V. parahaemolyticus* and *V. vulnificus* by 1.13 and 1.05 log MPN/g, respectively, within

4-6 h. However, extended exposure (>12 h) of oysters to EO water containing chlorine of >30 ppm was found detrimental to oysters. Application of EO water as a post-harvest treatment to reduce *Vibrio* contamination in oysters should be limited to <8 h to avoid death of oysters. Further studies are needed to determine effects of EO water treatment on sensory characteristics of oysters.

Tracking the progression of pink salmon spoilage through rapid bacterial species identification via cell wall fatty acid analysis.

A. MOREY*, B.H. Himelbloom and A.C.M. Oliveira. Fishery Industrial Technology Center, School of Fisheries and Ocean Science, University of Alaska Fairbanks, Kodiak, AK 99615-7401.

Classical taxonomic techniques developed for identification of microorganisms to the species level are time-consuming. Cell wall fatty acid profiling is rapid and robust from 25 years of progress. The Sherlock Microbial Identification System (MIDI) software identifies bacterial species through similarity indices when comparing the profiles to a database of known environmental and clinical bacteria. The objective of this research was to evaluate MIDI for rapid identification of bacterial species as pink salmon spoils in ice.

Fresh pink salmon (*Oncorhynchus gorbuscha*) obtained locally were washed, hand-filleted, packed and stored in ice up to 15 days. Skin swabs were taken from 10 sq.cm sections of fish every third day, diluted and spread-plated on plate count agar plus 0.5% NaCl. Aerobic plate counts (APC) were calculated after colonies had developed at 25° C for 48-72 h. From representative plates, ten colonies were randomly selected, purified and tested for cell wall type and catalase and oxidase activities. Cell wall lipids were extracted from isolates and reference strains, converted to methyl esters and analyzed by gas chromatography using the manufacturer's protocols.

The APC for iced pink salmon, skin-on fillets increased from 2 log colony-forming units (CFU/cm^2) initially to 5.6 log CFU/ cm^2 on day 15. A highly mixed bacterial flora confirmed the freshness of the day zero fillets. *Psychrobacter immobilis* emerged to predominance on days 3 and 9. *Pseudomonas fluorescens* and *Pseudomonas putida* comprised 40-60% of the skin bacterial flora on days 6, 9 and 15. *Shewanella putrefaciens* amounted to 20% and *P. immobilis* was a minor constituent of the salmon bacterial flora on day 15.

Rapid identification of the pink salmon skin bacterial species was successful using MIDI and may be useful in determining the quality of raw salmon stored in ice.

1:00 pm – 3:00 pm – Seafood Biochemistry

Change in proximate composition and fatty acid profile of snow crab, *Chionoecetes opilio*, embryos during development.

KERMIT D. REPPOND*[1], Louis Rugolo[2], and Alexandra C. M. de Oliveira[3]. NMFS/NWFSC, 118 Trident Way, Kodiak, [2]NMFS/AFSC, 301 Research Court, Kodiak, and [3]FITC-UAF, 118 Trident Way, Kodiak.

During the 1990s, snow crab supported the most viable crab fishery in Alaska with average annual landings of 85,000 MT. Since then, abundance has declined and remains depressed. Determining the level of important nutrients could provide an additional diagnostic tool in assaying the reproductive health of the snow crab population. The objective of this research was to document changes in the biochemistry of snow crab embryos during development with particular interest in the lipid fraction.

Crab from the eastern Bering Sea were transported to and maintained live in Kodiak Island until sampled for biometric and biochemical analysis. Moisture and ash were determined by AOAC methods. Protein content was determined by pyrolysis with a nitrogen analyzer. Total lipid content was determined by wet extraction using a 2:1 solvent mixture of chloroform and methanol. Fatty acid (FA) methyl esters were identified and quantified using gas chromatography.

Moisture content increased as the embryos matured while protein content remained unchanged. Ash content increased and lipid content decreased with maturity. These findings indicate that lipids were the main energy source for embryo maturation. The rate of utilization of each FA varied considerably with over 75% of C14:0, C18:4ω3, C20:1ω11, and C22:1ω11 being consumed during maturation. Other FA's such as C18:1ω9cis, C20:5ω3 and C22:5ω3 were utilized at 48%, 57%, and 49%, respectively. Long-chain polyunsaturated FA's such as C22:6ω3 (DHA) were among the least utilized at 36%. Our results concur with reported scientific observations where high levels of DHA were shown to be beneficial to larval survival in several marine species. Therefore, retention of DHA during embryo development in snow crab may be fundamental for larvae survival and growth after hatching. Results from this research may support formulation of management practices which confer stock stabilization and perhaps provide opportunities toward restoration to previous levels of abundance.

Effects of fumonisin B1 addition to feed on immune response, hepatopancreas and muscle proteins white shrimp (Litopenaeus vannamei).

J.M. EZQUERRA-BRAUER[1], A.L. Mexia-Salazar[1]*, A. Burgos-Hernández[1], M.O. Cortez-Rocha[1], R. Castro-Longoria [2], and J.Hernández-López [3]. [1]DIPA-Universidad de Sonora, Hermosillo, Sonora, México, [2]DICTUS-Universidad de Sonora, and [3]Centro de Investigaciones Biológicas del Noroeste.

The effects of fumonisin B1 addition to feed on immune response, hepatopancreas and muscle

proteins were studied on juvenile white shrimp (Litopenaeus vannamei) (5-6 g). The degree of hydrolysis (DH) of feed protein, immune system, thermal behavior of muscle by differential scanning calorimetry, and the hepatopancreas histology were evaluated. Shimps were exposed to feeds supplemented with 0.5, 0.75 and 1.0 ug/g with FB1 during 16 days. FB1 at 1 ug/g caused a significant feed protein DH drop, from 20% to 12% compared to the control. Prophenoloxidase activity behavior was affected at all FB1 concentrations tested. Both, total haemocyte count and phenoloxidase activity decreased by the 16th day in shrimp exposed to either 1.0 or 0.5 ug/g; however, they increased when exposed to 0.75 ug/g of FB1. Changes in electrophoretic pattern and thermodynamic properties of myosin were observed in shrimp fed with FB1. Marked histological changes in the hepatopancreas of shrimp fed on diet containing FB1 at the all three FB1 concentration tested were also observed. Severe degeneration of hepatopancreatic tubules was common in shrimp exposed to high concentration of FB1 (1.0 ug/g). Necrotic tissue was also observed.

Detection and partial isolation of chemopreventive fractions present in extracts from shrimp and octopus.

A. BURGOS-HERNÁNDEZ*[1], G. Wilson-Sánchez[1], Juárez, E[2], C. A. Velázquez-Contreras[2], J. M. Ezquerra-Brauer[1], and M. L. Aldana-Madrid[1]. 1DIPA-Universidad de Sonora, Hermosillo, Sonora, Mexico. DICTUS-Universidad de Sonora. [2]Dpto. Ciencias Químico-Biológicas, Universidad de Sonora.

Recently, several studies have carried out to determine the presence of chemopreventive compounds in foods. These include PUFA's, terpenoids, steroids, alcaloids, lipopeptides, pigments, among others. In this research work the detection of antimutagenic and/or antiproliferative activity was carried out followed by the partial isolation of the biologically active compounds. Chloroform and aqueous extracts from either shrimp and octopus, both captured at the Sea of Cortez, were obtained, dried, re-suspended in DMSO, and assayed for both, antimutagenic and antiproliferative activities. The antimutagenic potential of the extracts or fractions against aflatoxin B_1 (AFB_1) was determined using the Ames test using *Salmonella thyphimurium* TA98 and TA100 with metabolic activation. The antiproliferative activity was evaluated using a murine tranformed cell line C3F6. Partial isolation of active fractions was performed by thin layer chromatography (TLC) using silica gel. Both, aqueous and lipidic extracts showed antimutagenic activity; however, antiproliferation was only observed when the murine transformed cell line was exposed to lipidic extracts. After 3 consecutive TLC procedures, at least 4 antimutagenic- and 6 antiproliferative-fractions were detected. These results suggest the presence of at least 2 compounds, or groups of compounds, that inhibit the mutagenicity of AFB_1. In the same way, results suggest the presence of at least 3 compounds, or groups of compounds, that inhibit the proliferation of the murine transformed cell line C3F6. These results constitute a piece of evidence of the existence of possible chemoprotective/chemopreventive agents in shrimp and octopus; however, further *in vivo* studies must be performed for a full biological activity evaluation in order to consider them as an alternative for cancer prevention or treatment.

Characteristics of a Digestive Protease from the Pyloric Ceca of Hoki.

Changying Shi and BENJAMIN K. SIMPSON*. Food Science & Agricultural Chemistry Department McGill University (Macdonald Campus), QC. Canada.

Fish viscera are produced in large quantities in the fishing industry and pose a waste disposal and environmental pollution problem. However, this material is a rich source of enzymes that may have some unique properties, such as high molecular activity at low processing temperature, low temperature optimum, low thermostability, and high pH optimum/pH stability, to make them better suited for both basic research and industrial applications. In this study, a protease was purified to homogeneity from the pyloric ceca of the New Zealand hoki fish via ammonium sulfate fractionation, acetone fractionation and affinity chromatography on SBTI-Sepharose 4B matrix. The purified extract was simultaneously desalted and concentrated by ultrafiltration, and then characterized using N-α-benzoyl-DL-arginine-p-nitroanilide (BAPNA) as substrate. The affinity fraction migrated as a single band in SDS-PAGE gels as well as in isoelectric focusing gels. The molecular weight of the isolated trypsin was determined by SDS-PAGE to be approximately 26,000 Da, whereas the MALDI-TOF MS method of analysis indicated a molecular weight of 23,791 Da, and the isoelectric point (pI) was determined as 6.5. The kinetic properties, temperature, pH and inhibition effects on the activity of the purified trypsin were verified. On the basis of the kinetic properties, hoki trypsin showed higher amidase activity than bovine trypsin. The hoki trypsin had alkaline pH optimum (pH 9) and was stable at high pH. Hoki trypsin had a higher temperature optimum (60 ^{o}C) and still had relative higher activity at lower temperature. On the other hand, hoki trypsin was unstable at higher temperature. The enzyme was inhibited by the well known trypsin inhibitors, SBTI, aprotinin, benzamidine and PMSF. Based on the above characteristics of the enzyme as well as its N-terminal sequence, it is suggested that the hoki enzyme is authentic trypsin with potential for use in food industry and related applications.

Principles and applications of liquid chromatography mass spectrometry (LCMS) for seafood science and technology.

HAEJUNG AN*[1], Stan Louie[1], Pamela Tom[2], Cheng-i Wei[3], Keith Gates[4], and Jon Bell[5].
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Today mass spectrometry (MS) is considered as the most sensitive analytical method available for the structural characterization and quantitation of biomolecules. The major breakthrough in MS was made by the introduction of the soft ionization methods of electrospray (ESI) and matrix-assisted laser-desorption±ionization (MALDI). These ionization methods made it possible to directly analyze polar and thermally labile bimolecules without prior derivatization. This instrument is now widely used in the pharmaceutical industry for its sensitivity, specificity and accuracy. Steroids can now be detected and characterized at the picogram level, proteins separated by PAGE identified at the picomole level and below. Because the compounds of interest do not need to be derivatized prior to

the analysis, multiple compounds can be analyzed simultaneously within several minutes. Using this instrument, various compounds of xenobiotics such as intended preservative antibiotics and pesticides have been analyzed. In this presentation, the currently available LCMS systems and how it can be adapted to the research and development of seafood science and technology will be discussed with the focus on its application for the analysis of intended antibiotics.

3:00 pm to 5:00 pm – Seafood Processing and Engineering

Non-thermal antilisterial treatments for cold smoked fish.

Bittencourt, C*. and Ross T. Australian Food Safety Centre of Excellence, University of Tasmania, TAS.

Listeria monocytogenes is found in soil and water, on vegetation, food contact surfaces and in raw food materials including raw salmon. It grows at refrigeration temperatures and up to 14% sodium chloride making it almost impossible to control in chilled vacuum packed cold smoked salmon (CVCSS). This problem is compounded by its relatively long refrigerated shelf life. The primary aim of the work to be presented was to evaluate the use of sodium lactate (powder form), potassium lactate/sodium diacetate mix (liquid form) and Nisin/Rosemary extract mix (powder form) to inhibit *L. monocytogenes* growth on CVCSS at 4 and 10°C over a period of up to 40 days. The effect of the treatments on the sensorial attributes (color, taste and overall acceptance) of the powder treated samples was also evaluated. It was found that both sodium lactate powder (2.3% w/w) and the lactate/diacetate liquid mix (1.5% w/w) were capable of preventing the growth of *L. monocytogenes* at 4 and 10°C. The Nisin/rosemary extract powder mix, however, proved to be inadequate for this kind of product/application as it did not penetrate into the salmon fillets and was unable to inhibit *L. monocytogenes* growth within the fish tissue. Sensorial analysis for the samples treated with sodium lactate powder showed no significant difference ($p>0.05$) between control and treatment. The potential of these preparations as antilisterial treatments for CVCSS will be discussed.

Developing and using thin bladed Kramer cell and computer vision system to determine tenderness and color of fish muscle.

FANBIN KONG*[1], Juming Tang[1], Barbara Rasco[2], Chuck Crapo[3], Scott Smiley[3]. [1]Dept of Biological Systems Engineering 6120, Washington State University, Pullman, WA 99164-6120, [2]Dept of Food Science and Human Nutrition, Washington State University, Pullman, WA 99164-6120, and [3]Fishery Industrial Technology Center, University of Alaska Fairbanks, Kodiak, Alaska 99615-7401.

Kramer cell and spectrophotometer are commonly used to evaluate fish muscle tenderness and color. With those methods, large amounts of sample are needed to achieve representative results. However, detailed analyses on textural changes at different locations of a single fish after thermal processing require the use of much smaller samples to produce reliable results.

Our objective was to develop appropriate methods to accurately measure the tenderness and color of raw fish muscle as well as retorted fish fillets.

For tenderness determination, a new type Kramer cell with 10 thin blades (0.6mm thickness) was developed and fitted to a XT-2i Texture analyzer. A computer vision system was developed for color measurement. The digital picture of the sample was captured under proper lighting and analyzed using Adobe Photoshop to derive Hunter L, a and b values. Tiny samples (size: D 30 mm × H 6 mm) were taken from Pink salmon fillet at different locations from head to tail. The samples were sealed in aluminum cans and heated in an oil bath at 121°C for different time periods up to 120 minutes. The tenderness and color were determined for raw and retorted samples. The results show that the new measurement methods reduced standard deviations and improved consistency as compared with traditional methods.
In general, the shear force increased sharply to reach a maximum within 10 min of heating at 121˚C. The shear force then decreased to a minimum after about 20 min heating before increasing to a peak at approximately 60 min heating. After that, it decreased consistently. Within the first 10 min heating at 121°C, Hunter L increased to a maximum, and "a" and "b" decreased to a minimum. The samples in dorsal area are more reproducible.

Optimum transport temperatures for live New Zealand littleneck clams (Autrovenus stutchburyi).

GRAHAM C FLETCHER*, Joseph F. Youssef & Simon Brown. Processing and Preservation Technologies, Seafoods and Marine Extracts, New Zealand Institute for Crop & Food Research Limited, Private Bag 92169, Auckland, New Zealand.

New Zealand littleneck clams (Autrovenus stutchburyi) provide a small but profitable export industry and are in particularly high demand on the east coast of the USA. To meet this demand it is essential that the clams are marketed live which means that temperarture control during transportation is critical. The authors are part of a research consortium developing a packaging system which contains phase change materials (PCMs) which could help keep these temperature-sensitive animals within their optimum temperature range. Before developing such PCMs, we had to accurately determine the optimum storage temperatures for New Zealand littleneck clams.

Live clams were harvested in different seasons (2004-5) from Snake Bank (Whangarei Harbour, New Zealand) and 5 trays of 100 clams at each temperature were stored under high humidity (RH > 90%) and constant temperature conditions (0-15°C). Mortalities were recorded and plotted as cumulative percentages against storage time. Spline models were fitted to the mortality data grouped by season. Clams harvested in summer had substantially shorter storage lives (9.5 days at 5°C) than those harvested during other seasons while winter harvest had the best storage lives (14.1 days at 5°C). The maximum survival rate was always at temperatures of around 5°C and the biological variability in the results means that, under commercial conditions, clams stored at temperatures between 4 and 6°C will have maximum live storage lives.

Best practices for successful shipments. Elizabeth Darragh, Director of Supermarket & Food Strategic Marketing SENSITECH, INC. Beverly, MA 01915-6197.

"Best Practices for Successful Shipments" is derived from Sensitech's 15 years of cold chain management experience. Whether you are shipping fresh or frozen seafood by air, road, or container we offer some best practices advice for driving quality, improving process and complying with any regulatory requirements for storage of historical condition data. Through our TempTale monitoring devices, we will show examples of wide temperature variation as a direct result of poor loading and transport conditions. In today's competitive market, it's in distributors, processors, and retailers best interest to protect their brand integrity and investments.

Inactivation of *Listeria monocytogenes* in greenshell™ mussels by high pressure processing. GRAHAM C FLETCHER*, Joseph F. Youssef & Sravani Gupta. Processing and Preservation Technologies, Seafoods and Marine Extracts, New Zealand Institute for Crop & Food Research Limited, Private Bag 92169, Auckland, New Zealand.

New Zealand Greenshell™ mussels are currently shucked by heat processing and this is sometimes used as a listericidal step in HACCP plans. Shucking by high pressure processing (HPP) offers some advantages over heat shucking: increased meat yields, less alteration of raw characteristics, possibly decreased labor costs. Before HPP is implemented, processors need to understand the implications of this technology on the safety of their product with respect to *Listeria monocytogenes*. We associated *L. monocytogenes* with minced mussel meat and subjected samples (2g in foil pouches) to HPP at various pressures, times and temperatures. The most probable number (MPN) method was selected to allow recovery of injured cells. Enrichment in Buffered *Listeria* Enrichment Broth (BLEB) gave higher recoveries than the other two broths tested (*Listeria* Enrichment Broth and *Listeria* Repair Broth). Serial dilutions of mussel were made in the broth without selective agents in 96-well plates and incubated aerobically at 35°C for 4h. *Listeria* Selective Agent was then added to each well and the plates were incubated at 35°C for 48 h when drops from each well were transferred to *Listeria* Chromagar (Chromager, France) plates. These were incubated for 48 h at 35°C, scored for presence or absence of typical green colour and the results used to calculate 3 x 3 tube MPNs. Of 11 strains of *L. monocytogenes* tested the most resistant to HPP (Food Science Australia strain 2655 isolated from Australian processed meat) was selected for subsequent work. This strain showed two phase inactivation kinetics in response to time at tested pressures and temperatures. Approximately 5 $\log_{10}$ cells/g were rapidly inactivated in a log-linear fashion with time while the residue of cells were inactivated at a slower rate. The log-linear inactivation rates increased with increasing pressure and processing temperature.

ABSTRACTS

TUESDAY, March 7th

8:00 am – 9:20 am – Seafood Processing and Engineering

Radio Frequency Identification- How it will transform packaging, distribution, & handling of Alaska seafood. STEPHEN T. GRABACKI*. GRAYSTAR Pacific Seafood, Ltd., P.O.Box 100506, Anchorage, Alaska 99510-0506.

Radio Frequency Identification, sometimes called an “electronic bar code”, is a tool of supply chain management. It is already in use by the U.S. Department of Defense and its suppliers. Private-sector companies, including Wal-Mart and many other large American firms, are requiring their suppliers to put RFID tags on their products. RFID tags might be passive or active, and they can be linked to time-temperature recorders, contamination indicators, GPS units, and other technologies. RFID technology is evolving rapidly, and is quickly being adopted by the food industry.

Good fish, bad fish: Understanding risks/benefits in seafood consumption.
MICHAEL T. MORRISSEY*. Oregon State University Seafood Laboratory, 2001 Marine Dr., Rm 253, Astoria, OR 97103.

The health benefits that omega-3 fatty acids and fish consumption in general contribute to the reduction of cardiovascular disease are well established through a great number of scientific studies. More recently, a sizable number of studies are examining their potential role in mitigating other diseases and health conditions such as Alzheimer’s and infant brain development. Extensive scientific research and recommendations to consume fish regularly from professional societies, health organizations, and government agencies consistently support dietary guidance to consume fish regularly. Nevertheless, increasingly consumers are being warned to eliminate or minimize their consumption of certain species. The warnings, which have been issued due to risks associated with chemical contaminates such as PCB, dioxin and mercury in fish, have received extensive coverage in news articles and stories in popular magazines. Consequently, the consumer receives a mixed message and may reduce fish consumption for unwarranted reasons. The emerging news about the benefits of fish and warnings associated with possible risks from chemical contamination will be discussed in the context of their impacts on consumers and the seafood industry.

California sea grant seafood internet outreach and resources for industry
Pamela Tom*, University of California, Sea Grant Extension Program.

For over a decade the University of California Sea Grant Extension Program has taken the lead in utilizing the internet to transfer technology to the seafood community. Internet

methods include the HACCP Discussion List (which currently has over 925 global subscribers) and the Seafood Network Information Center (***SeafoodNIC***) web site (which averages about 70,000 hits monthly). The HACCP Discussion list effectively provides its subscribers with a timely and cost-effective service in alerting the industry, academia and regulators on seafood issues and regulatory updates. The ***SeafoodNIC*** web site serves as a primary information source on seafood technology issues such as research, processing guidelines and regulations, marketing resources, sanitation, publications, industry events, consumer information, etc. This talk highlights California Sea Grant's internet outreach efforts and will briefly discuss new and in-progress web page developments. An introduction to seafood web-based resources and key federal, industry association pages will be reviewed.

A panel session: New issues on salmon canning. JOHN OSSMAN*

Can company technical representatives will discuss salmon can manufacturing and double seaming in an open, audience-participation forum. Specific items for discussion will include the role of body hook butting and free space in double seam evaluations. Options for satisfying customer and regulatory requirements related to double seam quality will discussed.

10:40 am – 12:00 pm – Waste/Byproducts

Estimates of Alaska fish processing waste stream components. P.J. BECHTEL*[1], C.K. Bower[1], and C.A. Crapo[2].

[1]USDA-ARS Laboratory, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks AK 99775 and [2]Fishery Industrial Technology Center, 118 Trident Way, University of Alaska, Kodiak, AK 99615

More than half of the total fish harvested for human consumption in the USA come from Alaskan waters. This creates large amounts of fish processing byproducts which can be utilized for a number of products. There is little information on the amounts and types of the seafood processing byproducts and the outcomes and uses of the byproducts. Estimates are made of the amount of fish processing byproducts generated in Alaska waters as a function of 1) species, 2) amount of individual byproducts, 3) geographic region and 4) and offshore vs onshore processing sectors.

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 2005 harvest statistics for

ground fish, Alaska Department of Fish and Game 2005 harvest statistics for salmon and herring, and contacts with industry personnel. Percent heads, frames, viscera, skin and fillets were obtained from published values.

The marine fin fish 2005 harvest was approximately 2,450,000 metric tons (MT) and produced an estimated 1,300,000 MT of fish by-products, consisting of heads, viscera, frames and skins. Fish processing wastes from pollock and cod account for 79% of the total fish waste produced. FY 2005 estimates of fish meal and oil production in Alaska were over 100,000 MT. Results from the 2005 estimates will be contrasted with results from the year 2000.

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

Recovery and characterization of lipids from enzymatic digestion of fish eye tissue.
KERMIT D. REPPOND[1]*, Alexandra C. M. de Oliveira[2], and Peter J. Bechtel[3]. [1]NMFS/NWFSC, 118 Trident way, Kodiak, AK, [2]UAF/FITC, 118 Trident Way, Kodiak, AK 99615, and [3]USDA/ARS, 233 O'Neill Building, Fairbanks, AK99775.

Offal from processing of fish is typically processed into meal and oil by the conventional thermal process. Alternative processing techniques could prove useful in recovering marketable specialty products and creating value added products. The objective of this research was to determine if fish oil or lipid rich material could be recovered from fish eye tissue by enzymatic digestion.

The lipid content of fish eyes from Pacific cod, halibut, five salmon species and four rockfish species was determined by wet extraction using a 2:1 solvent mixture of chloroform and methanol. Samples of eyes from several species were acid digested with pepsin, neutralized, centrifuged and the layers separately freeze-dried. Fatty acid (FA) methyl esters were prepared and quantified using gas chromatography. Lipid classes were determined by TLC/FID.

Lipid content of fish eyes varied considerably among species and even among those in the same genus. Among salmon, eyes from cohos had the highest lipid content at 23% and pinks had the lowest at 8%. Among rockfish eyes, dusky had the highest lipid content at 9% while rougheye had the lowest at 3%. FA profiles of acid digests of eyes from the different species were similar. DHA, EPA and oleic acid were the predominant unsaturated FA, and palmitic was the predominant saturated FA. Saturated FA composed 23-28% of total FA in all fish eyes. Polyunsaturated FA ranged from 31% of total FA in chum salmon eyes to 37% in pink salmon eyes. Omega-3 FA ranged from a low of 28% in chum eyes to a high of 34% in eyes from pinks, with rockfish eyes having less ω-3 than salmon eyes. Regardless of fish species, lipids in eyes were essentially all triacylglycerides. Recovery of lipids from fish eye tissue is possible but commercialization may be useful only for certain species.

Converting Alaska fish by-products into high protein liquid concentrates.
C.K. BOWER* and P.J. Bechtel. USDA-ARS Laboratory, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks AK 99775.

Alaska's fishing industry generates over one million metric tons of fish processing wastes each year. In some locations these by-products can be converted into a low value, high ash fish meal, however smaller processors often use the grind-and-dump method of disposal. Production of high protein liquid concentrates can be an inexpensive method to preserve some of the fish by-products currently discarded by processors.

There are many methods for stabilizing fish by-products, however when producing a high protein liquid concentrate, the three most common techniques are ensilage, fermentation, and hydrolysis. Silage is prepared by grinding the fish, acidifying the homogenate below pH 4.0 to prevent microbial spoilage, and then allowing the natural enzymes to break down the fish proteins. Preparation of fermentates is similar to silage, except that an acid-producing bacteria is added to lower the pH, instead of directly adding acid. Hydrolysates are produced through the use of commercial enzymes, which digest the fish by-products to create a liquefied protein solution.

This presentation will describe these three stabilization methods, and discuss some current research projects designed to preserve fish by-products as high protein liquid concentrates in Alaska.

The quality of a high protein liquid concentrate is typically judged by the protein quality, oil content, and percent moisture, as well as the presence of free fatty acids, amino acids, and bitter compounds. Silage and fermentation are relatively simple processes that do not require heat. However, the more complex techniques used in the production of hydrolysates allow more control over the end product. Combinations of these methods may be needed to maximize the efficiency and reduce the cost of stabilizing fish by-products in Alaska.

Physical properties and glucosamine and chondroitin contents of red salmon heads. CHERRY SEIME*[1], Subramaniam Sathivel[1], and P.J. Bechtel[2]. [1]Fishery Industrial Technology Center, University of Alaska Fairbanks, 118 Trident Way, Kodiak, AK 99615, and [2]USDA/ARS Seafood Laboratory, USDA/ARS, 245 O'Neill Building, University of Alaska, Fairbanks, AK 99775.

In Alaska, approximately 50,000 mt of salmon heads are available from the processing of pink (Oncorhynchus gorbuscha) and red salmon (Oncorhynchus nerka). Salmon heads contain high levels of lipid in addition to protein and bone. There is an opportunity for utilizing more fish processing byproducts, such as salmon heads, to make human food protein ingredients. The objective of this study was to evaluate some of the physical, nutrition and functional properties, glucosamine and chondroitin contents of red salmon proteins.

Red salmon heads were separately minced and water was added to the mince (water: mince=1:1, V/W). The mixture was heated at 70 C for 1hr, oil was extracted from the mixture and the remaining soluble (RS) and insoluble (RI) fractions were separated and freeze dried.

The freeze-dried RS and RI protein powders were analyzed for protein, lipid, moisture, and ash contents. Emulsion stability, fat absorption, water activity, bulk density, minerals, amino acids and color of the protein powders were determined.

The RS and RI protein powders respectively contained 76.2% and 52.3% protein. The salmon protein powders were dark yellow in color. Emulsifying stability (%) of protein powder from RI (99.9) was greater than that of RS (81.1). Highest fat absorption was observed in the protein powder from RS. Water activity for RS and RI protein powders were 0.09 and 0.07, respectively. Glucosamine and chondroitin content for RS and RI were found to contain less than 2.5% glucosamine and 3% chondroitin.

The fish protein powders from red salmon head showed potential for use as nutritional functional protein.

Lipids and contaminants in fish oils from Alaska seafood processing byproducts.
SCOTT SMILEY*[1], Alexandra C.M. Oliveira[1], David A.J. Stone[2], Sebastien Plante[3], Peter J. Bechtel[4], and Ronald W. Hardy[5]. [1]Univ. Alaska -Fishery Industrial Technology Center, Kodiak, [2]Univ. Idaho - Hagerman Fish Culture Center, Hagerman ID, [3]Coastal Zone Research Institute, Shippagan NB, Canada, and [4]USDA-ARS, Seafood Laboratory, O'Neill Bldg., Univ. Alaska, Fairbanks.

Estimates of the production capacity for fish oil extracted from Alaska seafood processing by-products run as high as 70,000 mt annually. High transportation fees coupled with the cost-effectiveness of using fish oil in boilers on site as a substitute for fuel oil, currently restricts the availability of these high quality oils to aquaculture feeds manufacturers. However, as global demand for acceptable fish oils for aquaculture feed formulations increases, the use of byproduct derived Alaskan fish oil seems likely to become more advantageous. In this paper, we present our analysis of the lipid chemistry and lipid-soluble contaminants of fish oils derived from commercially important Alaskan species.

We examined the proximate lipid concentrations, fatty acid profiles, lipid class concentrations and levels of organic contaminants in fish oils extracted from processing waste derived from walleye pollock (*Theragra chalcogramma)*, pink salmon (*Oncorhynchus gorbuscha)*, Pacific ocean perch (*Sebastes alutus*), Pacific cod (*Gadus macrocephalus*) and sable fish (*Anoplopoma fimbria*). All oils were obtained from commercial fishmeal or fish hydrolysate manufacturers in Alaska in spring and summer of 2004 and 2005.

Results show that the fatty acid make-ups, as found in these oils, are nutritionally well suited for inclusion in aquaculture feed formulations and are broadly comparable to those found in menhaden oil. Menhaden oil is the premium standard used in commercial feeds for carnivorous fish aquaculture. Further, fish oils from cold water marine species, in contrast with those of temperate water menhaden, have two characteristics that make them quite desirable for incorporation into finishing diets for fish raised on plant oil based formulations.

1. Alaskan fish oils have low levels of lipid soluble organic contaminants.
2. Alaskan fish oils have high levels of ω9 and ω3 fatty acids, and low levels of ω6 species.

We present the methodologies used in the analysis of the proximate lipid concentration, fatty

acid make-up, lipid class concentrations and the levels of organic contaminants from these five commercially important cold-water marine species harvested in Alaska. This information is compared that derived from commercially available canola and menhaden oils, both commonly used in the manufacture of aquaculture feeds. Finally, our data resolves some of the published confusion centering on the lipid chemistry of sable fish.

Oil from fish processing byproducts as a viable renewable resource for biodiesel production.

SUBRAMANIAM SATHIVEL*. Fishery Industrial Technology Center, University of Alaska Fairbanks, 118 Trident Way, Kodiak, AK 99615.

Fish oil can be an alternative feedstock to produce biodiesel. Fish oil from byproducts and underutilized fish can be easily converted into usable biodiesel, which is a clean-burning bio-oil and can be used to reduce dependence on imported fuel and improve air quality. Fish byproducts and underutilized fish are an abundant resource in the United States. Both contain large amounts of fat, which could be used as an alternative and viable feedstock to produce fish oil-based biodiesel. Biodiesel can be produced from animal fats and oils, which are typically water-insoluble substances known as triglycerides. The transesterification reaction converts triglycerides into biodiesel commonly using sodium hydroxide as the base catalyst and methanol as the alcohol. The production of fish oil from fish byproducts would make a valuable renewable energy resource for rural communities by helping defray energy costs.

Gasification. Can it work for small seafood processors?

CHRISTINA DEWITT*[1], Cynthia Bower[2], Liz Brown[3], Sunny Rice[3], and Tim Bowser[1], [1]Oklahoma State University, [2]USDA-ARS Fairbanks, and [3]University of Alaska, Fairbanks.

The Pacific salmon industry is an important economic contributor to many small communities in Alaska. Over 300000 mt are harvested annually. Byproducts such as low grade whole fish, heads, skin and frame make-up over 50% of this harvest and can be used to make low cost proteins suitable for animal feed. However, in Alaska, many times the conversion and transportation of byproducts into fish meal is not economically feasible for many small processors. It has been estimated that over 50% of processing byproduct is not utilized. Gasification is a disposal process that may offer an economically viable alternative for small processors, especially those in isolated communities. Gasification is a process that uses heat in a low oxygen environment to convert solid organic waste into combustible gases which contain carbon monoxide, hydrogen, acetylene, and other combustible hydrocarbons. It is a process that reduces biomass by over 80% and converts a majority of that biomass into valuable energy. Recent research has successfully demonstrated the economic feasibility of gasifying food processing byproduct with other solid waste such as corrugated paper, wood pallets, and plastic typically generated by a large meat processing facility. A project involving researchers from USDA-ARS Fairbanks and Oklahoma State University in collaboration with Alaska Marine Advisory Program Agents has been proposed to evaluate the feasibility of gasification for small salmon processors. The project will include a survey of municipal

solid waste (food and other) generated at several small processors with the help of Alaska Marine Advisory Agents. USDA-ARS Fairbanks will coordinate collection of byproduct and will provide baseline information regarding its composition and heat value. Oklahoma State University will identify and quantify combustible gases produced using a pilot scale gasifier and determine the dry to wet waste ratio that maximizes efficiency.

Wastewater bacterial limits: Are they coming to Alaska?

ALAN ISMOND*. Aqua-Terra Consultants, 14841 SE 54th St, Bellevue, WA 98006.

There are seafood processing wastewater permit holders in the lower 48 that have bacterial limits in their permit. As well, there is a major study in the state of Oregon on profiling bacteria in and around seafood processing plants. Regulatory agencies are aware that seafood processing wastewater can contain bacteria at levels that could exceed water quality standards. At some point in the future, this could become an issue for the seafood industry in Alaska.

Although seafood plants maintain sanitary conditions for product quality, wastewater handling systems can result in high bacteria counts in the plant effluent. If bacteria limits were imposed, there are several options for compliance. The first involves disinfecting the wastewater. Because of the high organic load in seafood processing wastewater, disinfection technologies would be either ineffective or extremely costly. The second option involves identifying and eliminating bacterial sources as well as redesigning the wastewater handling system to reduce bacterial growth. Depending on the size of the plant, both strategies may need to be implemented.

Seafood plants in Alaska would be prudent to assess their bacterial situation in advance of future permit revisions. Failing this, it will be difficult to assess the cost and feasibility of compliance.

2:40 pm – 4:00 pm – Poster Session

Hydrolysis of wheat gluten proteins by trypsin from sierra (Scomberomorus concolor) guts. Estimation of kinetic parameters.

F. CABRERA-CHÁVEZ*, J.L. Cárdenas-López , J.M. Ezquerra-Brauer, and O. Rouzaud-Sández. Departamento de Investigación y Posgrado en Alimentos, Universidad de Sonora, Hermosillo, Sonora, Mexico.

Enzymes from marine sources, for the processing of cereal products are currently investigated in our laboratory. In this study, trypsin isolated from sierra (Scomberomorus concolor) gut extract, was evaluated for its hydrolysis capability on gluten, gliadins and glutenins from two

regional wheat varieties, “Júpare” (T. durum) and “Rayón” (T. aestivum). Km and Vmax were determined to establish the kinetic reaction status. The degree of hydrolysis was based on the reaction of primary amino groups with o-phthaldialdehyde (OPA). The lower value for Km was obtained from the “Júpare” fraction hydrolysis which also developed the highest Vmax. The degree of hydrolysis was 23.52%, 18.56% and 21.75% for gluten, gliadins and glutenins from “Júpare”, respectively. A similar degree of hydrolysis was obtained for Rayón gluten. Trypsin extracts from sierra guts had similar hydrolytic capability as other protease sources on protein fractions from the aestivum and durum wheat and have a potential as processing agents for these cereal products.

Temperature and pH stability of cathepsin L from jumbo squid (Dosidicus gigas) hepatopancreas.

CARDENAS-LOPEZ, J. L.[*1] and Haard, N. F[2]. [1]Departamento de Investigación y Posgrado en Alimentos, Universidad de Sonora. Hermosillo, Son. [2]Institute of Marine Resources, University of California, Davis. Davis, California.

A cysteine proteinase was extracted and partially purified from the hepatopancreas of jumbo squid (*Dosidicus gigas*) using a two-step purification procedure involving ammonium sulphate precipitation and gel filtration chromatography. It was identified as cathepsin L by proteomic techniques. The stability to pH and temperature was evaluated using an enzyme assay with Z-PAAFC, a cathepsin L specific synthetic substrate. The range for pH was 2 to 9 at 4°C and 37°C, and the range of temperature was from 4 to 70°C, measured at pH 4.5. It was found that at 4°C the proteinase was stable up to 250 h in almost all the pH values evaluated, at 37°C the residual activity decreased down to 40% very fast in all the pH range evaluated except at pH 6. In regards to temperature, residual activity varied from 100% at 4°C for 280 h down to 4% at 70°C for 30 min. The data obtained could have important implications in the use of the jumbo squid hepatopancreas tissue extracts as an enzymatic processing agent in the food or feed industry.

Protein concentrates produced by various drying processes from shrimp by-catch.

JULIO HUMBERTO CÓRDOVA MURUETA*, Fernando García-Carreño, and M. de los Angeles Navarrete. Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, B.C.S., Mexico and Mar Bermejo 195, Col. Playa Palo de Santa Rita, La Paz, B.C.S. 23090, México.

To develop protein concentrating processes for under-utilized fish, nine species of fish from shrimp by-catch (*Gillichthys seta, Oligoplites saurus, Eucinostomus entomelas, Synodus scituliceps, Diplectrum pacificum, Pseudopeneus grandisquamis, Xenistius californiensis, Arius seemanni, Orthopristis reddinig*) caught in the Gulf of California near Sonora, Mexico were evaluated. They were eviscerated and ground separately to produce protein concentrates by using three drying strategies (freeze-drying and oven drying at 65°C and 110°C). The soluble protein content (by species and process) was evaluated and analyzed by SDS-PAGE. The protein concentrates resulting from the different temperature processes were compared

with raw protein. Significant differences were observed in soluble protein. The composition of protein, was affected by temperature, as observed in the electrophoresis gels. In a further study, proteases in fish muscle were investigated. Raw and freeze-dried protein from *Synodus scituliceps* showed high proteolytic activity. Auto-hydrolysis was indicated in SDS-PAGE and in pH-stat results. Enzymes showed the highest activity at 65°C and optimum pH was 7.5, but with activity between pH 5-11. Enzyme activity was tested by using several protease inhibitors (SBTI, TLCK, E64, PMSF, chymostatin, EDTA, and PEFABLOC) in substrate SDS-PAGE. Activity was completely inactivated by soybean trypsin inhibitor (SBTI). The other inhibitors had no effect on activity. In vitro evaluation of digestibility of the protein concentrates demonstrated greater hydrolysis for protein obtained by drying at low temperature. This observation confirmed that protein structure is severely affected by heat, as demonstrated with electrophoresis.

Jumbo squid protein hydrolysates.

DE LA FUENTE-BETANCOURT, M. GABRIELA*, Navarrete-del Toro, M. Angeles, Córdova-Murueta, Julio, and García-Carreño L. Fernando. Centro de Investigaciones Biológicas del Noroeste (CIBNOR), Mar Bermejo 195. Playa Palo de Santa Rita, La Paz, B.C.S. 23090, Mexico.

Jumbo squid (*Dosidicus gigas*) is an underutilized marine resource from the Mexican Pacific; it is caught and sold as frozen raw material to Asian markets. In order to improve the value of the fishery, new processing methods should be developed to transform this low-cost catch into cost-effective products. This can be achieved by recovering its protein by prossessing by enzymatic hydrolysis, which has been demonstrated to improve functional properties of proteins. The aim of this work is to transform and to recover the protein in the mantle by enzymatic hydrolysis. Using three GRAS commercial enzymes (Alcalase™, bromelain and papain) squid protein hydrolysates were prepared. Enzyme to substrate ratio for each enzyme was adjusted with the intention of reach a 3% degree of hydrolysis (%DH). This value was selected as high enough for protein solubilization, and lower enough to retain or enhance functional properties useful in food systems. %DH was measured on a pH Stat system. Reaction conditions were conduced varying temperature (30, 35 and 40°C) and pH (8 and 9) for the three enzymes. Besides hydrolysis curve, reaction was followed by SDS-PAGE profile analysis. Squid protein hydrolysates were characterized by their functional properties: soluble protein recovered; whippability, foam stability, emulsion capacity and stability were evaluated. This study is in under current research and will give future opportunities for processors to produce value added products from jumbo squid.

Potential for jumbo squid protein hydrolysates.

M. GABRIELA DE LA FUENTE-BETANCOURT*, M. de los Angeles Navarrete del Toro, Julio Córdova-Murueta, Fernando L. García-Carreño. Centro de Investigaciones Biológicas del Noroeste (CIBNOR), Mar Bermejo 195, Playa Palo de Santa Rita, La Paz, B.C.S. 23090, Mexico.

Jumbo squid (*Dosidicus gigas*) is an under-utilized marine resource from the Mexican Pacific. It is sold as frozen raw material in Asian markets. To increase the value of this fishery, new processing methods should be developed to transform this low-value catch into cost-effective products. This can be achieved by recovering its protein by prossessing involving enzymatic hydrolysis, which has been demonstrated to improve functional properties of proteins. The report describes experiments to transform and recover protein in squid mantle by enzymatic hydrolysis. Using three GRAS commercial enzymes (Alcalase™, bromelain, and papain), squid protein hydrolysates were prepared. The enzyme to substrate ratio for each enzyme was adjusted to obtain 3% DH. This value was selected as high enough for protein solubilization, and lower enough to retain or enhance functional properties useful in food products. Hydrolysis was measured on a pH Stat system. Reaction conditions were conducted at 30, 35, and 40°C and pH 8 and 9 for the three enzymes. Besides determining hydrolysis curves, reaction was followed by SDS-PAGE profile analysis. Results of squid protein hydrolysates were characterized by functional properties: soluble protein recovered, whippability, foam stability, emulsion capacity and stability. This study is nearing completion. We expect the information will provide opportunities for processors to produce value-added products made from jumbo squid.

Recovery of jumbo squid muscle protein by acid and alkaline processes.
HUGO PALAFOX-CARLOS* and Fernando L. García-Carreño. Centro de Investigaciones Biológicas del Noroeste, A.P. 128, La Paz, B.C.S. 23000, Mexico.

Jumbo squid (*Dosidicus gigas*) is an important fishery in the Pacific coastal area of Mexico, yet is not a high-value product for export. One approach to increasing its value is to advance knowledge supporting technology for muscle protein transformation. Squid muscle has properties for producing protein isolates that can be used in food products. It is white in color, low in fat, and has almost no flavor. Development of new products would increase the prosperity of this fishery industry and its workers. Most studies in food science related to animal muscle focused on protein derivatives because they add functionality to foods. Solubility of proteins is of interest because of the relationship to many functional properties. This work describes two procedures for processing frozen muscle of giant squid to obtain protein isolates with high economic yields and functional properties. These processes are based on solubilization, precipitation (iso-electric point), and recovery of muscle protein. Solubility was determined for different pH values. Squid muscle proteins were extracted using acidic and basic solutions. About 90% of the initial muscle proteins were solubilized at pH 2-2.5 and 11-11.5, of which 97% and 96%, respectively, were recovered after precipitation at pH 5.5. The protein is then isolated and collected. The two pH extremes offer high yields and recovery of myofibrilar protein and eliminate impurities (membranes, skin, and connective tissue). Additional work is needed to evaluate the uses of the protein isolates and optimization of the isolation process.

Evaluation of gasification as a value-added process for handling meat processing byproducts. Bowser, T.J., Weckler, P.R., Patil, K.N., Rao, B.R., and DEWITT, C*. Oklahoma State University.

Value-added processing of food typically generates a significant volume of food processing byproducts (FPBs). Food processors face significant challenges with regard to use and/or disposal of FPBs. Traditional means of dealing with the sheer volume of food processing waste generated includes rendering, land application, microbial decomposition and/or preservation, incineration, and land-filling. All of these methods of disposal, however, have their shortcomings. Rendering requires extensive capital investment, energy, and is often associated with local air quality complaints. Land application can lead to phosphorous overload. Microbial decomposition and preservation is often time consuming and difficult to achieve on a consistent basis. Incineration creates smoke and ash pollution and land-filling is often simply perceived as being wasteful and aesthetically unpleasing. Gasification, however, is an alternative process that could possibly be utilized to convert FPBs into valuable energy. To test the feasibility of gasifying FPBs, a pilot-scale updraft, batch gasifier was designed, fabricated and tested. Data was collected regarding the volume and types of food processing waste generated at three value-added meat processing facilities. Pilot scale gasification was conducted on sludge, wood pellets, and sludge/wood pellet mixtures. Baseline data was also collected for moisture, ash, volatile matter, and heating values using bomb calorimetry. The cold gas efficiency was 47% for sludge, 58% for wood pellets, and 60% for sludge/wood composite. Ash production ranged from 6 to 16% of the feedstock input (mass basis). Composition of the producer gas included 2 to 3% H_2; 12 to 17% CO; and, 1 to 4% CH_4. An economic evaluation of available energy, potential income, potential savings (cost of current disposal practices), and total potential savings suggested the surveyed facilities could realize over $750,000 per year using gasification.

Ontogenetic changes in digestive enzyme activity of larval whiteleg shrimp (*Penaeus vannamei*).

CRISALEJANDRA RIVERA-PÉREZ * and F. L. García-Carreño. Investigaciones Biológicas del Noroeste, A.P. 128, La Paz, B.C.S. 23000, Mexico.

Enzymes involved in digestion are of interest because they control the absorption of nutrients for growth and survival. Understanding of digestive capabilities is of interest in larval culture of *Penaeus vannamei*, the most important shrimp in Mexican aquaculture. Changes in the larval stages are rapid, taking hours, and include changes in feeding habits. Digestive enzymes must match these changes. Digestive protease and lipase activities were measured during larval maturation. Whole individuals at different larval and postlarval stages were homogenized and assayed to quantify enzyme activities for specific substrates. Total proteinase activity was measured by the rate of hydrolysis of 0.5% azocasein in 50 mM Tris·HCl buffer at pH 7.5. Trypsin activity was measured with (BAPNA) and chymotrypsin activity with (SAPNA) as substrates. Lipase activity was measured with β-naphthyl caprylate as the substrate. In all developmental stages, trypsin and chymotrypsin activity was present, lipase was detected in the nauplii and postlarval stages. Maximum activities for all enzymes occurred between the third protozoea and mysis. In the three earliest stages (nauplii, zoea and mysis), lipase activity was relatively low. During postlarval development, lipase activity increased, whereas other enzyme activity was relatively constant. Ontogenetic changes in digestive enzyme activity reflects changes in feeding habits.

Molecular and virulence characteristics of pathogenic *Vibrio parahaemolyticus* isolated from Oregon and Washington coastal environments.

JINGYUN DUAN, Tsai-Hsin Chiu*, and Yi-Cheng Su. OSU Seafood Laboratory, Oregon State University, 2001 Marine Drive, Room 253, Astoria, OR 97103.

Molecular and virulence characteristics of 34 pathogenic *V. parahaemolyticus* strains isolated from Oregon and Washington coastal environments were analyzed for *tdh* and *trh* genes, urease production, O-antigen, and by pulsed field gel electrolysis (PFGE). The *tdh* gene was detected in 85% of the 34 isolates, while 88% of the isolates were *trh* positive. Almost (97%) all the isolates were capable of producing urease. Serological analysis yielded six O serogroup (O1, O3, O4, O5, O10, and O11) among the isolates with O5 (19 isolates) and O1 (9 isolates) groups being the most prevalent. PFGE analysis with *Not*I and *Sfi*I restriction patterns revealed 23 patterns with N1S1 being the most frequently (25.6%) followed by N2S2 (10.3%). Results of molecular, serological, and virulence analyses found that 9 isolates were identical to a strain (027-1C1) involved in a 1997 outbreak occurred in Oregon and 3 isolated were identical to another strain involved in Washington outbreak. The isolation of *V. parahaemolyticus* strains involved in 1997 Pacific Northwest outbreaks indicates the potential contamination of these strains in Oregon and Washington oysters remains a safety concern. Raw oysters should be kept at refrigeration temperature upon harvest till consumption to minimize risk of *V. parahaemolyticus* infections.

Antimicrobial activity of wine against *Vibrio parahaemolyticus*.

JINGYUN DUAN*, Ruiying Chen and Yi-Cheng Su. OSU Seafood Laboratory, Oregon State University, 2001 Marine Drive, Room 253, Astoria, OR 97103.

Wine is commonly drunk at mealtime and has been reported to exhibit antibacterial activity against many foodborne pathogens including *Salmonella*, *Shigella*, *Escherichia coli*, *Staphylococcus aureus*, and *Listeria monocytogenes*. This study investigated the antibacterial activity of wine against *Vibrio parahaemolyticus* and potential inactivation of *V. parahaemolyticus* in contaminated oysters by wine consumption. Raw whole oyster and oyster meat homogenate were inoculated with *V. parahaemolyticus* and mixed with red or white wine and held at 7 and 25°. Populations of *V. parahaemolyticus* in inoculated whole oysters decreased slightly by 0.6 log MPN/g after 24 h at 7°C, but increased by 1.8 log MPN/g over the same period at 25°C. However, the populations of *V. parahaemolyticus* in wine-treated whole oysters were reduced by >1.7 and >1.9 log MPN/g, respectively, after 24 h at 7 and 25°C. Both red and white wines were more effective in inactivating *V. parahaemolyticus* in oyster meat homogenate than in whole oyster. Populations of *V. parahaemolyticus* in oyster meat homogenate decreased rapidly from 3.8 log MPN/g to non-detectable level (<3 MPN/g) after 30 min of wine treatments at 25°C. These results suggest that chewing oysters before swallowing might result in greater inactivation of *V. parahaemolyticus* if wine is consumed. More studies are needed to determine the bactericidal effects of wine on *V. parahaemolyticus* in the complicate stomach environment.

A complementary centrifugation and pH shift treatment of stickwater as an alternative process to generate better quality effluents and solids recovery.

GARCÍA-SIFUENTES, C*., Pacheco-Aguilar, R., Goycoolea-Valencia, F., Hernández-Martínez, J., Torrescano-Urrutia, G., and Carvallo-Ruiz, M. G. Centro de Investigación en Alimentación y Desarrollo A.C., Tecnología de Alimentos de Origen Animal., Carretera a la Victoria Km 0.6, Col. La Victoria, Apartado Postal 1732, Hermosillo, Sonora, Mexico, Cp 83000, Tel-Fax 662-2800421.

The untreated wastewater from the fish industry is a potential source of environmental contamination of shorelines and bays, reason by which such effluents must be treated before reaching the sea. In addition to reduce pollution, the treatment could be designed to recover suspended or dissolved solids with both economic and nutritional value. In this study an alternative process for treatment of stickwater (SW) from a sardine fishmeal operation, based on a complementary centrifugation and pH shift for solids recovery was evaluated. The main goal was to generate effluents that comply with the Official Mexican Norm for industrial wastewater.

Stickwater was centrifuged (CSW) and the effluent recovered was treated for pH adjustment at acidic and alkaline values. The alkaline treatment alone was not satisfactory in the reduction of neither the biochemical oxygen demand (BOD_5) nor in the chemical oxygen demand (COD). However, a combination of alkaline and acid treatment followed by centrifugation results in a recovery from 50 to 60% of the total nitrogen compounds present (proteins, peptides, amino acids) and more than the 30% of the ash content in the CSW. The final effluent showed a 70% transmittance and a reduction above the 70% for the BOD_5 and COD levels (from 17,066 mg/L to 4,900 mg/L for BOD5 and from 64,646 mg/L to 23,000 mg/L for COD) as compared with the untreated SW.

Even tough more work needs to be done, preliminary results suggested that the proposed process could indeed be an alternative for the actual industrial SW treatment based on vacuum evaporation.

Physico-chemical study of fish meal produced in the state of Sonora, Mexico.

L. BRINGAS-ALVARADO*, J.O. Córdova-Castillo, G. Navarro-García, J. Ortega-García, and M.L. González-Félix. Departamento de Investigaciones Científicas Tecnológicas de la Universidad de Sonora. Hermosillo, Sonora, México.

Fish meal production represents the main method of utilization of pelagics and minor finfish. Approximately 30% and 59% of the pelagic's fisheries production in Mexico and in Sonora, respectively, is destined to the rendering industry. Fish meal is the main ingredient of balanced feeds. In aquaculture, those feeds represent up to 40-50% of the production costs. Thus, it is important to make sure its physico-chemical quality is adequate.

In this study, the physico-chemical quality of fish meal produced from December 2004 to July 2005 in three different plants (I, II y III) of Guaymas, Sonora, was evaluated. Raw material freshness was analyzed: trimethylamine (TMA) and total volatile bases (TVB); physical analysis of fish meal: color and particle size; chemical analysis of fish meal: chemical composition through proximal analysis (humidity, ash, crude fat, crude protein), and fatty acid and amino acid analyses.

The results show that the raw material's average TVB value of the three plants, 20.9±1.8 mgBVT-N_2/100gr, is very similar to values usually reported for this ingredient (30 mgBVT-N_2/100gr). TMA values ranged from 2.5 to 2.7 mg, which are under the permissible range (5-10mg TMA/100g). Fish meal protein (68.6±0.5%), fat (9.8± 0.5%), and ash (16.7±1.1%) values were very similar to average values generally reported for this product. For particle size, the largest percentage of the weight retained took place in the 40µ and 60µ mesh. Color values were L=28 for I, and 34 and 37 for II and III, respectively, which represent a higher heat exposure for the first one, and smaller for the second and third products. Both fatty acid and amino acid values were adequate to satisfy the requirements of typically cultured animals.

The processing plants in this study have recently adopted improved protocols; therefore, their products are considered to have good quality, making them suitable as ingredients for aquaculture feeds.

Composition of vacuum packaged wild pink salmon (*Oncorhynchus gorbuscha*) jerkies stored at 20°C and 40°C. A. MOREY*, A. Ambardekar, C. A. Crapo, A. C. M. Oliveira and B. H. Himelbloom. Fishery Industrial Technology Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 118 Trident Way, Kodiak, AK 99615-7401

In 2005 pinks accounted for 71% of all salmon caught in Alaska with an ex-vessel price of $0.10/lb, which makes this fish ideal for the manufacturing of value-added products such as jerky. Jerky quality can be increased by adding flavoring agents and preservatives through marinades.

We investigated variations to a marinade, on the composition, fatty acids (FA), lipid classes, thiobarbituric acid (TBA) values and water activity (a_w) of salmon jerky.

Pinks obtained from a processor (Kodiak) summer 2005 were hand-filleted and frozen into blocks. Blocks were cut into strips using a meat slicer and dipped, while frozen, in one of the three alternative marinades: **(S)** 5 % salt; **(SS)** 5 % salt + 15 % brown sugar; **(SSAO)** 5 % salt + 15 % brown sugar + 2 % mixture of tocopherols, polysorbates, ascorbic and citric acid. The strips were dried in a commercial smoker, vacuum-packed, stored at 20°C or 40°C, and analyzed for 60 days at 15-day intervals.

Yields were about 26%, regardless of treatment. Jerky contained initially 72% protein, 18% moisture, 4% ash and 5% lipid with approximately 30% omega-3 FA (mainly EPA and DHA). Moisture loss in 60 days was 22% and 53-58% at 20°C and 40°C, respectively. Addition of sugar maintained, for up to 30 days, a_w values of 0.685 and 0.657 at 20°C and 40°C, respectively. TBA values were low and did not exceed 2.7 µmol malondialdehyde/kg for all samples. Increase in FFA was lower (38% and 59% respectively) in SSAO samples stored at 20°C and 40°C when compared to other samples stored at identical temperatures. The maximum aerobic plate count at 60 days was less than 8.0×10^3 cfu/gm.

Storage at 40°C negatively affected jerky quality, while sugar combined with storage at 20°C were effective in maintaining the jerky quality for 60 days.

Structural comparison for differences in monterey sardine (*Sardinops sagax caeruleus*) trypsin and bovine trypsin by circular dichroism spectroscopy. Martha Félix-López[1], FRANCISCO JAVIER CASTILLO-YÁÑEZ*[2], Karina D. García-Orozco[2], Enrique F. Velázquez-Contreras[2], Ramón Pacheco-Aguilar[1] and Rogelio R. Sotelo-Mundo[1]. [1]Centro de Investigación en Alimentación y Desarrollo. Hermosillo. México and [2]Universidad de Sonora. Hermosillo, México.

Monterey sardine trypsin show similar biochemical characteristics to trypsins from cold water fish species and different to bovine trypsin, specially in its catalytic efficiency at cold temperatures. The structural basis for this behavior is not clear yet. The objective of this study is to analyze and to compare secondary structure of trypsin from Monterey sardine and bovine trypsins by circular dichroism spectroscopy. Results showed slight differences in secondary structure with 6.6% α-helix and 35.2% β-sheets for bovine trypsin and 5.4% α-helix and 35.8% β-sheets for Monterey sardine trypsin. Circular dichroism results show not significant differences between secondary structure in both trypsins. This data suggest that the differences in some biochemical characteristics in these trypsins may be due to conformational changes in their tertiary structure. Further research to determine the aminoacid sequence and tertiary structure by molecular biology are under way to obtain the evidence for the differences in catalytic efficiency in these homologues enzymes.

Freezing and cooking studies of three species of wild shrimp from the Gulf of California.

GUERRERO-MANJARREZ GRISEL*, Cardenas-Lopez Jose Luis and Ezquerra- Brauer Josafat Marina. Departamento de Investigación y Posgrado en Alimentos, Universidad de Sonora. Hermosillo, Son.

Freezing and cooking time were studied in three species of wild shrimp, Litopenaeus vannamei (CB), Litopenaeus stylirostris (CA) and Farfapenaeus californicus (CC). The specimens were subjected to a cooking-freezing process, the samples were kept intact, due to interest in this type of products in the European and local market. The cooking was done at 100°C, temperature was monitored at the center of the shrimp muscle. Raw and cooked shrimp were frozen by immersion in a mixture of acetone and CO_2 kept at –40°C until the center of the muscle reached -20°C. Results suggest that there is a species effect on cooking and freezing time. CB and CC showed similar cooking time, while CA was lower. For freezing of raw and cooked samples the order was CB, CC and CA from higher time to lower. This could be due to their differences in chemical composition. The study of the processing characteristics is important in the development of ready to eat frozen-cooked shrimp products.

Effect of the cooking process on a connective tissue extract from jumbo squid (*Dosidicus gigas*).

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The influence of cooking on a connective tissue extract (CTE) from jumbo squid (*Dosidicus gigas*) mantle was studied. The CTE was subjected to cooking at 100 °C over 5 min, and samples were taken at 0, 1, 2.5 and 5 min. The solubility, thermal behavior, electrophoretic mobility and Z potential were studied in the samples to detect modifications due to cooking process. Structural changes were also studied through histological studies. Modifications on solubility was observed in CTE with time (insoluble fraction was increased), and also modifications on Z potential. We detected a maximum value at pH 5.5 and two maximum values at pH 5.5 and 9.0 for CTE without cooking and cooked respectively. The cooked CTE fibers showed agglutination at 5 min of cooking and modification in their thermal behavior. An endothermic peak was found at 110 °C in the CTE without the treatment, while in the cooked CTE three endothermic peaks were found at lower temperatures and enthalpies. The electrophoregram showed modifications, a 45 kDa fraction disappeared and two fractions appeared above of the 200 kDa fraction while the time of cooking advanced. These results suggest that during the cooking process there were modifications to molecular bonds that hold the structure of the connective tissue of the mantle. These findings could lead to a better understanding of the textural changes that occur during the cooking process of squid mantle.

Production of omega-3 polyunsaturated fatty acid concentrate from sardine oil by immobilized Candida rugosa lipase in alginate-chitosan-$CaCl_2$ hydrogel.

TOMOKO OKADA* and Michael T. Morrissey. Oregon State University Seafood Laboratory, 2001 Marine Drive, Rm 253, Astoria, OR, 97103.

A study was conducted to develop an immobilized-enzyme system to entrap lipase in a chitosan-alginate-$CaCl_2$ hydrogel for the purpose of concentrating omega-3 PUFAs from sardine oil. The objectives were to determine the characteristics of the system, hydrolytic activity and efficiency for omega-3 PUFAs concentration compared with a free lipase system. Sardine oil was extracted by a direct acidification at pH 5.5. Lipase was immobilized by an ionotropic gelatin method achieved by adding anionic polyelectrolyte solution (sodium-alginate) drop-wise into an acidic chitosan solution. The mechanical strength of hydrogels made with alginate-chitosan, alginate-$CaCl_2$, and alginate-chitosan-$CaCl_2$ were determined by texture analyzer. The percent lipase loading in immobilized hydrogels at different alginate concentrations (0.5, 1.0, 1.5, and 2.0%) were determined by the Lowry method. Optimum pH and temperature of immobilized and free lipase were determined by measuring hydrolytic activities by the Japanese industrial standard method. Hydrolysis was run for various time periods (0.5, 1.0, 1.5, 3.0 h). The effect of a second hydrolysis was also examined after removing released free fatty acids. The fatty acid profiles were determined by gas chromatography and mono-, di-, triglyceride fraction were separated by thin layer chromatography. Lipase immobilized hydrogels prepared with alginate-chitosan-$CaCl_2$ showed the highest breaking force (3.35g). The highest lipase loading (87.41%) was shown in hydrogels with 2.0% sodium-alginate. Optimum pH of immobilized lipase shifted to pH 6 from that of free lipase (pH 7.0), and immobilized lipase showed higher stability against pH changes. Original sardine oil contained 45.26% PUFA fraction (27.94% EPA and 8.6% DHA), and omega-3 PUFAs were significantly increased from 43.11 to 53.66% (33.36% EPA and 11.81% DHA) after first hydrolysis for 1.5 hr with the lipase immobilized hydrogel. Second hydrolysis resulted in significantly higher levels of omega-3PUFAs, increasing omega-3

PUFA levels to 70.00% (43.04% EPA and 16.01% DHA). Among different lipid fractions, the monoglyceride fraction was found to contain the highest omega-3 PUFAs.

Effect of freezing process on collagen extracted from jumbo squid (*Dosidicus gigas*) Mantle.

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The effect of freezing processing (-40ºC) on collagen extract (CE) from jumbo squid (Dosidicus gigas) was investigated. Collagen frozen sample were taken at 0, 3, 5 and 12 min of the freezing process. Structural modifications were investigated by light microscopy observations, protein solubility, "Z" potential (isoelectric point), thermal properties, and SDS-polyacrylamide gel electrophoresis. Light microscopic observations showed modification in the connective tissue cells. Salt-and-acid-soluble collagen fractions as well as insoluble collagen indicated changes in solubility during the freezing process. Changes in thermodynamic properties of CE were observed during the process because of changes in structure. CE obtained after each freezing time showed three fractions with molecular weight about 200, 97 and 45 kDa. SDS-PAGE analysis showed an increase in the number of bands corresponding to high molecular weight protein fractions. The result suggests that collagen might affect the texture properties of squid muscle during freezing process and during frozen storage. The changes might be caused by insolubility, modification in structure, and formation of intramolecular cross-linkage.

Cloning and expression of the genes encoding an antibacterial peptide salmine in *Escherichia coli* BL21.

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Salmine is a unique peptide found in the spermatic cells of salmon and composed of 32 amino acid residues (PRRRRSSSRPVRRRRRPRVSRRRRRRGGRRRR). Salmine sulfate has been used as a drug for years to retard release of insulin or as an antidote to anticoagulant heparin in certain surgical procedures. Salmine has been reported to possess unique antimicrobial properties against a variety of bacteria, yeasts and molds and shows a great potential as a natural and safe food preservative. This study reported the possibility of producing salmine with genetic engineering methods instead of extraction from salmon sperm. Three primers were designed and synthesized for cloning the gene encoding salmine using the preferred codons of *E. coli*. The gene fragments obtained were cloned into the pED plasmid which was reconstructed by inserting a modified gene fragment encoding the C-terminal peptide

fragment of L-asparaginase (L-ansB-C) into the BamHI and HindIII sites of pET28a. The recombinant expression vector was expressed in *E. coli* BL21. The sequence of recombinant DNA was determined and verified to be identical to the originally designed for encoding salmine. SDS-PAGE analysis showed that expression of the cloned gene resulted in an expected fusion protein of 20 KD. These results indicate that cloning of genes encoding salmine and construction of its expression vector and fusion expression system were successful. Further studies are needed to investigate the methods and conditions for isolating and purifying the target peptide from the fusion protein and evaluating its antimicrobial spectrum.

Properties of pollock skin hydrolysates and their effects as glazing ingredients on the quality of pink salmon (*Oncorhynchus gorbuscha*) fillets during frozen storage.
JIAQI HUANG*, Subramaniam Sathivel, and P. J. Bechtel.

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It is a common practice to glaze the frozen fish products with water or water plus an agent to reduce yield loss and oxidation during frozen storage. The fish processing industry is very interested in finding new glazing materials that can be used to reduce moisture loss and lipid oxidation of fish products during frozen storage. Glazing pink salmon fillets with a solution containing hydrolysates made from pollock skin may suppress lipid oxidation during storage.

The objectives of this study were to determine the properties of pollock skin protein hydrolysates (PPH) and to evaluate the effects of glazing ingredients made from PPH on the quality of pink salmon fillets during frozen storage.

Fresh pollock skin was hydrolyzed at 10 (SK10), 30 (SK30), and 45 min (SK45) using a commercial proteolytic enzyme. The freeze-dried pollock skin protein hydrolysates were analyzed for physical and nutritional properties. Glazing solutions were prepared from SK10, SK30, and SK45 by dissolving 4.7% PPH in 93.5% distilled water (DW), and 1.8% glycerin (G). Fresh skinless pink salmon fillets were frozen at -35C for 1hr using a plate freezer. The frozen-fillets were then dipped in glazing solutions at 4C for 30 sec, drained for 30 sec, again frozen at -35C for 1 hr, individually packed in freezer bags, and stored at –35C for 4 months. Nonglazed-fillets (NC), fillets glazed with DW and/or G were used as controls. After the storage period the fillets were analyzed for yield, percent drip loss, color, and lipid oxidation (TBA). Triplicate experiments were conducted and results statistically analyzed.

All PPH samples had desirable essential amino acid profile. PPH samples had similar emulsification stability, fat adsorption capacity, bulk density and water activity values. All the glazing treatment had increased fillet yields when compared to NC. The thaw yield of glazed fillets was higher ($p<0.05$) than that of NC. Fillets glazed with all PPH treatments had higher ($P<0.05$) drip loss than NC. The TBA values of fillets glazed with SK45, SK30, and SK10, DW,

and G were significantly lower than NC. Small differences in color between glazed and NC treatments were observed after storage in the freezer.

This study demonstrated the potential for using fish skin protein hydrolysates as functional food and glazing ingredients for salmon fillets during frozen storage.

Changes in quality parameters of monterey sardine (Sardinops sagax caerulea) during the canning process. Uriarte-Montoya, Mario Hiram; Pacheco-Aguilar, Ramon; Villalba-Villalba, Ana Gloria; Garcia-Sanchez, Guillermina; Lugo-Sanchez, Maria Elena Carvallo-Ruiz, Maria_Gisela, and CELIA OLIVIA GARCIA SIFUENTES*. Centro de Investigación en Alimentación Desarrollo, A.C. Carretera a la Victoria Km. 0.6, Hermosillo, Sonora, Mexico. C.P. 83000. Apdo. postal 1735.

In this work the quality of fresh Monterey sardine destined to canning was assessed in a local Mexican plant. Postharvest and processing times were monitored, as well as the sardine temperature in 5 different process' stages. Spoilage indexes were determined to the postmortem sardine (pH, N-TVB, N-TMA, Histamine, Peroxide value and TBARS); K value was also determined as Freshness indicator. Three process samplings were performed and the results were statistically treated using ANOVA.

Inadequate temperature increments were detected during the process, giving final readings of 14 and 18ºC. The sardine's chronological age, when arriving to the exhauster, was between 33 and 59 h. The main tendency of the spoilage indexes was to remain constant throughout the canning, which means that no deterioration was present in the product. Concerning to the freshness indicator, it was found that even though the sardine being canned showed a good quality, a reduction in freshness occurs in the product during the whole process with a rate 3 times faster respect to its handling under optimum conditions (0°C). As a consequence, the product showed a higher K value and biochemical age.

The results indicated that current handling and process' operational conditions to which the sardines are treated can be improved in order to assure a greater uniformity and control of products and processes. As a result, it is expected that these factors can be corrected giving an added value to the product in terms of quality and safety to the consumer.

ABSTRACTS

WEDNESDAY, March 8th

8:00 am – 12:00 pm – Current Regulatory Issues

1. CHARLES BREEN*, FDA District Director Seattle

2. BRIAN VAUBEL*, USDC, Supervisory Consumer Safety Officer

3. WILL SATAK*, Washington Dept. of Agriculture

4. DAWN SMITH*, Oregon Dept. of Agriculture

5. RON KLEIN*, Alaska Dept. of Environmental Conservation

Emerging Issues: The application of risk/benefit evaluation to contaminants in seafood.

PHILIP SPILLER*. Director Division of Programs and Enforcement Policy for Philip Spiller Director Office of Seafood.

The Food and Drug Administration (FDA) is developing a potential risk/benefit model for contaminants in commercial fish products that could affect how the agency thinks about risk management. The first effort is focusing on methymercury by a team of FDA policy analysts and scientists in collaboration with Thomas Billy the former Codex Alimentarius Chairman.

The presentation will address FDA's traditional safety/hazard assessment approach to risk management and compare it to an alternative approach that would more formally consider,risk-to-benefit profiles for the food in question (in this case, fish) and for the consequences of the agency's regulatory actions affecting the availability of that food or the public's understanding of risk. FDA is focusing on methylmercury in fish for its first formal risk/benefit evaluation for several reasons. First, methylmercury is a contaminant that continues to draw considerable attention. Second, there is a relatively large body of human data on methylmercury. Finally, there is also a substantial body of evidence on the nutritional and other health benefits that can be derived from the consumption of fish.

The utility and limitations of safety assessments as they apply to methymercury will be discussed. Safety assessment is quite different from quantitative risk assessment because it is designed to identify only one exposure level that is deemed to be without significant risk rather than calculate how the risk shifts through the range of exposures that a given population is experiencing, Risk/benefit evaluation contemplates being able to compare shifts in risk as exposure increases or decreases against similar shifts in health benefits in order to allow consumers and regulatory officials to understand how those benefits could be maximized while keeping risk low.

Partnership agreements: A new approach to seafood regulation of foreign produced products.

TIMOTHY HANSEN*. Director Division of Programs and Enforcement Policy for Philip Spiller Director Office of Seafood.

Over 70% of seafood consumed in the United States is derived from foreign sources. FDA recognizes that the agency does not have sufficient resources to regulate the processing conditions of foreign producers at the same level as domestic producers. One possible way to address this situation is to engage our major trading partners in partnership agreements that are mutually beneficial, result in safer seafood and promote trade.

Partnership agreements are intended for developing countries that have significant seafood trade to the United States. It would begin with an audit of the foreign competent authority that would be fundamentally different than current systems audit conducted by FDA. Instead of just identifying the deficiencies of a country's food safety system for seafood, FDA would also assess the capabilities of the competent authority and highlight their strengths in regulating food. We prefer to regard this as a benchmarking exercise. Once the strengths of our food safety colleagues is established we could enter into an agreement that is tailor made that considers the safety risks of the food, volume of trade and the capability of the competent authority. This agreement would likely involve recognition, information sharing and technical assistance. It would also have to be actively managed by both parties. FDA would hope to receive stronger HACCP compliance and information and the exporting country could receive recognition by FDA, technical assistance, specific information about seafood policy and a lower "may proceed" rate of shipments upon entry.

FDA is not currently seeking to enter in to equivalence agreements because of conceptual problems of applying it in practice and because legal analysts do not presently understand how this concept would mesh with the Food Drug and Cosmetic Act. Partnership agreements are an attempt to fill a practical need and will hopefully be learning experiences that will help us better implement future partnerships and be more effective regulators. FDA also recognizes that some of our trading partners do not have a developed food safety system or do not want to work cooperatively with the U.S. FDA will continue to conduct seafood HACCP compliance inspections in those countries.

These partnerships should result in safer seafood, smooth the flow of trade and enable both FDA and our foreign colleagues through the sharing of information. These are all worthy goals that are mutually beneficial to the United States and our trading partners.

Common mistakes in HACCP.

LIZ BROWN*. Marine Advisory Program, University of Alaska Fairbanks, PO Box 1549, Dillingham, AK.

The Alaska Department of Environmental Conservation performs HACCP audits of seafood processing plants under contract with the U.S. Food and Drug Association. These audits have resulted in awareness of mistakes repeated among processors. The seven topics in the CMIH

series are intended to help processors avoid common mistakes when complying with the seafood HACCP rule as well as encouraging agreement in regulation interpretation among agencies. The three newest topics, Government Agencies, SSOPs and Hot Smoked Salmon will be discussed.

CODEX and National Collaboration.
DOMINIC CHEUNG*. Senior Policy Analyst, Fish, Seafood and Production Division, Canadian Food Inspection Agency.

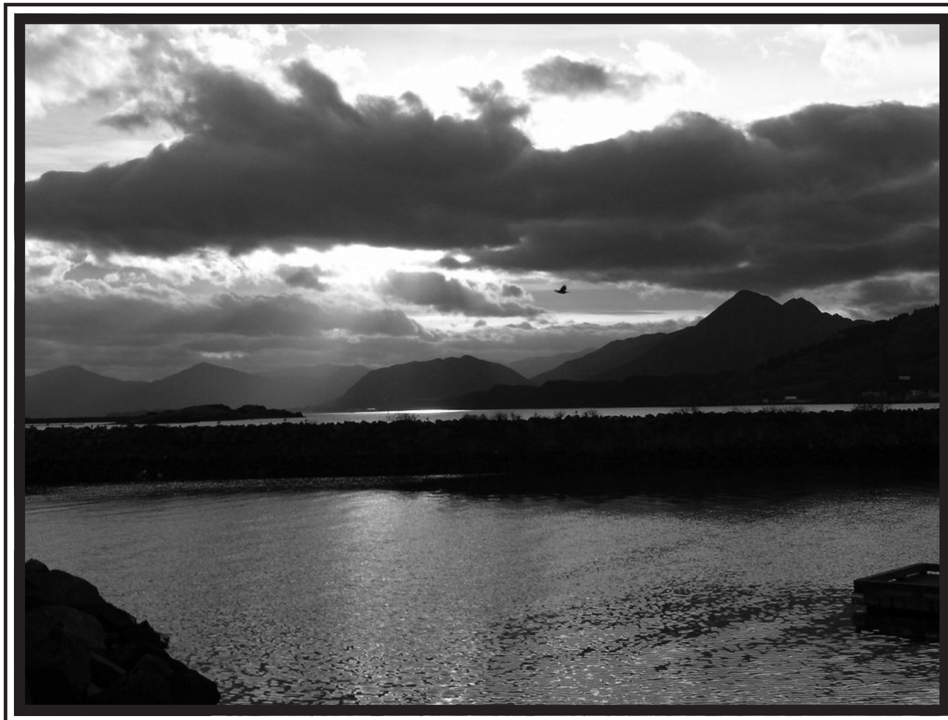
This presentation will provide information on the Codex Alimentarius Commission (CODEX), a joint Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) international Food Standards programme especially related to fish and fishery products. It will cover the following topics: (1) significance of World Trade Organization (WTO) & CODEX; (2) basic overview of CODEX (objectives, mandate, organization/structure, consultation process); (3) Codex Committee on Fish and Fishery Products and highlight of standards and codes of practice that are considering emerging post harvest technologies; (4) scientific basis for CODEX work and (5) Canadian Food Inspection Agency - Fish Inspection Program's perspective.

FDA Perspective on import products. JIM BARNETT*.

KODIAK TRIP
PLANT TOUR

Fishery Industrial Technology Center (FITC)
Bi-Products Reduction Facility
A Local Seafood Processing Facility

March 9th 9:00am



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ANCHORAGE WALKING MAP

Courtesy of the Anchorage Visitor's Bureau

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