Factor 1 - **Research Assignment**

A. Assigned Responsibility

Incumbent is a Research Food Technologist with the USDA-ARS Subarctic Agricultural Research Unit (SARU) and whose program was recently disrupted by permanent relocation to remote Kodiak Island, Alaska. Research is being conducted in Aquaculture (ARS National Program 106) in a project titled Alaska Fish Processing Byproducts. Research in this area is broad and complex, and employs only two ARS scientists, thereby requiring the incumbent to lead two project subobjectives: 1) Develop technologies for utilizing seafood-processing byproducts as human food ingredients; and 2) Develop technologies for stabilizing fish-processing wastes for intermediate-term storage. Because of the incumbent's focus on rarely studied cold-weather stabilization techniques, this research is expected to have regional, national, and international impact.

B. Research Objectives and Methodology

Incumbent has been assigned to develop techniques for stabilizing and storing fish byproducts in subarctic conditions, and to produce high quality value-added products for food and agricultural use. Research objectives and methodology for two CRIS subobjectives were independently conceived and designed by Incumbent. Fish-skin gelatin research involves biochemical manipulation of the gelation process to produce gels and films possessing different functionalities (e.g. enhanced permeability and "barrier" properties, as well as the capacity to serve as carriers of useful compounds). A major challenge is to innovate new food-safe methods to replace common industrial techniques (e.g. chemical crosslinking) so that products can earn GRAS status and retain their relevance to the food industry. Incumbent's research also involves byproduct stabilization, a complex task since individual fish components are differentially perishable and remain poorly characterized. Since products developed during this research may be used for agricultural feeds and human foods, an added research burden exists to ensure that viral, bacterial, fungal, and prion diseases are not passed through the processing system. The incumbent's cold-climate stabilization techniques are considered innovative and have not been investigated by any other researchers nationally or internationally.

C. Expected Results

This research is expected to impact the sustainability and economics of fisheries in Alaska by providing fish processors with a selection of environmentally sound options for adding value to byproducts that are currently discarded as waste. This project also addresses a significant environmental issue, since shore-based processors often grind waste material and pump it into the ocean, disrupting the marine ecology and creating unfavorable conditions that impact tourism in Alaska.

D. Knowledge Required

In-depth knowledge and professional experience across a wide range of disciplines is required for this position. Incumbent must have food science training (to develop food-safe products as part of an association with National Program 306), including a background in food engineering and microbial fermentation technologies. Knowledge of chemistry and biochemical testing methods are also essential, as well as advanced microbiology and the ability to safely handle pathogenic bacteria in a Biological Safety Level 2 laboratory. Additionally, incumbent requires the ability to read and understand U.S. code in order to mitigate the unlawful discrimination by ARS personnel that results in decreased resources for research.

E. Supervisory Responsibilities

On June 5th, 2010, all trained technical support was withdrawn by ARS when incumbent was transferred to Kodiak Island. Prior to that event, Incumbent provided technical and administrative supervision for a GS-5 STEP and a GS-7 Biological Science Technician (although 20% of the technician's time was diverted from incumbent's lab for a non-research collateral duty assignment for the Unit). Incumbent was responsible for making selections for positions, assigning duties, reviewing work, approving/disapproving leave, and evaluating performance. Ensures equal opportunity is extended to all employees supervised and all candidates for employment without regard to race, color, religion, sex, national origin, age, or nondisqualifying handicapping condition, even though unlawful EEO activities were intentionally perpetrated against the incumbent and every other ARS woman research scientist in Alaska from 2004 until present. Ensures affirmative implementation of Equal Employment Opportunity plans of action and applicable Civil Rights provisions, which includes full consideration of eligible minority group members and women in filling vacant positions; providing career counseling and orientation; enhancing career opportunities through training and development, job redesign, and/or similar techniques; and ensuring full consideration of these employees in recommending promotions, awards, and other forms of special recognition.

Factor 2 – **Supervisory Controls**

A. Assigned Authority
Incumbent is responsible for identifying research needs and determining the appropriate research approach. Independently develops hypotheses, plans and conducts experiments, analyzes and interprets data, and reports results to scientific journals, citizens, and management agencies. The incumbent is authorized to act and speak for the ARS in dealing with groups or individuals on technical aspects within the research assignment. The incumbent has freedom to apply for extramural funding in support of research program objectives. Incumbent also exercises a leadership role within the Unit by serving as Acting Research Leader as needed.

B. Technical Guidance Received
Technical supervision for incumbent within ARS has been nonexistent. The Research Leader has never provided technical information to the incumbent nor assisted with interpretation and reporting scientific research results. However, the RL has actively contributed to incumbent's exclusion from project information and associated opportunities, resulting in decreased resources and a position of extreme scientific isolation.

C. Review of Results
Incumbent has freedom to analyze, interpret, and report results. None of incumbent's manuscripts submitted for publication has ever been rejected by a journal. The Research Leader, (an entomologist with no overlapping areas of expertise) has never provided any scientific oversight.

D. General Supervision
Since January 2008, interactions with Incumbent's administrative supervisor have been handled almost entirely through email, except for mid-year performance reviews and annual appraisals. Unit-wide staff meetings are rare. Supervisor does not participate in monthly aquaculture CRIS meetings (attended only by the incumbent, the Lead Scientist, and the Lead Scientist's post-doctoral personnel). CRIS meetings are simply a formality and have never been used to discuss research activities. Supervisor frequently wields administrative power to deny and/or delay Incumbent's research, budget, travel, and information requests, creating situations that often escalate to Area level personnel (and beyond) for resolution.

Factor 3 - **Guidelines and Originality**

A. Available Literature

Information on the functional and nutritional characterization of most cold-water fish tissues is not yet available in the scientific literature, and the studies that have been conducted usually focus on whitefish. Salmon, unlike white fish, are anadromous (living in the ocean, but spawning in fresh water) and present wide ranges of maturity when harvested at sea. The resulting differences in biochemical constituents (proteolytic enzymes, lipids, moisture, etc...) produce wide batch-to-batch variations, which can drastically influence stabilization processes. Additionally, methods of fish byproduct preservation, other than production of fish meal and low-value silage, have not been widely investigated, and these techniques are generally tailored to either whitefish or to fish from tropical locations. The literature does not contain useful information about cold-climate stabilization techniques such as those currently being pioneered in Alaska.

B. Originality Required

A high degree of creativity and originality is required to devise practical methods for stabilizing large quantities of highly perishable fish byproducts in Alaska's cool temperatures. The first complexity is introduced by the diversity of the catch. Whitefish are landed year-round in established locations with existing infrastructure to process the waste stream into fish meal. However, salmon are harvested seasonally, often in geographically-remote locations where lack of refrigeration makes fish byproduct ventures unprofitable. Since value-added commodities cannot always be prepared on-site, effective stabilization methods must be designed for each discarded fish component that is targeted for commercialization. Low-moisture stabilization techniques must be envisioned to reduce transportation costs when shipping across the road-less expanses of Alaska. In addition to extracting and using high-value marine proteins and lipids for foods and feeds, this research must also expand byproduct utilization into industrial fields, including energy production. Ultimately, creativity will be the driving force when diverting fish byproducts from the waste stream into the profit stream.

Factor 3 - Guidelines and Originality

C. Demonstrated Originality
Dr. Bower became a leader in the area of antimicrobial protein adsorption after publishing the first-ever paper on the efficacy of "adsorbed" antimicrobial agents for inhibiting the growth of pathogenic *Listeria* on food contact surfaces. Dr. Bower was also first to demonstrate that surface conditions, such as hydrophobicity, could be used to control the lethality of antimicrobial compounds during adsorption. This research was expanded to produce the first-of-its-kind *in vivo* study of surface-adsorbed antimicrobial agents to increase the safety of biomedical devices. Dr. Bower's current research focuses on stabilization of highly perishable fish byproducts, which are considered a waste material by the fish-processing industry. Converting these byproducts into more valuable items, rather than pumping them into the ocean would benefit Alaska both economically and environmentally. In approaching this low-visibility, but still important research topic, Dr. Bower applied her high level of creativity and devised a number of innovative strategies including stabilizing the byproducts through acidification, bacterial fermentation, and smoke-processing. Additionally, new methods of composting the processing wastes were evaluated, and byproducts were even gasified to produce energy. Generating practical ideas and independently investigating the merits of each research direction has always been a hallmark of Dr. Bower's career. For example, after stabilizing fish byproducts during the warmest of Alaska's coastal days (20 °C), she expanded her studies to more relevant temperatures (10 °C) by successfully employing a cold-tolerant food-safe bacterium not yet utilized anywhere else in the world. Despite the hardship of being isolated in Alaska, Dr. Bower's unique insights have resulted in a variety of official ARS Collaborative Agreements, many of which possess CRADA-potential.

Factor 4 – **Contributions, Impact, and Stature**

A. **Demonstrated Accomplishments**
Dr. Bower has been teaching and conducting research in science, agriculture, and bioengineering for over 20 years and has moved from an internationally recognized expert in protein adsorption phenomena to an authority in the field of cold-climate fish byproduct stabilization and utilization. She has published 20 peer-reviewed manuscripts, 15 of which were first-author publications. Her research has been cited in Scopus over 223 times, both nationally and internationally, including 62 citations for her groundbreaking paper on the surface-adsorbed antibiotic nisin. Alaskan fish byproduct research, not surprisingly, is relevant to a much smaller audience. In five years, Dr. Bower's first-author research has only been cited seven times by other authors. However, this number of citations is comparable to those received by her GS-15 co-worker on his first-author fish byproduct publications from the last *ten* years, (i.e. co-worker was cited 13 times by others, not including papers in which he was a co-author and elected to cite himself).

1. **Accomplishment:**
Bacteria that attach to food-contact surfaces demonstrate increased resistance to antimicrobial agents, and can lead to dangerous biofilms. Dr. Bower investigated the efficacy of adsorbing biologically active proteins to surfaces to inhibit the initial attachment of bacterial growth, rather than trying to remove microorganisms after adhesion had occurred. Using real-time image analysis, Dr. Bower was the first to

visually demonstrate that the activity of adsorbed antimicrobial compounds was dependent upon the degree of surface hydrophobicity. She also was the first to discover that structural differences among a set of bacteriophage T-4 lysozyme variants, differing in structure by a single amino acid residue, determined the activity of the adsorbed enzymes. This research contributed to the key engineering concept that proteins unfold within an interface, and it is the degree of unfolding that influences the loss of functionality for each molecule. Applying these antimicrobial adsorption discoveries, *in vivo* research was conducted on actual medical implants (in blood vessels and in the upper airway) through a unique collaboration with Oregon State University's College of Veterinary Medicine. **Role:** The concept of adsorbed antibiotics was initially conceived by two professors during Dr. Bower's graduate studies. However, Dr. Bower conducted all experiments, independently expanded the research, and prepared all first-author manuscripts for publication. **Impact:** Dr. Bower's successful experiments supported U.S. Patent 5,451,369 and added a new dimension to the field of designer proteins, genetically engineered to have specific adsorptive properties in a defined environment. These cutting-edge studies are still being cited in publications today. (Exhibit 1a, #1; Exhibit 1b, #10; and #2, 3, 4, 5, 6, 7, 8, 9)

***2**. **Accomplishment:** Fish skins are a collagen-rich byproduct of the fishing industry that can be used to produce food-grade gelatin. However, gelatin can also serve as a source of nutrition for bacteria. Dr. Bower's previous research at Oregon State University characterized the antimicrobial properties of lysozyme exposed to different surface conditions. In her Alaska studies, Dr. Bower was first to demonstrate that fish-skin gelatin gels and films could be protected against bacteria by inclusion of the food-safe antimicrobial enzyme, lysozyme. Dr. Bower discovered that the presence of lysozyme did not seriously affect essential gelatin characteristics such as gelation temperature, although gel strength was slightly impacted. **Role:** Dr. Bower independently conceived the idea within a few weeks of her employment with ARS in 2004. She designed the entire study and carried out the microbiology component alone in Fairbanks. To acquire technical expertise in gelatin film production and gel-strength testing, she collaborated with ARS scientists at WRRC in Albany, California. Dr. Bower prepared the first draft of the manuscript, supervised input from her coauthors, and then ushered the paper through the publication process. **Impact:** Fish-skin gelatin gels and films, when formulated with lysozyme, provided a unique, functional barrier with the potential to protect perishable products such as food. This proof of concept study opened the field for functional additives using fish-skin gelatin films as a carrier to directly protect (or modify characteristics of) food products. The merit of this line of research was confirmed in 2009 when it received approval through OSQR as a CRIS research direction. (Exhibit 2a, #6; Exhibit 2b, #12)

3. **Accomplishment:** Wild-caught Alaskan salmon possess high concentrations of long-chain n-3 polyunsaturated fatty acids (PUFA), which are susceptible to oxidative degradation. When incorporating healthy PUFAs into foods and feeds, the oxidative stability of the oils must be ensured to prevent loss of nutritive properties, including fat-soluble vitamins. While working with fish byproducts in Alaska, Dr. Bower discovered salmon heads that were subjected to high temperatures (95 °C) during smoking produced oils with fewer products of oxidation than their unprocessed counterparts. Dr. Bower recognized that the smoking process might serve to reduce oxidation of salmon oils during unrefrigerated storage and transport, so she designed a study and successfully proved her hypothesis. **Role:** Dr. Bower conceived the idea, designed the study, assigned research roles to her collaborators, prepared the first draft of the manuscript, and ushered the paper through the publication process. **Impact:** Dr. Bower devised a "natural" process, which outperformed traditional antioxidants such as ethoxyquin and butylated

hydroxytoluene, for stabilizing PUFA-rich salmon oils. This new low-tech method can be used to transport unrefrigerated oils without the addition of expensive chemical antioxidants. The concept of antioxidant-rich "smoked oils" generated interest in the food industry and a collaborative agreement was initiated to develop a cheese product incorporating the oils (NFCA 58-5341-9-164). (Exhibit 3a, #13; Exhibit 3b, #15)

4. **Accomplishment:** Alaska's fishing industry generates over one million metric tons of processing waste each year, much of which is discarded. Dr. Bower devised a solution for stabilizing perishable fish byproducts in remote Alaskan locations where the infrastructure for drying technologies may not be present. Using acidification strategies that employ lactic acid bacteria for fermentation, Dr. Bower has produced a variety of silages and fermentates from salmon byproducts. Short-term silages retaining high protein quality are suitable for aquaculture and agricultural animal feeds, whereas long-term stabilization can preserve byproducts as a biomass for compost or a feedstock for energy production. **Role:** Dr. Bower conceived the idea of subarctic silage using cold-tolerant bacteria. She designed the experiments, supervised all sampling and data analysis, wrote the manuscripts and ushered them through the publication process. **Impact:** Bacterial acidification may represent the most efficient method for stabilizing the currently discarded fish biomass in Alaska. Collaborations were established with two Alaskan fish processors for on-site stabilization of salmon processing wastes using lactic acid bacterial fermentation techniques (NFCA No. 58-5341-9-370N – Kenai River Seafood, and NFCA No. 58-5341-9-371N – Alaska General Seafoods). Smoked silage (after oil extraction) also gained attention, and an MTA was established to introduce a high-protein smoked salmon "cracker" that is shelf-stable, PUFA-rich, contains vitamin E and has antioxidant activity. This cracker material also showed promise as a growth stimulant in aquaculture feeding trials in collaboration with Oceanic Institute (Hawaii). Additionally, preserved byproducts can be used to produce energy (e.g. Gasification of salmon processing waste to heat remote Alaskan greenhouses - SCA 58-5341-8-411). (Exhibit 4a, #14; Exhibit 4b, #20; and #30)

5. **Accomplishment:** Alaska pollock is the U.S.A.'s largest commercial fishery, with an annual catch of over 1 million tons. During processing, pollock skins are discarded or made into fish meal, despite their high collagen content, which can be converted into food-grade gelatin gels and films. The absence of facilities in Alaska for processing gelatin necessitates drying of the skins before transport to decrease the moisture content, but conventional hot-air drying is expensive. Dr. Bower was the first to conceive of a novel dehydration method that uses a less energy-intensive technology for stabilizing pollock skins. By harnessing the dehydrating power of food-grade desiccants, the water weight in pollock skins could be significantly reduced prior to shipment without damaging the functional properties of the gelatin. **Role:** Dr. Bower independently conceived the idea and designed the entire study. She assigned research to collaborators and supervised their input prior to preparation of the manuscript. Dr. Bower then ushered the paper through the publication process. **Impact:** The paper was presented at a national conference (IFT, 2009) and attracted the attention of several major gelatin company representatives. The ability to stabilize fish skins by using common food industry desiccants provides an environmentally-friendly business opportunity for any entrepreneur who wishes to preserve and ship a valuable fish processing waste to a distant facility that processes gelatin. (Exhibit 5a, #19)

Additional Accomplishment: Each year Alaska's seafood processing industry discards over a million metric tons of fish byproducts, including viscera, heads, fins and frames. Salmon processing waste is high in moisture, protein, lipid, and inorganic compounds, which creates a challenge for producing high-value secondary products. However, fish byproducts constitute an inexpensive source of biomass for use as a feedstock for energy

production through gasification. Phase one of the research demonstrated the viability of generating energy from fish byproducts. Phase two optimized the conditions of pyrolysis for heating greenhouses, towards the goal of allowing remote Alaskan fishing villages access to inexpensively grown foods. **Role and Impact:** Dr. Bower initially conceived the idea of gasifying fish byproducts to produce energy. She assembled a team with appropriate expertise, wrote a Specific Collaborative Agreement (SCA #58-5341-6-139; Gasification of Alaskan Processing Waste in Alaskan Communities) and served as ADODR. A peer-reviewed manuscript was published, which generated interest in conducting a second phase of research. Dr. Bower launched the next Specific Collaborative Agreement (SCA #58-5341-8-411; Gasification of salmon processing waste to power greenhouses in Alaska) to expand the potential of "burning" fish byproducts for energy. Together these gasification projects have laid the groundwork for introducing an energy-generating technology into rural Alaska.

B. Stature and Recognition

1. **Honors and Awards**

1991-1992	American Society for Enology and Viticulture Scholarship (for scholastic excellence)
1991-1992	Clorox Co. Graduate Student Scholarship (for scholastic excellence)
1992	Honor Society of Phi Kappa Phi member
1992	Gamma Sigma Delta Honor Society of Agriculture member
1992-1993	Institute of Food Technologists Certificate of Merit (for scholastic excellence)
1995	Registry of Distinguished Students, College of Agricultural Sciences, Oregon State University

2. **Special Invitations**

a. Bower, C.K. and McGuire, J. 1995, Adsorption of Antimicrobial Agents, American Inst. Chem Engrs Conference on Food Engineering, Chicago, IL. *invited speaker*
b. Bower, C.K. 2002, Microbial Biofilms, Food Microbiology & Food Safety Short Course, Food Innovation Center, Portland, OR. *invited speaker*
c. Bower, C.K. 2005, Cold-water Fish Skin Gelatin, Fishery Industrial Technology Center, University of Alaska, Kodiak, AK *invited speaker*
d. Bower, C.K. 2006, Foodborne Illnesses, Food Safety/Food Preservation course, University of Alaska Fairbanks, AK *invited speaker*
e. Bower, C.K. 2006, Gasification of Food Byproducts, Fishery Industrial Technology Center, University of Alaska, Kodiak, AK *invited speaker*
f. Bower, C.K. 2006, – Post Harvest Handling, Storage, and Treatment for Fresh Market of Berry Fruit. *invited book chapter*
g. Bower, C.K. 2007, Solving the Fish Byproducts Puzzle, the Institute of Marine Science, University of Alaska, Fairbanks *invited speaker*
h. Bower, C.K. 2008, Waste Protein Generated by Seafood Processing, American Oil Chemist's Society annual meeting, Seattle, WA *invited speaker*
i. *Invited speaker* (Declined), Aquaculture America (March 1-5, 2010, San Diego, CA),
j. *Invited session moderator* for Pacific Fisheries Technologist's annual meeting. 2008. Portland, OR (Feb 23-25)
k. *Invited session moderator* for the Sustainable Byproducts symposium in Portland, OR (Feb 25-26)

3. **Offices & Committee Assignments Held in Professional & Honorary Societies**

None

4. **Participation in Professional Meetings, Technical Conferences, Workshops, etc.**

a. American Society for Enology and Viticulture, 1991
   Attended 1 meeting and made 1 presentation
b. Institute of Food Technologists, 1993-2009
   Attended 8 meetings and made 8 presentations
c. American Institute of Chemical Engineers Conference on Food Engineering, 1995
   Attended 1 meeting and made 1 presentation
d. Pacific Food Technologists, 2008-2009
   Attended 2 meetings and made 2 presentations
e. American Aquaculture Society / World Aquaculture Society, 2005-2009
   Attended 3 meetings and made 3 presentations
f. American Association for the Advancement of Science, 2005-2009
   Attended 5 meetings and made 5 presentations
g. Trans-Atlantic Fisheries Technology, 2006-2009
   Attended 2 international meetings and made 2 presentations
h. Second International Congress on Seafood Technology, 2010
   Attended 1 meeting and made 1 presentation

C. Advisory and Consultant Activities

1. Professional Advisory and Consulting Activities

a. Reviewer for 8 journals, 1995-2010, (Journal of Aquatic Food Product Technology, Food Hydrocolloids, Journal of Food Science, Langmuir Journal, Annals of Biomedical Engineering, Journal of Colloid and Interface Science, Journal of Food Biochemistry, Journal of Women and Minorities in Science and Engr)
b. Reviewer for US Small Business Administration (SBIR) grants, and USDA National Research Initiative Competitive Grants Program, and NOAA grant proposal, 1996-2010.
c. Panel member, CSREES NRI Competitive Grants Program, Value-Added Products, Washington D.C., May, 2001, and Food Safety, Washington D.C., March, 2003
d. Paid consultant for Food Science Department, Oregon State University, (provided information concerning safety consequences in the dairy industry associated with queso fresco cheese), 2004
e. Paid consultant for Hayes and Associates, Corvallis, OR, (provided technical information concerning the clinical consequences of ultrahigh molecular weight polyethylene wear debris for total knee and hip replacements), 2000

2. Special Assignments

None

D. Other

1. Educational Background

1974-78 Oregon State University, Zoology B.S. 1979
1982-83 Oregon Health Sciences University, Medical Technology B.S. 1983
1990-94 Oregon State University, Food Science and Technology Ph.D. 1995

2. Research Experience

1990-94 Graduate Research Assistant, Oregon State University, Corvallis, OR
1995-97 Post Doctoral Research Associate, Bioresource Engr. OSU, Corvallis, OR
1999-01 Asst Professor (Senior Research), Bioengineering, OSU, Corvallis, OR
2000-01 Taught a fermentation research lab course [BIOE 459/559], OSU
2002-03 Asst Professor (Senior Research), Food Science, OSU, Corvallis, OR

2003-04 Research Asst, Environ. Molecular Toxicology, OSU, Corvallis, OR
2004-present, GS-12, Research Food Technologist, USDA ARS, Fairbanks, AK

3. Other Significant Information

a. Dr. Bower was ADODR for:
   - Specific Cooperative Agreement (No. 58-5341-6-0139) with Oklahoma State University, exploring gasification as a new technology for utilizing fish byproducts to create energy, 2006-2007.
   - Specific Cooperative Agreement (No. 58-5341-8-411) with University of Alaska Fairbanks, optimizing gasification of salmon processing waste to heat remote Alaskan greenhouses, 2008-2010.
   - Non-Funded Cooperative Agreement (NFCA 58-5341-9-164) with University of Maine, investigating the concept of antioxidant-rich "smoked oils" in cheese, 2008-2010.

   - Non-Funded Cooperative Agreements with Kenai River Seafood (No. 58-5341-9-370N) and with Alaska General Seafoods (No. 58-5341-9-371N) for on-site stabilization of salmon processing wastes using lactic acid bacterial fermentation techniques, 2009-2010.

b. Dr. Bower is an Affiliate Professor with the Fishery Industrial Technology Center (Kodiak AK) in the School of Fisheries and Ocean Sciences at University of Alaska, Fairbanks AK.

c. Dr. Bower received over $500,000 in competitive grants at Oregon State University
   - Protein antimicrobial barriers to bacterial adhesion. McGuire, J., Daeschel, M.A., and Bower, C.K. $13,667, Mallinckrodt Medical, Inc., 1997
   - Efficacy of nisin as a surface-active agent in pharmaceutical applications. Ayres, J.W., Daeschel, M.A., McGuire, J., Ofoli, R.Y., and Bower, C.K. $169,400, USDA, 1998-2001
   - Protein antimicrobial barriers to bacterial adhesion *in vivo*. Bower, C.K., and Parker, J. $8,000, Oregon State University Research Council, 2000-2001
   - Production of Entomopathogenic nematodes using novel *in vitro* methods. Fisher, G., Gothro, P., and Bower, C.K. $30,000, USDA, 2001-2002
   - Improving Microbial Safety of Northwest Fresh and Processed Berries. Yanyun Zhao, M.A. Daeschel, Bower, C.K., and John Henry Wells. $325,000, USDA, 2002-2005

d. Dr. Bower routinely disseminates information about the ARS fish byproducts project by staffing booths at fish processing trade shows and rural small business conferences where potential CRADA partners are likely to be found.
   - 2005- 2010, ComFish annual commercial fisheries trade show, Kodiak, AK
   - 2006, Changing Tides: Wild Alaskan Salmon event, Anchorage, AK
   - 2007, Rural Small Business Conference, Anchorage, AK
   - 2007-2009, Global Food Alaska Conference and Tradeshow, Soldotna, AK
   - 2009, Chena Hot Springs Renewable Energy Fair, Chena, AK

e. Committee Service
   - 1999-2000, Member of the Graduate Admissions Committee, Department of Bioengineering, Oregon State University

- 1999-2001, Member of the Bicycle Advisory Committee, Oregon State University
- 2004-2006, Member of the SARU Safety Committee, Fairbanks, AK. Designed and maintained an informative safety-quiz webpage for the Unit.
- 2005-2009, Member of the Lab Chemical Safety Committee, University of Alaska Fairbanks

f. Dr. Bower seeks out relevant continuing education opportunities.
   - Preparing for Leadership: What It Takes to Take the Lead, American Management Association, Seminar # 2536, May 7-8, 2009. San Francisco, CA
   - Leadership in Science and Technology, Federally Employed Women National Training Program, July 11-15, 2010, New Orleans, LA
   - AgLearn Self-Development. Communication (14 hrs), Leadership (8.5 hrs), Teambuilding (5 hrs), and EEO, Ethics, & Conflict Resolution (7 hrs). 2008.

g. Exceptional and extenuating circumstances have unfavorably affected the quality and quantity of research output for every woman research scientist in ARS Alaska. However, Dr. Bower is forbidden (by ARS Manual 431.3-ARS - RPES Case Writeup Preparation and Guidance for Panelists) from discussing her decreased resources (e.g. technical personnel, laboratory space, collaborative agreements, funding for travel, career advancement opportunities, and absence of mentoring) because ARS deems such matters as "irrelevant to RGEG application".

h. Bower, C.K., Hietala, K.A. and Delaca, T.C. Fermentation of pink salmon (*Oncorhynchus gorbuscha*) using potatoes as a carbohydrate source. J Food Biochem. *In Review*.

i. Conquest, L., Deng, D-F., Dominy, W.G., Smiley, S., Bower, C.K., and Bechtel, P.J. 2011. Utilization of Alaskan fisheries by-products as feeding stimulants in plant protein based diets for Pacific white shrimp (*Litopenaeus vannamei)*. J World Aquaculture Society. *In Review*.

E. **Publications**

Peer-Reviewed Journal Articles and Patents

1. **Bower, C. K.**, McGuire, J., and Daeschel, M. A. Suppression of *Listeria monocytogenes* colonization following adsorption of nisin onto silica surfaces. Appl. Environ. Microbiol. 61:992-997. 1995.

2. **Bower, C. K.**, McGuire, J., and Daeschel, M. A. Influences on the antimicrobial activity of surface-adsorbed nisin. J. Ind. Microbiol. 15:227-233. 1995.

3. **Bower, C.,** McGuire, J., and Daeschel, M. A. The adhesion and detachment of bacteria and spores on food-contact surfaces. Trends Food Sci. Technol. 7:152-157. 1996.

4. **Bower, C. K.**, Daeschel, M. A., and McGuire, J. Protein antimicrobial barriers to microbial adhesion. J. Dairy Sci. 81(10):2771-2778. 1998.

5. **Bower, C. K.**, Xu, Q., and McGuire, J. Activity losses among T4 lysozyme variants after adsorption to silica nanoparticles. Biotechnol. Bioeng. 58:658-662. 1998.

6. **Bower, C. K.**, Sananikone, S., Bothwell, M. K., and McGuire, J. Activity losses among T4 lysozyme charge variants after adsorption to colloidal silica. Biotechnol. Bioeng. 64:373-376. 1999.

7. **Bower, C. K.**, and Daeschel, M. A. Resistance Responses of Microorganisms in Food Environments. Int. J. Food Microbiol. 50:33-44. 1999.

8. McGuire, J., **Bower, C. K.**, and Bothwell, M. K. On the molecular origins of protein structure and function at interfaces. Australian J. Dairy Technol., 55:65-70. 2000.

9. **Bower, C. K.**, Bothwell, M. K, and McGuire, J. Lantibiotics as surface active agents for biomedical applications. Colloids Surf. B: Biointerfaces 22:259-265. 2001.

10. **Bower, C. K.**, Parker, J. E., Higgins, A. Z., Oest, M. E., Wilson, J. T., Valentine, B., Bothwell, M. K, and McGuire, J. Protein antimicrobial barriers to bacterial adhesion: *in vitro* and *in vivo* evaluation of nisin-treated implantable materials. Colloids Surf. B: Biointerfaces 25:81-90. 2002.

11. **Bower, C. K.**, Schilke, K. F. and Daeschel, M. A. Antimicrobial properties of raisins in beef jerky preservation. J. Food Sci. 68(4):1484-1489. 2003.

12. **Bower, C. K.**, Avena-Bustillos, R. J., Olsen, C. W., McHugh, T. H., and Bechtel, P. J. Characterization of Fish-Skin Gelatin Gels and Films Containing the Antimicrobial Enzyme Lysozyme. J. Food Sci. 71(5):M141-145. 2006.

13. **Bower, C. K.**, Malemute, C. L., and Oliveira. A. C. M. Preservation Methods for Retaining n-3 Polyunsaturated fatty acids in Alaska Coho Salmon

(*Oncorhynchus kisutch*) Products. J Aquatic Food Product Technol. 16(4):45-54. 2007.

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14. **Bower, C. K.**, and Hietala, K. A. Acidification Methods for Stabilization and Storage of Salmon By-Products. J Aquatic Food Product Technol. 17(4):459-478. 2008.

15. **Bower, C. K.**, Hietala, K. A., Oliveira, A. C. M., and Wu, T. H. Stabilizing oils from smoked pink salmon (Oncorhynchus gorbuscha). J Food Sci. 74 (3):C248-C257. 2009.

16. Wu, T. H., Bechtel, P. .J., and **Bower, C. K**. Effects of delayed processing of pink salmon (*Oncorhynchus gorbuscha*) by-products on fishmeal quality. J Aquatic Food Product Technol 18 (4):345-359. 2009.

17. Rowland, S., **Bower, C. K.**, Patil, K. N., and DeWitt, C. A. M. Updraft gasification of salmon processing waste. J Food Sci. 74 (8):E426-E431. 2009.

18. Bechtel, P. J., Morey, A., Oliveira, A. C. M., Wu, T. H., Plante, S., and **Bower, C. K.** Chemical and nutritional properties of pacific ocean perch (*sebastes alutus*) whole fish and by-products. J Food Process and Preserv. 34 (SUPPL. 1):55-72. 2010.

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