

SFOS

University of Alaska Fairbanks
Annual Progress Report for 2002 and Funding Proposal for 2003

TO: Pollock Conservation Cooperative Research Center
School of Fisheries and Ocean Sciences
245 O'Neill Building
University of Alaska Fairbanks
Fairbanks, AK 99775-7290

FROM: Juneau Center
Fisheries Division
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Fairbanks, AK 99775-7220

TITLE: An examination of the maturation of walleye pollock in the eastern Bering Sea
in relation to temporal and spatial factors.

PRINCIPAL INVESTIGATOR: Dr. Gordon H. Kruse
Professor


NEW/CONTINUATION: Continuation

DURATION: Second year

PROPOSED START DATE: 1 February 2003

AMOUNT REQUESTED: \$???

Foreword

In fall 2001, we submitted a proposal to the Pollock Conservation Cooperative (PCC) for a multi-year study titled, *An Examination of the Maturation of Walleye Pollock in the Eastern Bering Sea in Relation to Temporal and Spatial Factors* (Appendix 1). The proposal was approved, and the first year of this project was funded with a budget of \$48,190. The purpose of this document is to present an annual progress report and to request a second year of funding.

Annual Progress Report

Project Overview

The overall goal of this study is to estimate accurate maturity schedules for walleye pollock (*Theragra chalcogramma*) in the eastern Bering Sea for use in annual stock assessments. Maturation rate is the proportion of fish that are mature at a specific age or length. Estimates of maturity are an integral part of yield determination process, because they are used to estimate spawning stock biomass from which total allowable catches are derived. For example, in November 2001, NMFS projected the biomass of age 3+ (mature and immature) pollock to be 9.8 million metric tons in 2002, but the female spawning biomass was estimated to be just 3.0 million metric tons. The difference between the two estimates is attributed to immature fish, and small errors in maturity rate can result in large errors in spawning biomass estimates. Smith (1981) conducted the original study of pollock maturity nearly 25 years ago, and those results still form the basis for determining pollock spawning stock biomass. This project collects pollock maturity data from PCC-member vessels in the eastern Bering Sea in the winter (January-April) fishery in 2002 and 2003. Data will be analyzed for spatial and temporal patterns. Results will be compared with recent, unpublished data on pollock maturity collected by the National Marine Fisheries Service (NMFS) during winter hydroacoustic surveys. This project represents a unique collaborative effort between the University of Alaska Fairbanks (UAF), PCC-member vessels, NMFS, and Resource Analysts International (Dr. Vidar Wespestad). The project directly relates to two PCC research priorities – *fishery stock assessment and stock assessment models* and correct estimation of maturity and spawning biomass are necessary to understand *pollock stock dynamics*. The original proposal, submitted to PCC in fall 2001, appears in Appendix 1.

Project Progress

The first year of this project was funded during February 1, 2002 to January 31, 2003. The project remains on schedule as excellent progress has been made so far in the first year. In particular, the following milestones were accomplished to date:

Late winter 2002. Drs. Wespestad and Kruse developed a sampling manual and forms on which date, haul number, and fish length, weight, and maturity data are recorded. Sampling packages were prepared consisting of instructions, forms, a measuring strip, and a photographic guide to pollock maturity stages.

Early spring 2002. Dr. Wespestad oversaw the implementation of the sampling protocol on PCC catcher-processor vessels. This entailed liaison with PCC-member companies and training of

company quality control personnel in data collection methodology. Copies of manuals and forms were provided to all participating PCC vessels.

Late spring – early summer 2002. Cooperation by PCC-member company vessels was outstanding during the pollock “A” season in 2002. A total of 14 vessels participated in data collection, which includes all member vessels except one. Dr. Kruse recruited a master’s graduate student for this project, and Ms. Jennifer Stahl was selected (curriculum vitae attached).

Mid-summer 2002. Dr. Kruse traveled to Seattle and visited with Dr. Vidar Wespestad and NMFS scientists, Drs. Jim Ianelli, Taina Honkalehto, and Neal Williamson, who are collaborators on this project. Project objectives were discussed, and cooperation was agreed. Nineteen NMFS research surveys since 1989 were identified in which at least some pollock gonad data were collected in the Bering Sea. Of these, 7 years were identified in which gonad data were collected on the eastern Bering Sea shelf in winter; this subset appears compatible with observations collected in our study and will be included in the data analysis. Drs. Kruse, Wespestad and Ianelli conducted a preliminary review of the data collected in 2002.

Late summer – fall 2002. Copies of data forms were made. A cost estimate for data entry was secured from a vendor, and a purchase requisition is being prepared. Ms. Stahl began her graduate studies at UAF in September 2002, and she is currently focusing on classes directly applicable to this project, including courses in statistics and marine ecosystems.

Plans for the Remainder of the 1st Year

The following work is planned during the remainder of the first year, which ends on January 31, 2003.

Early winter 2002. Ms. Stahl will form her graduate committee. Data will be entered and validated. Drs. Kruse and Wespestad and Ms. Stahl will carefully review sampling procedures and first-year data to investigate whether sampling protocol revisions are needed for collections in the upcoming season. For instance, in 2002 one vessel had a scale that was only accurate to ± 50 grams. We hope to secure arrangements for a more precise scale for the upcoming season.

Funding Proposal for 2003

Proposal Overview

In summary, in the next 12 months (February 1, 2003 – January 31, 2004), we will collect a second year of pollock maturity data and we will initiate preliminary data analyses. A proposal was submitted for a 2.5-year study in response to last year’s Request for Proposals (see Appendix 1), and to avoid repetition, we attached our original proposal as Appendix 1. Here, we focus on the *Timeline Including Work Schedule and Reporting Deadlines* and *Budget Justification/Summary* for year 2.

Timeline Including Work Schedule and Reporting Deadlines

The second year of this project will be conducted during February 1, 2003 through January 31, 2004. The following schedule outlines the timeline for major activities in the coming year.

Winter – early spring 2003. Dr. Wespestad will provide industry liaison and coordination with Dr. Kruse and Ms. Stahl on sampling protocols and data preparation. Consistency of reporting among vessels will be verified. The second year of data will be collected during the pollock “A” season. All three scientists (Drs. Kruse and Wespestad and Ms. Stahl) intend to take part in the at-sea sampling. The plan is to visit vessels this spawning season and verify collection procedures. Samples of female gonads (ovaries) will be collected for each maturity stage, as determined by quality control officers. These samples will be preserved and returned to the laboratory for subsequent analysis. Ms. Stahl will take her second semester of graduate courses, including an advanced statistics class and a course on geographic information systems (GIS). Ms. Stahl will prepare an outline of her thesis research proposal for approval by her graduate student committee.

Late spring – early summer 2003. Data forms will be collected from participating vessels, and data will be entered and verified. In early summer, Ms. Stahl will visit the NMFS-Kodiak Laboratory to access histological equipment needed for making slides of pollock ovaries: tissue processor, embedder, microtome, and staining station. Sampled ovaries will be examined to ascertain the egg development stages corresponding to each maturity stage as determined by quality control officers aboard PCC vessels.

Mid- to late summer 2003. Summary statistics of data will be prepared for the two years of data. Summary data will be plotted spatially using GIS.

Fall-early winter 2003. Ms. Stahl will take additional courses, including fish population dynamics. Preliminary data analyses will continue. Dr. Kruse will oversee the preparation of the annual progress report on the second year of data. Preliminary results will be presented at the annual meeting of the Alaska Chapter, American Fisheries Society meeting and the North Pacific Marine Science Organization (PICES). In addition to reporting and presentations at scientific meetings, we wish to share our results with the public using appropriate media. We seek advice from PCC about the preferred means of public communication. One option is Alaska Sea Grant, who can compose radio segments to be aired on Alaska Public Radio with web links. There is no charge for this Sea Grant service.

Budget Justification/Summary

A detailed budget is attached for February 1, 2003 through January 31, 2004. In overview, the budget provides the following:

Budget

Salaries and Benefits	\$ 33,918
Travel	\$ 13,900
Services	\$ 13,000

Supplies	\$ 3,500
<u>Tuition</u>	<u>\$ 6,444</u>
Total Requested	\$ 72,262

The primary expense of this project includes salaries for the principal investigator (1 month) and the MS student stipend and tuition. The second major expense includes travel by Drs. Kruse and Weststad and Ms. Stahl to Dutch Harbor to participate in data collection. Also, Ms. Stahl will travel to Kodiak to use equipment at the NMFS-Kodiak laboratory for histological analysis of pollock ovaries. Also, travel funds are requested for attendance at the PCC program review in January 2004 and for presentation of results at two fishery science conferences

Service costs include a one-month salary for Dr. Vidar Weststad and roundtrip travel to Dutch Harbor to facilitate liaison and to participate in sampling. Also, contractual funds are allocated for data processing of data collected in 2003. The remaining budget item is supplies, which include purchase of statistical software and annual GIS software license.

Anticipated Future Funding Request

At a minimum, Ms. Stahl will require two full years of graduate work to complete her MS thesis. Note that she began her program in fall 2002, whereas this project started in February 2002. Therefore, we anticipate the need to request an additional 0.5 years of funding in 2004 to allow Ms. Stahl to complete courses and thesis research in spring semester of 2004. This represents an ambitious schedule (many graduate students take more than 2 years to complete a MS degree), but we remain optimistic that the project can be completed by June 2004. Given this, we anticipate the following milestones for 2004.

Late winter – spring 2004. Ms. Stahl will complete coursework in spring 2004, including a course in management of marine biological resources. Comprehensive analysis of all data will be completed, include data from this study collected in 2002/2003, recent NMFS data collected during hydroacoustic surveys (1995-2002) and historical data (late 1970s) that currently form the basis for pollock stock assessments. Spatial and temporal patterns will be identified. Management recommendations will be prepared. Results will constitute a master's student thesis, and Dr. Kruse will oversee the preparation of a final report to the PCC. At least one manuscript will be prepared for submission to a peer-reviewed fisheries journal.

Deliverables. The main deliverables include two annual progress reports, a final report, and a MS student thesis. The student thesis will be prepared in a format suitable for submission to a professional fisheries journal. To aid in dissemination of findings, results will be presented at annual meetings of the Alaska Chapter of the American Fisheries Society, the Western Groundfish Conference, and the North Pacific Marine Science Organization (PICES).

Appendix 1. PCC proposal submitted and funded during February 1, 2002 – January 31, 2003.

Abstract

Maturation rate is an important parameter for determining the optimum exploitation strategy for a fish stock. For eastern Bering Sea walleye pollock (*Theragra chalcogramma*) maturation rates were developed in the late 1970s (Smith 1981). These rates have been used in assessments since the mid 1980s (Wespestad and Traynor 1989, Ianelli et al. 2001). Maturity data, collected during recent winter surveys in the southeastern Bering Sea, indicate different maturity rates from those developed in the 1970s (Honkalehto et al. 2001). The difference between the maturity rates could potentially influence estimates of allowable harvest by several thousand metric tons annually. There is some reason to believe that the recent survey-derived estimates of maturation may be biased due to limited temporal-spatial coverage of the eastern Bering Sea pollock stock. This proposal seeks to more fully explore the maturation of eastern Bering Sea pollock by analyzing pollock gonads collected by at-sea processors throughout the spawning season over the geographic range occupied by the stock. Data collection methods will include a combination of maturity stage information and gonado-somatic indexing (Gunderson and Dygert 1988). Data collection will span two spawning seasons, and the analysis will include the estimation of a pollock sexual maturation schedule and analysis of temporal and spatial variation in pollock maturity.

Background and Relevance to Research Priorities

Pollock (*Theragra chalcogramma*) is the single most abundant fish species in the eastern Bering Sea and comprised 70% of the total groundfish catch by weight in 2001. The North Pacific Fishery Management Council adopted a harvest policy that is based on maintaining a spawning stock size that produces maximum sustainable yield. An integral part of the yield determination process is the pollock maturation rate. Maturation rate is the proportion of fish that are mature at a specific age or length. Smith (1981) conducted the primary study of pollock maturity. Results from Smith's (1981) study, conducted nearly 25 years, still form the basis for determining pollock spawning stock biomass in the annual stock assessments that are used to manage this valuable fishery.

Recently, the Alaska Fisheries Science Center of the National Marine Fisheries Service (NMFS) conducted winter surveys of pollock distribution and abundance in the eastern Bering Sea. Pollock maturation data were collected during these surveys. Preliminary results suggest that maturity-at-length may differ from previous studies and that there may be interannual variability in the maturity schedule (J. Ianelli, NMFS, pers. comm.). Pollock maturity-at-age in the eastern Bering Sea differs from that in the Gulf of Alaska (Figure 1). Preliminary results from recent winter surveys indicate that maturation in the eastern Bering Sea may be more similar to the Gulf of Alaska. However, there is some concern that those recent results may not be representative because the coverage of recent winter surveys is limited in space and time.

Because maturation rate is such an important factor in the stock assessment process and because there is uncertainty about the true current maturation schedule for the eastern Bering Sea stock, we propose a comprehensive 2.5-year study of pollock maturation rates. This research proposal

directly relates to PCC research priority #6, *fishery stock assessments and stock assessment models, including development of improvements to such assessments and models.*

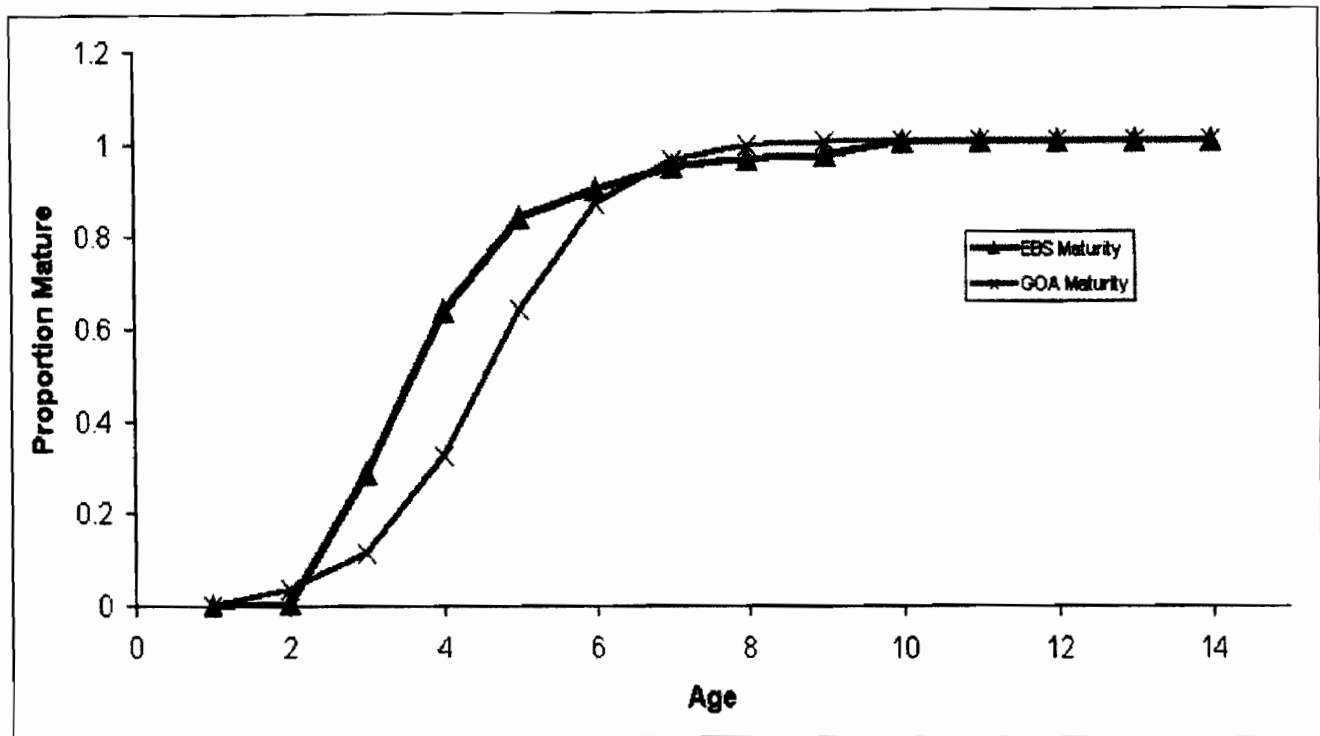


Figure 1. Maturity ogives (proportion mature at age) for walleye pollock in the eastern Bering Sea (EBS) and Gulf of Alaska (GOA).

Objectives/Hypotheses

The goal of our study is to provide accurate pollock maturity schedules for use in the annual stock assessments from which estimates of sustainable yield are derived. Collection of samples aboard commercial fishing vessels will insure that samples of spawning pollock are collected from throughout the range of eastern Bering Sea spawning pollock and throughout the spawning season since at-sea catcher-processors operate from late January through April along the entire eastern Bering Sea outer shelf.

Our main objectives are to estimate current pollock maturity-at-age for the eastern Bering Sea stock, and to test for any evidence of spatio-temporal variability in pollock sexual maturity. Our study is designed to test the following two sets of null and alternative hypotheses:

- H₀₁: The sexual maturity schedule for eastern Bering Sea pollock has not changed since the late 1970s as estimated by Smith (1981).
- H_{a1}: The sexual maturity schedule for eastern Bering Sea pollock has changed over time.

- H₀₂: The pollock maturity schedule does not differ across its geographic range within the eastern Bering Sea.
- H_{a2}: The pollock maturity schedule differs regionally within the eastern Bering Sea.

Methods/Analyses

Data Collection

A collaborative data collection program will be instituted involving the University of Alaska Fairbanks (UAF), Pollock Conservation Cooperative (PCC) and NMFS. Data will be collected during the 2002 and 2003 spawning seasons on pre-spawning pollock. The spatial scale of sampling will reflect the geographic distribution of the at-sea processors during the pollock "A" (roe) fishing season.

A sampling manual and forms will be developed and provided to all participating PCC vessels. In order to insure unbiased sampling, samples will collect a daily random sample of pollock (minimum of 20 fish) at a random hour of the day from the processing line. The sample collection will be delivered to the vessel quality control (QC) department for processing.

The QC personnel will segregate fish by sex, and measure and record the following data from female pollock in the sample: (1) length to the nearest cm, (2) whole weight to the nearest gram, (3) gonad weight to the nearest gram, and (4) maturity stage. These data will be entered onto a form on which the time (Alaska Standard Time) and sample location (latitude and longitude) are also recorded. In addition, the total number of fish in the sample and total number of females will be recorded. A random subsample of gonads will be frozen and returned to the laboratory for histological analysis to confirm the maturity stage data collected by QC personnel.

Stage of maturity may be described using a five-point maturity scale and gonado-somatic indexing (Gunderson and Dygert 1988). An orientation-training workshop will be held for QC personnel prior to the 2002 season. In addition, sampling procedures will be reviewed after initial data compilation to investigate whether sampling protocol revisions are needed for collections in the following season.

Data Analysis

Schnute and Richards (1990) developed a unified approach to the analysis of fish growth, maturity and survivorship data. In overview, the proportion of mature fish will be estimated for each 5-cm length class. Maturity will be estimated by logistic regression (McCullagh and Nelder 1989), and the significance of fish length as a predictor of the proportion mature will be tested by likelihood chi-square test. Nonparametric bootstrap methods will be used to estimate standard errors in model parameter estimates.

Temporal and geographic differences in maturity schedules will be tested by logistic regression using a step-wise approach to determine the best model considering sample year, area, fish length, and interactive terms. Nonparametric bootstrap methods will be used to estimate standard errors in model parameter estimates.

Timeline Including Work Schedule and Reporting Deadlines

This project will be conducted during February 2002 through June 2004. The following schedule outlines the timeline for the conduct of major activities.

Late winter—spring 2002. Drs. Wespestad and Kruse will develop a sampling manual and forms corresponding to the chosen sampling protocol. Dr. Wespestad will oversee the implementation of the sampling protocol on PCC catcher-processor vessels. This will entail liaison with PCC member companies and training of company quality control personnel in data collection methodology. Copies of manuals and forms will be developed and provided to all participating PCC vessels. He will be responsible in the initial stages of data collection and collation. Resultant data will be entered into a database.

Summer 2002. Drs. Kruse and Wespestad will review sampling procedures to investigate whether sampling protocol revisions are needed for collections in following seasons. If available, the graduate student will be involved in this aspect of the project.

Fall 2002. The graduate student will take courses. Dr. Kruse will oversee the preparation of the annual progress report.

Late winter—spring 2003. Dr. Wespestad will provide industry liaison and coordination with Dr. Kruse and his master's student on sampling protocols and data preparation. The master's student will take part in the at-sea sampling. The second year of data will be collected.

Summer 2003. The graduate student will conduct preliminary analysis of the second year of data.

Fall 2003. The graduate student will take courses. Dr. Kruse will oversee the preparation of the annual progress report on the second year of data.

Winter 2003—spring 2004. The student will complete coursework. Comprehensive analysis of new (2002/2003) data, NMFS survey data (2000/2001) and historical (late 1970s) data will be conducted for temporal and spatial trends. The MS student thesis will be prepared. Dr. Kruse will oversee the preparation of a final report.

Deliverables. The main deliverables include two annual progress reports, a final report, and a MS student thesis. The student thesis will be prepared in a format suitable for submission to a professional fisheries journal. Results will be presented at the Alaska Chapter, American Fisheries Society meeting, and international meeting, such as the North Pacific Marine Science Organization (PICES) and/or the annual meeting of the American Fisheries Society (parent society).

References

- Gunderson, D. R. and P. H. Dygert. 1988. Reproductive effort as a predictor of natural mortality rate. *J. Cons. Int. Explor. Mer* 44:200-209.
- Honkalehto, T., P. Walline, D. McKelvey, and N. Williamson. 2001. Echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) on the southeastern Bering Sea shelf and in the Aleutian Basin near Bogoslof Island in February and March, 2001. In assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pac. Fish. Mgmt. Council, Anchorage, AK, Section 1, Appendix 1.
- Ianelli, J.N., T. Buckley, T. Honkalehto, N. Williamson and G. Walters. 2001. Bering Sea-Aleutian Islands Walleye Pollock Assessment for 2002. In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pac. Fish. Mgmt. Council, Anchorage, AK, Section 1:1-120.
- McCullagh, P., and J.A. Nelder. 1989. Generalized linear models, 2nd edition. Chapman and Hall, New York, NY.
- Schnute, J.T., Richards, L.J. 1990. A unified approach to the analysis of fish growth, maturity, and survivorship data. *Can. J. Fish. Aquat. Sci.* 47:24-40.
- Smith, G. 1981. The biology of walleye pollock. In: D.W. Hood and R. Calder (eds.), *Bering Sea Shelf Oceanography and Resources*, Vol.1. Univ. Wash. Press.
- Wespestad, V. G., and J. Traynor. 1989. Walleye pollock. In: L-L. Low and R. Narita (editors), *Condition of groundfish resources in the Bering Sea-Aleutian Islands region as assessed in 1988*. U. S. Dep. Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., NOAA Tech. Memo. NMFS F/AKC-178.

Curriculum Vitae of Dr. Gordon H. Kruse

Contact Information

University of Alaska/Fairbanks
School of Fisheries & Ocean Sciences, Juneau Center
11120 Glacier Highway
Juneau, AK 99801

Office: (907) 465- 8458
Home: (907) 364-3797
Fax: (907) 465-8461
Email:

Education

Ph.D.	<i>Fisheries</i>	Oregon State University	1983
M.S.	<i>Fisheries</i>	Oregon State University	1981
B.A.	<i>Biomathematics</i>	Rutgers College, Rutgers University	1977

Selected Publications

- Zheng, J., and G.H. Kruse. MS. Stock-recruitment relationships for Alaskan crab stocks. *Fisheries Research*, in press.
- Zheng, J., G.H. Kruse, and D.R. Ackley. 2001. Spatial distribution and recruitment patterns of snow crabs in the eastern Bering Sea. Pages 233-255 *In* G.H. Kruse, N. Bez, A. Booth, M.W. Dorn, S. Hills, R.N. Lipcius, D. Pelletier, C. Roy, S.J. Smith, and D. Witherell (editors). *Spatial processes and management of marine populations*. University of Alaska Sea Grant, Report AK-SG-01-02, Fairbanks.
- Rosenkranz, G.E., A.V. Tyler, and G.H. Kruse. 2001. Effects of water temperature and wind on recruitment of Tanner crabs in Bristol Bay, Alaska. *Fisheries Oceanography* 10: 1-12.
- Kruse, G.H., L.C. Byrne, F.C. Funk, S.C. Matulich, and J. Zheng. 2000. Analysis of minimum size limit for the red king crab fishery in Bristol Bay, Alaska. *North American Journal of Fisheries Management* 20: 307-319.
- Fu, C., T.J. Quinn, II, and G.H. Kruse. 2000. Analyses of harvest strategies for pandalid shrimp populations. *Journal of Northwest Atlantic Fishery Science* 27: 247-260.
- Zheng, J., and G.H. Kruse. 2000. Rebuilding probabilities under alternative rebuilding strategies for eastern Bering Sea Tanner crab. *Alaska Fishery Research Bulletin* 7: 1-10.
- Zhou, S., and G.H. Kruse. 2000. Modifications of cod pots to reduce Tanner crab bycatch. *North American Journal of Fisheries Management* 20: 897-907.
- Zheng, J., and G.H. Kruse. 2000. Recruitment patterns of Alaskan crabs and relationships to decadal shifts in climate and physical oceanography. *ICES Journal of Marine Science* 57: 438-451.
- Zhou, S., and G.H. Kruse. 2000. Capture efficiency and size selectivity of two types of pots for red king crabs in the Bering Sea. *Alaska Fishery Research Bulletin* 6(2): 94-103.
- Kruse, G.H., and J. Zheng. 1999. Are changes in Bering Sea crab and groundfish populations related? Pages 143-148 *in* *Ecosystem approaches for fisheries management*. University of Alaska Sea Grant Report 99-01, Fairbanks.
- Kruse, G.H. 1998. Salmon run failures in 1997-1998: A link to anomalous ocean conditions? *Alaska Fishery Research Bulletin* 5(1): 55-63.
- Zhou, S., T.C. Shirley, and G.H. Kruse. 1998. Feeding and growth of the red king crab *Paralithodes camtschaticus* under laboratory conditions. *Journal of Crustacean Biology* 18: 337-345.

- Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, *Patinopecten caurinus* (Gould, 1850), in Alaska. *Journal of Shellfish Research* 14(1):71-78.
- Kruse, G.H., D. Hicks, and M.C. Murphy. 1994. Handling increases incidental mortality of softshell Dungeness crabs returned to the sea. *Alaska Fishery Research Bulletin* 1:1-9.
- Woodby, D., G.H. Kruse, and R. Larson. 1993. A conservative application of a surplus production model to the sea cucumber fishery in Southeast Alaska. Pages 191-202 in G.H. Kruse, D.M. Eggers, R.J. Marasco, C. Pautzke, and T.J. Quinn II (editors). *Proceedings of the International Symposium on Management Strategies for Exploited Fish Populations*, University of Alaska Sea Grant College Program Report 93-02, Fairbanks.
- Zheng, J., F. Funk, G.H. Kruse, and R. Fagen. 1993. Threshold management strategies for Pacific herring in Alaska. Pages 141-165 in G.H. Kruse, D.M. Eggers, R.J. Marasco, C. Pautzke, and T.J. Quinn II (editors). *Proceedings of the International Symposium on Management Strategies for Exploited Fish Populations*, University of Alaska Sea Grant College Program Report 93-02, Fairbanks.
- Kruse, G.H., and A.V. Tyler. 1989. Exploratory simulation of English sole recruitment mechanisms. *Transactions of the American Fisheries Society* 118: 101-118.
- Kruse, G.H., and A. Huyer. 1983. Relationships among shelf temperatures, coastal sea level, and the coastal upwelling index off Newport, Oregon. *Canadian Journal of Fisheries and Aquatic Sciences* 40: 238-242.
- Kruse, G.H., and A.V. Tyler. 1983. Simulation of temperature and upwelling effects on the English sole (*Parophrys vetulus*) spawning season. *Canadian Journal of Fisheries and Aquatic Sciences* 40:230-237.

Curriculum Vitae of Dr. Vidar Weststad

Contact Information

21231 8th Place W.
Lynnwood, WA 98036
Telephone: 425 672-7603
Fax: 425 672-1357
E-mail: Vidar@worldnet.att.net

Fisheries Consultant

Current and recent projects include:

Developing and supervising research for the Pacific Whiting Conservation Cooperative comprised of companies operating catcher processor vessels in the U.S. west coast whiting fishery;
Assisting in stock assessments of marine species in central Chile;
Evaluation of Bering Sea fishery resources for clients interested in development projects;
Review of status and trends of Puget Sound herring relative to industrial development;
Analysis of trends and formulating forecasts of biomass and yield in the world's major whitefish fisheries.
Modeling and forecasting Bering Sea walleye pollock recruitment using biophysical data for the Alaska Fish. Sci. Center.
European Fish Ageing Network – consultation on length based stock assessment methodology
Development plan for Sitka Sound herring spawn-on-kelp fishery.
Scientific advisor to the American Fisheries Research Foundation (Pacific albacore industry)
Reviewer and consultant to the Norwegian Research Council on fisheries assessment and management.

1992-1997: Supervisory Fisheries Research Biologist, National Marine Fisheries Service, Alaska Fisheries Science Center, 7600 Sand Point Way N. E. Seattle, WA 98115. I also served as a scientific advisor, delegate or representative to: Coastal Pelagic Working Group, PICES, Northeast Arctic Working Group, ICES

1977 – 1992: Fisheries Research Biologist, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, 7600 Sand Point Way N. E. Seattle, WA 98115.

1975 – 1977: Fisheries Environmental Biologist, Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, UT 84114

1973 – 1975: Graduate Research and Teaching Assistant, Dept. Fishery and Wildlife Biology, Colorado State University

1964 – 1968: U. S. Air Force

Education

Doctor of Philosophy in Fisheries Science, 1991, University of Washington, Seattle, WA 98195
Master of Science in Fisheries Science, 1975, Colorado State University, Fort Collins, CO 80521
Bachelor of Science (cum laude), 1973, Colorado State University, Fort Collins, CO 80521

Professional and honorary society memberships

American Fisheries Society:
Co-chair, World Fishery Congress (Athens, 1992) Steering Committee
International Fisheries Section, President 1989-91
Colorado State Chapter, President 1972-73
Marine Fisheries Section,
Co-organizer Microcomputer Workshops, AFS Symposium #6
Chairman, membership committee
Chairman, program committee
Gamma Sigma Delta
Xi Sigma Pi

Awards

NOAA Special Achievement, 1979
Full-time long term university training, 1982
NOAA Outstanding Performance, 1983

Honorable Mention for Best Paper in Fishery Bulletin, 1983
Senior Scientist Fellowship, Norwegian Fishery Research Council, 1986
Norwegian Marshall Fund, Research Fellowship, 1991.
American Fisheries Society Distinguished Service Award, 1992
Rockefeller Foundation Scholar-in-Resident, Bellagio Center, Bellagio, Italy, 1996.

Membership on Symposia Organizing Committees

International Herring Symposium, Anchorage, AK, 1980
International Hydroacoustic Symposium, Seattle, WA 1987
International Pollock Symposium, Anchorage, AK 1988
International Herring Symposium, Anchorage, AK, 1990
World Fisheries Congress (Co-chair), Athens, Greece, 1992
International Symposium on Ocean Ranching, Arendal, Norway, 1993
International Forage Fish Symposium, Anchorage, AK 1996
Third World Fisheries Congress, Beijing, China 2000

Publications

Professional papers 34
Refereed journal papers 29

Recent Publications and Presentations

Vidar G. Wespestad, Lowell W. Fritz, W. James Ingraham, and Bernard A. Megrey. 2000. On Relationships between Cannibalism, climate variability, physical transport and recruitment success of Bering Sea Walleye Pollock, *Theragra chalcogramma*. ICES Journal Marine Science 57(2) 272-279.

Wespestad, V. The Pacific Whiting Conservation Cooperative: An example of Industry restructuring to promote responsible fishing and reduce ecosystem impacts. (Poster) ICES Symposium on ecosystem effects of fishing. Montpellier, France, April 1999.

B. A. Megrey and V. G. Wespestad. 1998. Using Neural Networks to Examine Relationships Between Features of the Environment and Recruitment Variation in Exploited Marine Fish Stocks. International Workshop on Application of Artificial Neural Networks to Ecological Modeling. Toulouse, France December 1998. (In Press)

J. Ianelli and V. Wespestad. 1998. Status and trends of North Pacific pollock stocks. Groundfish Forum Proceedings, London, October, 1998.

Wespestad, V., J. Ianelli, L. Fritz, T. Honkalehto, N. Williamson, and G. Walters. 1997. Bering Sea/Aleutian Islands Walleye Pollock Assessment for 1998. In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pac. Fish. Mgmt. Council, Anchorage, AK, 35-120.

Wespestad, V. G. 1998. Trends in North Pacific Pollock and cod and 1998 Harvest Prognosis. In: A. Moller (ed.) Groundfish Forum Proceedings:50-58, London, October, 1997.

Stahl, Jennifer Paige
4300 University Dr.
Juneau, AK 99801

(907)-790-9869

Education

Pursuing Master of Fisheries

University of Alaska Fairbanks, Juneau Center
Expected Graduation August 2004

Bachelor of Science Biology (Ecology, Evolution, and Conservation)

University of Texas at Austin
May 1999

Work Experience

National Marine Fishery Service Observer, Galveston Lab (10/01-8/02)

Four trips at a total of 82 days at sea:

- Identified both invertebrate and vertebrate bycatch aboard Gulf of Mexico shrimp trawl vessels
- Keyed out all unknown vertebrate and invertebrate species found in sample nets aboard Gulf of Mexico shrimp vessels
- Compared samples obtained from experimental by catch reduction devices with samples obtained from control nets
- Collected biological data of weights and lengths on invertebrate and vertebrate by catch species

Bear Watch Tour Guide (7/01 to 9/01)

- Developed and performed informative speech pertaining to salmon hatchery operations, black bear behavior, and other Alaskan wildlife
- Managed groups of up to thirty in remote setting among numerous wild black bears

National Marine Fishery Service Observer, Pacific Islands Area Office (9/00-1/01)

Three trips at a total of 75 days at sea on 71 to 98 foot long line vessels

- Tagged and released endangered species of sea turtles
- Collected biopsy samples from sea turtles, billfish, and tuna
- Obtained biological data for fish life history of billfish, tuna, and sharks
- Performed marine mammal watches
- Photographed and measured sea turtles

Fish & Wildlife Technician I, Texas Parks & Wildlife (11/99-9/00)

- Monitored and maintained water quality and spawning conditions of red drum and spotted seatrout broodfish
- Incubated eggs and fry
- Maintained water quality of fingerling ponds and assisted in fingerling pond harvest
- Provided public education through facility tours and outreach events
- Managed facility during solitary night shift

Research Assistant, University of Texas Marine Science Center (6/99 to 8/99)

- Conducted wetland vegetation sampling through collection of leaf area index measurements, pore water samples, and biomass cores
- Performed nutrient analysis for both ammonium and nitrate content of seagrass bed and marshland water samples
- Prepared, sorted, and weighed lower and upper biomass of seagrass and halophyte plant species
- Assisted with experimental seagrass restoration project