REPORT OF THE TWELFTH ANNUAL CONFERENCE OF THE PARTIES TO THE CONVENTION ON THE CONSERVATION AND MANAGEMENT OF POLLOCK RESOURCES IN THE CENTRAL BERING SEA

September 4-5, 2007
Beijing, China

1. Opening of the Conference

Mr. Zhou Yingqi, Professor, Shanghai Fisheries University (China), welcomed the delegations of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea to the Twelfth Annual Conference. He invited the representatives of People's Republic of China (China), Japan, Republic of Korea (Korea), Poland, the Russian Federation (Russia), and the United States of America (US), to present opening statements.

2. Welcome Address and Statements of the Delegates

Opening statements provided by the Parties are included in Appendix 1. A list of the participants is presented in Appendix 2.

3. Election

3.1 Chair

Mr. Zhou Yingqi, Professor, Shanghai Fisheries University (China), was elected as Chair of the Twelfth Annual Conference.

3.2 Vice-Chair

Mr. Sergei Podolyan, Deputy Director, Federal Fisheries Agency (Russia), was elected Vice Chair.

3.3 Chair of Scientific and Technical Committee

Patricia Livingston (US) was elected the Chair of the Scientific and Technical Committee.

3.4 Rapporteur

LCDR Daniel Schaeffer (US) served as lead rapporteur with assistance from each of the member countries.

4. Adoption of the Agenda

The Agenda was adopted (Appendix 3).

5. Report of the Scientific and Technical Committee

The Chair of the Scientific and Technical (S&T) Committee reported on the results of the S&T Committee meeting of September 4-5, 2007, in Beijing, China. The resulting report was distributed to the Parties (Appendix 4). The Chair summarized the S&T Committee discussions as follows:

5.1 Update catch and effort statistics

5.1.1 Tables of historical catch and effort statistics on pollock catch in the Bering Sea were updated and included in the final S&T report.

5.2 Review results of trial fishing

5.2.1 Korea was the only nation that conducted trial fishing in the region in 2007. Korea presented final results of 2006 trial fishing. Preliminary results of the Korean trial fishing in 2007 are also included as an attachment to the S&T report.

5.3 Review results of research cruises

5.3.1 Japan presented data on the BASIS surveys.

5.3.2 Russia reported on the results of the western Bering Sea pollock research cruises.

5.3.2 The US reviewed results of the 2007 Bogoslof survey. The next Bogoslof survey will be conducted in 2009. The US also reported on the preliminary results of the acoustics survey of the Eastern Bering Sea and Aleutian Islands region.

5.4 Review the status of Aleutian Basin Pollock stocks

5.4.1 The US stated that recent studies indicate that the pollock stock in the Central Bering Sea is low. It was further noted that there was no comprehensive survey that could be used to determine the status of the Aleutian Basin stock. Detailed information is included in the S&T report.

5.5 Factors affecting recovery of the stocks

5.5.1 There was no new information or discussion on this topic.

5.6 The effects of the moratorium and its continuation

5.6.1 Russia and the US noted that the moratorium has been in place for more than 14 years with no sign of recovery of pollock stocks in the Convention Area. This time span is a long time for fishermen but a short time for nature or science.

5.6.2 Parties agreed that the moratorium should continue.

5.7 Methodologies to determine Allowable Biological Catch (ABC) and AHL and Recommendation on AHL

5.7.1 Parties agreed that biomass should be determined using the indirect method in the Annex to the convention.

5.7.2 Proposals were discussed in determining ABC. Japan and Poland suggested using US methods for the Bogoslof region.

5.7.3 Poland suggested using the US ABC calculations for the Bogoslof region to determine ABC for the Aleutian Basin and convention area. US and Russia stated there is no evidence to support the percentage distribution.

5.8 Recommendation on AHL

5.8.1 Consensus was not reached on how to set an AHL; therefore, the default mechanism in Annex 1 applies.

5.9 Other matters and recommendations of the S&T Committee

5.9.1 USCG presented a report on enforcement efforts in 2007. The USCG boarded both Korean trial fishing vessels with no fish found onboard. C-130 aircraft provided verification of VMS positions. No violations were noted.

5.9.2 Korea submitted a proposal for trial fishing in 2008. Japan supported Korean efforts and suggested they conduct the trial fishing in late Nov –Dec.

5.9.3 The US requested that as much lead time as possible be given to USCG contacts prior to trial fishing efforts in order to facilitate enforcement efforts. One month was given as the ideal lead time.

5.9.3 The proposed genetics workshop was not held because no significant new information was available that would make the workshop worthwhile. Limited progress was noted from 2005 to present, therefore the planned workshop was cancelled in 2007 with no definitive date for a future workshop. Genetics workgroup contacts should remain active and work together to post updated information and potentially hold a workshop when needed.

5.9.4 The survey group is working toward a comprehensive survey of the convention area. The plan includes the use of trial fishing vessels as part of the survey operation. The group will continue to work with the proposal and develop an operational plan when capable.

5.9.5 The US reminded parties that it will not be able to conduct annual surveys in the Bogoslof area. The next survey will be conducted in 2009. If other counties can utilize their research vessels to conduct the survey, they would be welcome. If no other survey vessels are used, there will be no survey for 2008 of the Bogoslof area.

6. Action Items

6.1. The review of scientific data and conservation measures of the Coastal States related to Pollock fishing in the Bering Sea

6.1.1 The US and Russia submitted fishery catch statistics and research results which were included in the S&T report.

6.2. The establishment of a plan of work for the Scientific and Technical Committee

6.2.1 There is no plan of work for the S&T committee. The Parties supported the issues raised by the S&T committee to continue to coordinate functions for the two working groups with an annual report to the Annual Conference on the progress of the workshops.

6.3. The establishment of the Allowable Harvest Level

6.3.1 Poland recommended setting the AHL for the Aleautian Basin based on the ABC calculations of the US for the Bogoslof region. This would set the AHL at 1,394 mt.

6.3.2 PRC recommended that AHL for 2008 be set at zero. The total biomass does not reach the level necessary by the convention to set an AHL to anything other than zero.

6.3.3 Japan supported Poland in setting the AHL based on US calculations of Bogoslof region ABC. Stated they understand that Korea, Japan and Poland would support this proposal but that Russia and the US would not, therefore, they understand that AHL will be set at zero.

6.3.4 Korea supported Poland's proposal and stated that 14 years is a long time for fishermen in Korea not to be allowed to fish for pollock. By offering even a small AHL, it gives hope to the fishermen who are awaiting the recovery of the pollock stocks in the Central Bering Sea.

6.3.5 The Chair summarized the situation, stating that the Parties had two different positions: Japan, Korea, and Poland submitted a proposal to set AHL, while China, Russia and the US supported setting AHL at zero. The Chair stated that because consensus was not reached, there was no choice but to set AHL according to Convention Article VII, which refers to the procedure outlined in Annex Part I, paragraph (c), and setting the AHL for 2008 at zero.

6.4. The establishment of the Individual National Quotas

6.4.1 The Chair stated that since AHL could not be established, no individual national quotas could be established.

6.5. The adoption of appropriate conservation and management measures based upon the advice of the Scientific and Technical Committee

6.5.1 There should be no action on this item because conservation and management measures should remain status quo at this time.

6.6 The establishment of the terms and conditions for trial fishing in 2008

6.6.1 Korea stated that it could not support a change of the two week advance notification period without consulting with their industry.

6.6.2 US stated it is not comitted to a one month time frame. It is a recommendation to give as much lead time prior to fishing as possible to faciliate enforcement efforts.

6.7 Trial fishing plans

6.7.1 Korea plans to conduct trial fishing with two vessels in 2008.

6.7.2 All parties agreed that trial fishing is an important measure available to gather scientific data and information necessary to potentially revise the moratorium.

6.7.3 Japan may possibly conduct trial fishing in 2008 after reviewing available scientific information.

6.8. Reception of reports relating to measures taken to investigate and penalize violations of the Convention

6.8.1 US presented a report on monitoring and enforcement efforts in the S&T committee.

6.9. The consideration of matters related to the conservation and management of living marine resources other than pollock in the Convention Area

6.9.1 No discussion on this topic.

6.10. Meeting Observers

6.10.1 No discussion on this topic.

7. Thirteenth Annual Conference

7.1 Time and Location

7.1.1 Russia agreed to host the Thirteenth Annual Conference. Russia plans to hold the meeting in Kaliningrad in early September 2008. Exact details will be placed on the web site when arrangements are finalized.

7.2 Election of Chair and Vice-Chair

7.2.1 Russia nominated Mr. Sergei Podolyan, Deputy Director, Federal Fisheries Agency (Russia) as Chairman for the Thirteenth Annual Conference.

7.2.2 United States nominated Dr. Jim Balsiger to serve as the Vice Chair for the Thirteenth Annual Conference.

8. Other Business

8.1. US supported continuing with the annual meeting schedule.

8.2 PRC supported US position to continue annual meetings.

9. Closing Statements

The Parties provided closing statements.

Appendices:
1. Opening Statements.
2. Delegation List.
3. Plenary Agenda.
4. Report of the Scientific and Technical Committee.

List of Participants
CBSPC
4-7 September 2007
Beijing, China

CHINA

Zhu BAOYING
Senior Officer
Division of International Cooperation
Bureau of Fisheries
Ministry of Agriculture
Phone: +86 10 64192974
Fax: +86 10 64192951
Email: inter – coop@agri.gov.cn

Wan CHEN
Senior staff,
Division of Farseas Fishing
Bureau of Fisheries, Ministry of Agriculture
Phone: +86 10 64192969
Fax: +86 10 64193056
Email: bofdwf@agri.gov.cn

JAPAN

Yasuaki IWAMOTO
Deputy Director
International Division
Department of Resources Management, Fisheries Agency
Phone: +81 3 3502 8111
Fax: +81 3 3502 0571
Email: yasuaki_iwamoto@nm.maff.go.jp

Taku SASAKI
Deputy Director
Far Seas Fisheries Division
Department of Resources Management, Fisheries Agency
Phone: +81 3 3502 2443
Fax: +81 3 3591 5824
Email: taku_sasaki@nm.maff.go.jp

Ichiro KANTO
Resource Research Coordinator
Resources and Environment Research Division
Department of Resources Enhancement Promotion, Fisheries Agency
Phone: +81 3 3502 8111
Fax: +81 3 3592 0759
Email: ichiro_kanto@nm.maff.go.jp

Akira NISHIMURA
Chief, Grounfish Biology Section
Subarctic Fisheries Resources Division
Hokkaido National Fisheries Research Institute
Fisheries Research Agency
Phone: +81 154 92 1716
Fax: +81 154 91 9355
Email: anishimu@fra.affrc.go.jp

Sekiichi KANAI
Executive Vice president
Kanai Fisheries Co., LTD
Phone: +81 154 41 9181
Fax: +81 154 41 9186

Hajime ONISHI
Secretary
Hokuten Trawlers Association
National Federation of Medium Trawlers
Phone: +81 3 3508 0361
Fax: +81 3 3508 0364
Email: onishi@zensokoren.or.jp

Seiji HARAGUCHI
Directed Manager
Hokkaido Trawl Fisheries Cooperative Federati
on
Email: kisenren@mtd.biglobe.ne.jp

Takayuki SHIMIZU
Vice Consul
Consulate General of Japan in Busan
Phone: +82 51 465 5102
Fax: +82 51 4421 1622

Stawonir SZULC
Interpreter

KOREA

Chiguk AHN
Deputy Director
Ministry of Maritime Affairs and Fisheries
Phone: +82 2 3674 6994
Fax: +82 2 3674 6996
Email: chiguka62@yahoo.com

POLAND

Leszek DYBIEC
Duputy Director
Fishery Department of Ministry
Ministry of Agriculture and Rural Development
Phone: +48 22 628 96 84
Fax: +48 22 623 22 04
Email: leszek.dybiec@minrol.gov.pl

RUSSIAN FEDERATION

Alexander GLUBOKOV
Chief of the Department
VNIRO
Phone: +7 95 264 9143
Fax: +7 95 264 9021
Email: glubokov@vniro.ru

Vadim NIKOLAEV
VNIRO
Phone: +7 95 928 3344
Fax: +
Email: nikolaev@fishcom.ru

Mikhail STEPANENKO
Principle scientist
TINRO
Phone: +7 4232 400 881
Fax: +7 4232 300 752
Email: stepanenko@tinro.ru

Igor MELNIKOV
Deputy director
TINRO
Phone: +7 4232 400 377
Fax: +7 4232 300 752
Email: melhikov@tinro.ru

Oleg ZOLOTOV
Senior scientist
KamchatNIRO
Phone: +7 415 2 12 34 24
Fax: +7 415 2 11 27 01
Email: zolotov@kamniro.ru

Oleg Yu. DANKO
Deputy Representative in the Republic of Korea
Federal Agency for Fisheries
Ministry of Agriculture of the Russian Federation
Phone: +82 2 567 6946
Fax: +82 2 567 6950
Email: fishrepk2@hanafos.com

USA

Loh-Lee LOW
International Affairs Coordinator
Alaska Region NOAA Fisheries
Phone: +1 206 526 4190
Fax: +1 206 526 6723
Email: Loh-Lee-Low@noaa.gov

Patricia A. LIVINGSTON
Division Director
Resource Ecology & Fisheries Management Di vision
Alaska Fisheries Science Center
Phone: +1 206 526 4172
Fax: +1 206 526 6723
Email: Patt.Livingston@noaa.gov

Amanda J. MILLER
Foreign Affairs Officer
Office of Marine Conservation
Phone: +1 202 647 4824
Fax: +1 202 736 7350
Email: johnsonmillerax@state.gov

Alan AUSTERMAN
Fisheries Policy Advisor
Office of the Governor
Frank H. Murkowski
Phone: +1 907 465 3500
Fax: +1 907 465 3532
Email: Alan_Austerman@gov.state.ak.us

Steven J. BARBEAUX
Resource Ecology & Fisheries Management Di vision
Alaska Fisheries Science Center
Phone: +1 206 526 4211
Fax: +1 206 526 6723
Email: Steve.Barbeaux@noaa.gov

Daniel E. SCHAEFFER
Lieutenant Commander
Coast Guard Liaison Officer Department of State
Phone: +1 202 6473177
Fax: +1 2027367350
Email: daniel.e.schaeffer@uscg.mil

Carl HINSHAW
Lieutentant Commander
U.S Coast Guard
Phone: +1 907 463 2223
Fax: +1 907 463 2216
Email: carl.s.hinshaw@uscg.mil

Hazel NELSON
CEO
BC Contractors, Inc.
Phone: +1 907 222 6256
Fax: +1 907 222 6258
Email: becharof@gci.net

Dave BENSON
Trident Seafoods Corporation
Phone: +1 206 783 3818
Fax: +1 206 781 7883
Email: davebenson@tridentseafoods.com

Richard B. LAUBER
Phone: +1 907 463 3669
Fax: +1 907 463 3622
Email: RickLauber@aol.com

Al BURCH
Phone: +1 907 486 3910
Fax: +1 907 486 6292
Email: alaska@ptialaska.net

Earl E. KRYGIER
Alaska Dept. Fish & Game Commercial Fisheries
Extended Jurisdiction
Phone: +1 907 267 2111
Fax: +1 907 267 2442
Email: earl_krygier@fishgame.state.ak.us

Bill TWEIT
Columbia River Policy Lead
Intergovernmental Resource Management
Phone: +1 360 902 2723
Fax: +1 360 902 2158
Email: tweitwmt@dfw.wa.gov

Henry MITCHELL
Executive Director
Bering Sea Fishermen's Association
Phone: +1 907 279 6519
Fax: +1 907 258 6688
Email: henry@cdpdb.org

Paul E. NIEMEIER
Foreign Affairs Specialist
Office of International Affairs
NMFS
Phone: +1 301 713 2276
Fax: +1 301 713 2313
Email: paul.niemeier@noaa.gov

Richard MARASCO
North Pacific Fishery Management Council
Phone: +1 425 788 2546
Email: richmarasco@hotmail.com

12th ANNUAL CONFERENCE OF THE PARTIES TO THE CONVENTION ON THE CONSERVATION AND MANAGEMENT OF POLLOCK RESOURCES IN THE CENTRAL BERING SEA

REPORT OF THE MEETING OF THE SCIENTIFIC AND TECHNICAL COMMITTEE

4-7 September 2007 – Beijing, China

Final: 07 September 2007

Delegations from Japan, People's Republic of China, Poland, the Republic of Korea (Korea), the Russian Federation (Russia), and the United States (US) participated in a meeting of the Scientific and Technical (S&T) Committee in conjunction with the 12th Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea in Beijing, China.

1. Opening remarks

Patricia Livingston (US), Chair of the Scientific and Technical Committee, opened the meeting at 10:42, 4 September 2007. A list of the participants is provided (attachment 1).

2. Appointment of Rapporteur

Mr. Steven Barbeaux (US) was appointed as lead rapporteur. Each delegation agreed to select rapporteurs to aide Mr. Barbeaux with this function.

3. Adoption of Agenda

3.1 There were no changes or additions to the proposed agenda (attachment 2).

4. Discussion of Science Issues

4.1. Update catch and effort statistics

4.1.1. Dr. Loh Lee-Low (US) provided the latest catch statistics for the North Pacific pollock fisheries in a handout (attachment 3: Table 1 and Table 2).

4.1.2.The Russian party reported that the pollock catch for the Navarin region was 462,500 t and in the Olyotorskiy – Karagin region was 3,900 t for 2006. Catch in the Navarin Region through August 10, 2007 was 245,370 t. Catch from the Olyotorskiy – Karagin region were not yet available for 2007.

4.2. Review results of trial fishing

4.2.1. Mr. Chiguk Ahn (Korea) presented final results from the 2006 (attachment 4) and preliminary results from the 2007 Korean trial fisheries. He reported that for 2007 two vessels spent 20 days (July 26 – August 14) in the Central Bering Sea area, conducted 40 hauls landing a total of 2 pollock. A full report for 2007 will be submitted once the data have been fully analyzed. There was no other trial fishing reported by the member nations for 2007.

4.3. Review results of research cruises

4.3.1. Dr. Nishimura (Japan) presented data on pollock bycatch in the Japanese salmon gillnet and BASIS trawl surveys (attachment 5). He indicated that the salmon gillnet and BASIS trawl surveys were conducted at shallow depths (10 m – 50 m), were designed for sampling salmon, and thus may not be an accurate index of pollock abundance. Although not a direct measure of abundance, these salmon surveys still may give some indication of pollock distribution. Dr. Nishimura indicated that birthdate information from the juvenile pollock collections may give some indication of origin, but resources were currently not available to process and analyze these data. Otoliths for the juvenile pollock had been collected during the recent BASIS trawl surveys, but had not been analyzed since the 2000.

4.3.2. The Russian party provided a detailed report on trawl surveys conducted in Russian waters in 2007 (attachment 6). The Russian survey trawls were fit with a 10-12mm mesh net liner. The Karagin area showed a marked increase of 130,000 t since the 2003 survey. The Navarin area pollock biomass is highly variable and the actual biomass estimate will not be known until late Autumn.

4.3.3. Mr. Barbeaux (US) presented a review of the results of the 2007 echo-integration-trawl survey of pollock in the southeastern Aleutian Basin near Bogoslof Island conducted by the R/V MILLER FREEMAN and R/V OSCAR DYSON. The cruise was able to complete acoustic data collection and completed 9 trawl hauls. The pollock biomass estimate for the Bogoslof Island area was 292,000 t (attachment 3 and attachment 7). Two visiting fisheries researchers from CBS Convention countries participated in the 2007 Bogoslof survey; Tian Siquan from Shanghai Fisheries University, China, and Sun Do Hwang from NFRDI, Korea.

4.3.4. Mr. Barbeaux (US) presented the preliminary results from the 2007 Eastern Bering Sea shelf EIT survey (attachment 7). This year the survey was allowed into Russian waters. The survey revealed that approximately 5% of the pollock biomass was in Russian waters, 83% was found between 170°W and the Russian/US border, and 12% of the pollock biomass was found east of 170°W. Final biomass estimates are not yet available. Size data indicates a substantial amount of small pollock located in the western areas with fewer, but larger fish in the southeast corner of the survey area (East of 170°W).

4.4. Review the status of Aleutian Basin pollock stocks

4.4.1. Mr. Barbeaux (US) presented the stock assessment for the Eastern Bering Sea and Aleutian Islands pollock stocks (attachment 3 and attachment 8). The latest Eastern Bering Sea and Aleutian Islands stock assessments can be found at http://www.afsc.noaa.gov/refm/stocks/assessments.htm. The Eastern Bering Sea assessment shows a decline in pollock abundance in 2007. This decline can be observed in the lower than normal cumulative catch in the Eastern Bering Sea Fishery. The ABC for the Eastern Bering Sea is expected to decline to below 1.0 million t by 2008 from an average of 1.40 million t for 2000-2005. The Aleutian Islands Cooperative Acoustic Survey Study conducted in 2007 show indications of very low pollock biomass in the Central Aleutians region. TAC in the Aleutians is set at or below 19,000 t; catch has been significantly lower since 2005.

4.4.2. Mr. Barbeaux (US) presented the methodology employed by the US to determine ABC in the Bogoslof region of the US EEZ (attachment 9) for its domestic fishery. The directed pollock fishery in this area has been closed since 1992 and a TAC of 1,000 t has been set for bycatch purposes only. If the US Council follows precedent, the ABC for 2008 will be 7,967 t with a rebuilding goal of 2,000,000 t for the region.

4.5. Factors affecting recovery of the stocks

4.5.1. No further factors were discussed.

4.6. The effects of the moratorium and its continuation

4.6.1. Dr. Low Lee-Loh (US) reiterated the Russian opening statement which stated that although 14 years may be a long time for fishermen, this is not a long time for the ecosystem. Other stocks around the world have shown that recovery can take a much longer time period (20-30 years). Declining stock trends can be seen in Korean pollock stocks as well, and the decline of pollock populations might be a wider issue. Therefore the US supports the continuation of the moratorium.

4.7. Methodologies to determine Allowable Biological Catch (ABC) and Allowable Harvest Level (AHL)

4.7.1. All parties agreed that since there was insufficient science and technical information available to allow the parties to establish the Aleutian basin pollock biomass, the biomass will be determined as per the Annex of the Convention Section b. This results in a biomass estimation of 292,000 t / 0.60 = 486,667 t.

4.7.2. The Japanese party proposed setting ABC for the convention area based on methodology used by the US for setting the Bogoslof region ABC domestically. This was supported by the Polish and Korean parties.

4.7.3.The US party stated that an ABC could be determined using this method and would result in an ABC of 27,740 t for the entire Aleutian Basin stock including pollock located in the US and Russian EEZ, but that there is no scientific evidence suggesting that this is an appropriate way of setting ABC. The Russian party supported the US party's statements.

4.7.4. The Polish party suggested that AHL be set by using area such that the US ABC for the Bogoslof region is assumed to be a conservative estimate for the total Aleutian Basin AHL. Taking into account that the Convention Area represents 17.5% of the Aleutian Basin area a conservative AHL could be calculated by multiplying this proportion by the US Bogoslof ABC resulting in an AHL of 1,394 t. This proposal was supported by the Japanese and Korean parties. The US party stated that this method would only be valid if the pollock population was distributed uniformly throughout the region. Furthermore the Russians noted that the Korean trial fisheries have shown this not to be accurate and there are virtually no fish in this area. The Russian party stated that the Korean trial fisheries have shown that an AHL of 1,394 t could not be supported in the basin region.

4.7.5. The Chinese party stated that there is currently insufficient evidence to determine an appropriate AHL at this time and suggested more research be conducted on this matter so that it could be better discussed next year.

4.8. Recommendation on AHL

4.8.1 There was no consensus among the parties on how to set AHL and therefore the process must follow that established in the convention under Annex 1.

5. Discussion of Enforcement and Management Issues

5.1. Trial fishing terms and conditions for 2008

5.1.1. The US party presented information on US Coast Guard activity in monitoring trial fishing in the Central Bering Sea (attachment 10). VMS data were used to track the location of the vessels during the trial fishery. The US Coast Guard boarded the two Korean trial fishing vessels in the Central Bering Sea and did not observe any pollock aboard the vessel. A C-130 flight was conducted in the convention area, but no trial fishing activity was observed.

5.1.2. The Korean party retracted its plan to conduct trial fishing using five fishing vessels due to the small amount of pollock observed in the 2007 and lack of interest by its fishermen. The Korean party instead submitted a proposal for conducting trial fishing using 2 vessels in 2008 (attachment 11).

5.1.3. The United States party asked that countries planning on conducting trial fishing give the other parties as much lead time as possible, preferably more than one month.

5.1.4. The Japanese party wanted to thank the Korean delegation for conducting trial fishing and providing much needed information on the Central Bering Sea pollock and suggested to the Korean delegation that trial fishing in the summer may be the wrong season and highly recommended that the Korean party consider trial fishing in late November or December.

6. Other Matters and Recommendations

6.1.1. Dr. Nishimura (Japan) reported that there was insufficient progress in the study of pollock genetics since 2005 to warrant a workshop on the subject. Dr. Nishimura suggested that each delegation should present its findings separately at the annual conference. Dr. Loh Lee-Low (US) suggested that Dr. Nishimura should continue to keep in contact with the genetics working group members. He suggested that all new information on the subject should be shared between parties and could be provided to all convention members via a website. The details should be determined by the genetics working group.

6.1.2. The Russian party reported that it has published a book on pollock in the Northern Bering Sea on pollock containing information on pollock genetics and that it is currently being translated into English. It will be provided to the parties to the convention when it is finished.

6.1.3. Dr. Low (US) reported that the survey working group chaired by Neal Williamson continues to investigate the possibility of a BASIS like program for pollock named BAPIS as proposed by the Russian delegation in 2005.

6.1.4. The parties agreed that the Genetics and Survey working groups should provide annual reports on progress to the S&T committee at the annual conference.

6.1.5. US party wanted to remind the other parties that they would not be conducting a Bogoslof area survey in 2008 and welcomed other parties to conduct this survey. The Japanese party responded that they would not have the resources for this in 2008.

7. Report to the Annual Conference

7.1. The Chair of the S&T gave the S&T report to the Annual Conference.

8. Closing Remarks

8.1. The Chair thanked all the participants of the S&T for their thoughtful discussions, and thanked the rapporteurs for compiling the written report. With that, the Chair closed the S&T meeting on Wednesday, September 5, 2007.

List of Attachments:
1. S&T Committee Participants for 2007
2. S&T Agenda for 2007
3. Supporting Information Submitted by the United States Delegation to the 12th Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea, with amended tables - USA
4. Report on the Korean trial fishing for walleye pollock in the Convention Area in the Bering Sea in 2006 - Korea

5. Report on pollock bycatch in the Japanese salmon gillnet and BASIS trawl surveys - Japan
6. Results from the bottom and ichthyoplankton trawl surveys conducted by Russia in the Western Bering Sea in 2007 – Russia
7. Results of 2007 Bogoslof EIT Survey and preliminary results of the Eastern Bering Sea EIT survey – USA
8. US Stock assessment presentation – USA
9. US methods for setting ABC in the Bogoslof Region – USA
10. Report on US Coast Guard Activities in the Convention Area – USA
11. Korean trial fishing plan for 2008

Proposed Agenda for the Scientific and Technical Committee

TWELFTH CONFERENCE OF THE PARTIES TO THE CONVENTION ON THE CONSERVATION AND MANAGEMENT OF POLLOCK RESOURCES IN THE CENTRAL BERING SEA

September 4-7, 2007
Beijing, China

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3. Adoption of the Agenda

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   - 4.1. Update catch and effort statistics
   - 4.2. Review results of trial fishing
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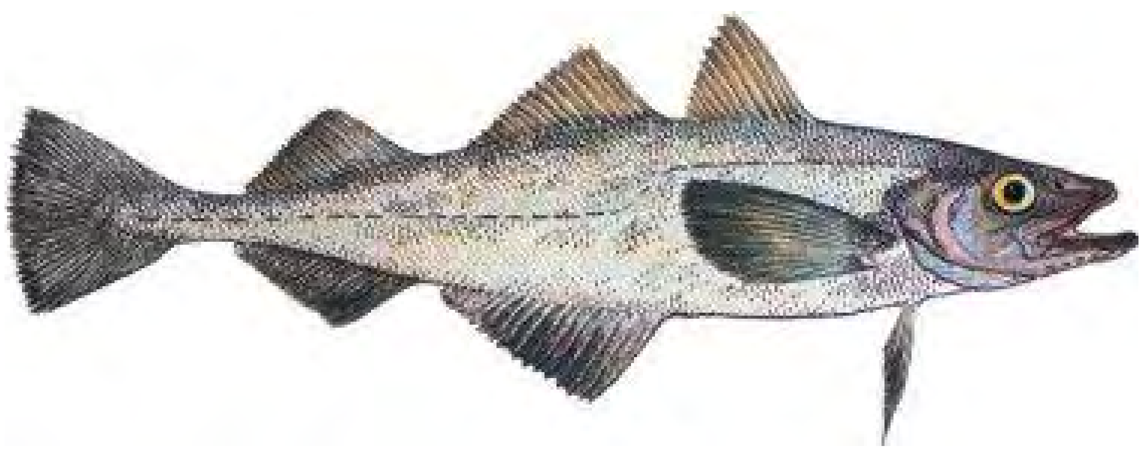
7. Report to the Annual Conference

8. Closing Remarks

Supporting Information Submitted by the United States Delegation to the Twelfth Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea



September 4-7, 2007
Beijing, People's Republic of China

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Table 1. All-nation historical catch of pollock from the Bering Sea, in metric tons, 1977-2006

Year	Olyotorskiy-Karagin (W of 170W)	Navarin Region (E of 170W)	Donut Hole	Bogoslof	Aleutian Region	Eastern Bering Sea	Total Bering Sea
1977	265,000				7,625	978,370	1,250,995
1978	417,000				6,282	979,431	1,402,713
1979	546,000				9,504	935,714	1,491,218
1980	825,000				58,156	958,280	1,841,436
1981	1,133,000				55,516	973,502	2,162,018
1982	976,000				57,978	955,964	1,989,942
1983	1,006,000				59,026	981,450	2,046,476
1984	252,000	503,000	181,200		81,834	1,092,055	2,110,089
1985	134,000	488,000	363,400		58,730	1,139,676	2,183,806
1986	297,000	570,000	1,039,800		46,641	1,141,993	3,095,434
1987	349,000	463,000	1,326,300	377,436	28,720	859,416	3,403,872
1988	475,000	852,000	1,395,900	87,813	30,000	1,228,721	4,069,434
1989	345,000	684,000	1,447,600	36,073	15,531	1,229,600	3,757,804
1990	582,000	232,000	917,400	151,672	79,025	1,455,193	3,417,290
1991	326,000	178,000	293,400	264,760	78,649	1,217,301	2,358,110
1992	282,000	315,000	10,000	160	48,745	1,164,440	1,820,345
1993	288,000	389,000	1,957	885	54,074	1,198,790	1,932,706
1994	204,000	288,900	NA	556	53,224	1,197,224	1,743,904
1995	79,000	427,300	Trace	264	60,184	1,169,614	1,736,362
1996	34,000	753,000	Trace	389	26,597	1,102,579	1,916,565
1997	30,000	735,000	Trace	163	24,721	1,036,789	1,826,673
1998	25,000	719,000	Trace	8	22,053	1,058,288	1,824,349
1999	46,000	639,000	Trace	1	965	889,561	1,575,527
2000	15,000	507,000	Trace	29	1,174	1,019,067	1,542,270
2001	25,000	526,000	0	61	788	1,247,305	1,799,154
2002	8,000	370,000	0	22	1,134	1,331,416	1,710,572
2003	14,600	411,200	0	24	1,653	1,491,356	1,918,833
2004	6,200	424,500	0	0	1,150	1,493,394	1,925,244
2005	4,400	446,800	0	0	1,622	1,483,398	1,936,220
2006	3,900	462,500	0	0	1,736	1,486,414	1,954,550
2007*		245,370	0	0	2,359	988,103	1,235,832

* US data through 11August 2007 and Russian data through 10 August 2007.

Sources of Data

U.S. Data, 1979-1992 from Pollock stock assessment document at 7th Annual Conference
1993-2006 data from web site: www.fakr.noaa.gov
Navarin Data, 1994-2001 (from Russian pollock stock assessment document presented by the Russian Party at the 6th annual conference in Poland)
Navarin Data, 1984-1993 (from The Aleutian Basin Pollock Stock in 2001 written by TINRO and presented at 6th annual conference)

Table 2. Estimated Biomass (mt) of Pollock in the Aleutian Basin region of the Convention Area based on assumption that the Bogoslof Survey biomass represents sixty percent of the Aleutian Basin biomass.

Year	Bogoslof Biomass from Surveys, mt	Basin Biomass (Extrapolated Biomass)	Catch mt	Exploitation Rate (%)
1984			181,200	?
1985			363,400	?
1986			1,039,800	?
1987			1,326,300	?
1988	2,396,000	3,993,333	1,395,900	35
1989	2,084,000	3,473,333	1,447,600	42
1990			917,400	?
1991	1,283,000	2,138,333	293,400	14
1992	888,000	1,480,000	10,000	1
1993	631,000	1,051,667	1,957	0
1994	490,000	816,667	0	0
1995	1,020,000	1,700,000	0	0
1996	582,000	970,000	0	0
1997	342,000	570,000	0	0
1998	432,000	720,000	0	0
1999	393,000	655,000	0	0
2000	270,000	450,000	0	0
2001	208,000	346,667	0	0
2002	227,000	378,333	0	0
2003	198,000	330,000	0	0
2004	No survey		0	?
2005	253,000	421,667	0	0
2006	240,000	400,000	0	0
2007	292,000	486,667	0	0

Table 3. Summary of Trial Fisheries on Pollock in the Central Bering Sea Donut Hole Area

Year	Dates	Nation	No. Vessels	Vessel Name	Vessel Days	Data Source (Annual Conference Report)	Catch (KG)	Catch Number
2006	Jul 20-Aug 20	Korea	1	Oriental Angel (Keuk Dong Co	6	11th	0.0	0
2006	Jul 20-Aug 20	Korea	1	Nambuk Ho (Nambuk Fish Co	9	11th	0.0	0
2006	Jul 22-Aug 22	Korea	1	Joosung Ho (Hansung Enterprise Co)	9	11th	0.7	1
2003	Mar 12-26	Korea	2	Man Jeck No. 21, O Yang Ho - 2	27	9th	2.6	2
2003	Oct - Nov	Korea	1	O-Ryong 503	15	9th	0.0	2
2003	Nov 15-27	Russia	1	Pioner Nikolayeva	13	9th	1.6	1
2001	Nov 11-14	China	2	Ming Zhu, Kai Feng	8	7th	0.0	0
2001	Jun 7 - Jul 14	China	1	Kai Tuo	38	6th	*~24.0*	16
2000	Jan 12 - Feb 3	Korea	1	Oriental Discoverer	23	5th	0.0	0
2000	May 11-20	Korea	1	Oriental Angel	10	5th	0.0	0
2000	May 20 - Jun 28	China	1	Kai Chuang	40	5th	*~64.5*	43
1999	Aug 17-30	Poland	1	Homar	14	5th	2.3	2
1999	Apr 29 - May 3	Poland	1	Acamar	5	4th	2.9	2
1998	Sep 3-8	Poland	1	Acamar	6	4th	3.3	2
1997	Oct 12-15	Poland	1	Acamar	4	Polish Delegation	0.0	0
1997	Aug 16-19	Russia	1	Vigo	4	2nd	0.0	0
1997	Jun & Aug	China	2	?	8	2nd	*< 900.0*	*< 600*
1996	?	China	1	?	?	2nd	?	?
1996	Sep 1-11	Poland	1	Acamar	11	Polish Delegation	244.2	184
1995	Oct 13 - Nov 10	Poland	1	Homar	29	Polish Delegation	?	12
1995	Oct 18 - Nov 12	Poland	1	Acamar	25	Polish Delegation	40.3	31
1993	Jul 2 - Sep 4	Poland	1	Adm. Arciszewski	63	Polish Delegation	627500	470,454
1993	Jun 6-14	Japan	1	?	9	unpub ms	?	?
1993	Jul 13-22	Japan	1	?	10	unpub ms	?	?
1993	Nov 12-17	Japan	1	?	6	unpub ms	?	?
1993	Dec 8-17	Japan	1	?	6	unpub ms	?	?

? indicates unknown

Italics indicate non-reported estimated numbers

Table 4. United States Pollock Catches in metric tons, 1993-2007

Year	E. Bering Sea	Aleutians	Bogoslof	Gulf of Alaska
1993	1,198,790	54,074	885	108,066
1994	1,197,224	53,224	556	110,890
1995	1,169,614	60,184	264	73,248
1996	1,102,579	26,597	389	37,106
1997	1,036,789	24,721	163	89,893
1998	1,058,288	22,053	8	123,805
1999	889,561	965	1	93,422
2000	1,019,067	1,174	29	23,643
2001	1,247,305	788	61	70,485
2002	1,331,416	1,134	22	50,712
2003	1,491,356	1,653	24	48,573
2004	1,493,394	1,150	50	60,929
2005	1,483,398	1,622	0	80,040
2006	1,486,414	1,736	0	68,950
Through 11 August 2007	988,103	2,359	0	32,516
Catch Quota for 2007	1,394,000	19,000	10	60,842
Remaining Quota	405,897	16,641	10	28,326

Note: (Data from http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm)

Table 5. Pollock assessment numbers determined for management of the U.S. 2007 pollock fisheries

Area	OFL	ABC	TAC	TAC/ABC
Eastern Bering Sea	1,640,000	1,394,000	1,394,000	1.00
Aleutians Region	54,500	44,500	19,000	0.43
Bogoslof	48,000	5,220	10	0.00
Gulf of Alaska	110,100	79,650	79,650	1.00

Notations: OFL = Overfishing Level, ABC = Acceptable Biological Catch, TAC = Total Allowable Catch

Table 6. Summary of more recent studies of genetic stock structure in walleye pollock
(Table compiled by Mike.Canino@noaa.gov)

Study	Area	Marker	Results
Mulligan et al. 1992	Eastern BS and GOA	mtDNA RFLP	significant genetic heterogeneity. Donut Hole and Bogoslov more similar than Adak or GOA
Shields and Gust 1995	BS, Aleutians, GOA	mtDNA sequence	no genetic heterogeneity among samples. Pooled samples Western BS differentiated from Eastern BS, Donut Hole (n = 8)
Kim et al. 2000	Korea -Bogoslov	mtDNA RFLP	no significant genetic heterogeneity
Olsen et al. 2002	Western north Pacific, Eastern BS, GOA, PWS	mtDNA RFLP allozyme microsatellites	east -west heterogeneity between Asian and N American populations regional heterogeneity among GOA samples (PWS vs SHEL) Discordant results between BS and GOA - significant differentiation observed with allozymes and mtDNA but in different years
O'Reilly et al. 2004	Western north Pacific, North Central BS, Eastern BS, GOA, Puget Sound	microsatellites	weak structuring (global F_{ST} = 0.004) genetic isolation by distance over moderate scales (~1500 km) sign. genetic differentiation between NCBS and GOA
Canino et al. 2005	Western north Pacific, North Central BS, Eastern BS, GOA, Puget Sound	pantophysin (*Pan* I) locus	stronger differentiation than observed with microsatellites (global F_{ST} = 0.038) north-south cline in *Pan* I allele frequencies correlated with water temperature North Central BS sample differentiated from Eastern BS and PWS sample
Grant et al. In press	reanalysis of mtDNA data from first 4 studies above, plus new mtDNA sequence data from Puget Sound	mtDNA	Five haplotypes gave range of F_{ST} estimates from 0.011-0.058. most common haplotype showed north-south cline and was correlated with water temperature and geographic distance haplotype numbers and homozygosity revealed widespread departures from neutrality, suggesting the effects of temperature-mediated selection in the EBS and North Pacific

Approaches for setting ABC in the Bogoslof Region under US Fishery Management practices

August 2007

James Ianelli
AFSC NMFS/NOAA
Seattle WA 98115

Stock status summary

The National Marine Fisheries Service has conducted echo-integration-trawl (EIT) surveys for Aleutian Basin pollock spawning in the Bogoslof Island area annually since 1988, with three exceptions: a Bogoslof Island area EIT survey was not conducted in 1990, 2004 and in 1999 the survey was conducted by the Fisheries Agency of Japan. The annual Bogoslof Island area EIT survey results (Fig. 1) suggest that the spawning population can be described in three periods with regards to geographic distribution, dominant year class, and total biomass. In the first period,1988-93, pollock covered a wide area surrounding Bogoslof Island and the population was dominated by the 1978 year class. The average estimated biomass in the “specific area” was 1.456 million t. During the second period, 1994-99, the primary spawning location shifted to inside Samalga Pass, and the population was dominated by the 1989 year class. The average estimated biomass declined to 0.543 million t. During the third period, 2000-present, the primary spawning locations were Samalga Pass and to a lesser extent, northeast Umnak Island. Year-class dominance has alternated between the 1989 and younger year classes (1992, 1996, and 2000) and the average biomass is about 0.241 million t (Honkalehto et al 2005).

The 1989 year class moved into the Bogoslof Island area and was partly responsible for the 1995 increase (Fig. 2), but the abundance of all ages increased between 1994 and 1995. The decrease between 1995 and 1996 was followed by a continued decline in 1997. This suggests that the 1995 estimate may have been over-estimated, or that conditions in that year affected the apparent abundance of pollock. The summary Bogoslof Island area EIT survey biomass estimates, 1988-2007, are shown in Table 1. The 2006 Bogoslof EIT survey shows a 38% increase in the numbers of pollock under 50 cm FL from the 2005 survey with the largest increase in fish between 43 and 49 cm FL. This size range is consistent with the large 2000 year class observed in the 2005 and 2006 age data. The 2007 survey saw an additional increase in the proportion of fish greater than 50 cm FL and is believed to reflect the continued growth of the 2000 year class and low recruitment in the latter year classes. The current population levels on the eastern Bering Sea shelf, and the absence of extremely large year classes, suggests that pollock distribution throughout the Bering Sea has shifted. The extent that this is due to environmental causes is unclear.

The information available for pollock in the Aleutian Basin and the Bogoslof Island area indicates that these fish belong to the same “stock”. The pollock found in winter surveys are generally older than age 5 and are considered distinct from eastern Bering Sea pollock. Data on the age structure of Bogoslof-Basin pollock show that a majority of pollock in the Basin originated from year classes that were also strong on the shelf, 1972, 1978, 1982, 1984, 1989, 1992, 1996, and 2000 (Fig. 3). There has been some indication that there are strong year classes appearing on the shelf that have not been coincidentally as strong (in a relative sense) in the Bogoslof region (Ianelli et al., 2001). The conditions leading to strong year classes of pollock in the Basin appears to be density related and may be functionally related to abundance on the shelf. Additional information relating the total mortality of the 1992 cohort shows that the estimate is much higher than expected in the Bogoslof region compared to the EBS shelf (Fig. 4).

Differences in spawning time and fecundity have been documented between eastern Bering Sea pollock and Aleutian Basin pollock. Pollock harvested in the Bogoslof Island fishery (Area 518) have noticeably different age compositions than those taken on the eastern Bering Sea shelf. For example, the average number of age 15 and older pollock observed from the Bogoslof EIT survey since 1988 is 18% while for the same period in the EBS region, age 15 and older averages only 2% (by number for all fish older than age 7). Pollock in the northern shelf have a similar size at age as Aleutian Basin pollock although a very different age composition. However, Aleutian Basin pollock may not be an independent stock. Very few pollock younger than 5 years old have ever been found in the Aleutian Basin including the Russian portion. Recruits to the basin are coming from another area, most likely the surrounding shelves either in the US or Russian EEZ.

Computation of ABC and OFLs

Since 1999 the North Pacific Fishery Management Council (NPFMC) has generally been presented with a number of alternative methods for computing ABC values for the Bogoslof region. These have included:

1) Using a biomass-adjusted harvest rate rule (with 2,000,000 ton estimate as a target stock size) with an estimate of a F_{ABC} based on growth, natural mortality, and maturation rate.

2) Using a harvest rate as a simple fraction of natural mortality rate (e.g., $F_{ABC} = 0.75M$) .

3) An approach using a simple age-structured model.

The NPFMC Science and Statistical Committee (SSC) considered the third approach using an age-structured model to be inappropriate since it covered only part of the stock. The approach 1) and 2) above are provided below for comparison (along with alternative assumptions about F_{ABC} level for 1). The section included in this document reviews the details of the current NPFMC's Tier system for setting ABCs and OFLs.

Using method 1) above and given the survey estimate of exploitable biomass of 0.292 million t and M = 0.2 and considering of a target stock size of 2 million tons, the F_{ABC} level is computed as:

$$F_{abc} \le F_{40\%} \bullet \left(\tfrac{B_{2007}}{B_{40\%}} - 0.05\right) \Big/ \left(1 - 0.05\right)$$

Assuming that $F_{40\%} = 0.27$ (as in past assessments), this gives a fishing mortality rate of 0.0273 that translates to an exploitation rate of 0.0269. This value multiplied by 292,000 t, gives a **2008 ABC of 7,967 t for the Bogoslof region.** The value assumed for $F_{40\%}$ that is critical for this calculation was based on uncertain assumptions about selectivity, natural mortality, growth, and maturation. Some of these assumptions were reevaluated here using a simple knife-edged selectivity at age 4 and age 5. Female pollock were specified to be 50% mature by age 5 and immature for younger pollock and 100% mature for older pollock with a natural morality of 0.3. This results in an $F_{40\%}$ level of 0.22 for age-4 knife edge assumption and $F_{40\%} = 0.33$ for the age-5 knife-edge assumption. These two scenarios provide ABCs for 2008 that would be 6,492 t or 9,737 t for the age-4 and age-5 knife edge assumptions, respectively. Clearly, these rules are sensitive to assumptions about expected selectivity, assumed growth, natural mortality, and maturation rates.

The approach for computing ABC levels under 2) above (a Tier 5 computation) simply uses the most recent survey biomass estimate applied to an adjusted natural mortality. Given a value of $M=0.3$ then the ABC level would be (2007 survey biomass $\times M \times$ 0.75) of **65,700 t** at a biomass of 292,000 t. With $M = 0.2$, the ABC would be 43,800 t.

Further work on developing a simple age-structured model tuned to the EIT winter survey data (Fig. 5) suggest that, by the same NPFMC rules used for setting groundfish ABCs, the current Bogoslof stock size is about 75% of the target level ($B_{40\%}$) and that the "unfished" level (given observed recruitment at age 6 to this region) is approximately 330,000 t (female spawning biomass). This is substantially lower than the 1 million t "target" currently in use. Forward simulations using this model result (and fishing using the maximum permissible ABC) shows that the 90 percentile range of female SSB is between about 50,000 t and 430,000 t while under a no-fishing scenario, this range increases to nearly 1 million t (Fig. 6). This reflects the main characteristic that seems to prevail for basin pollock: they are highly susceptible to year-class variability.

In summary, there is a range of ABC levels that have been calculated under the NPFMC guidelines. The second approach results in the highest ABC level since the levels are not adjusted by some perceived target level. The first approach results in ABC levels that are nearly an order of magnitude lower due to the built-in adjustment to recover stock sizes to a target level. This approach was sensitive to assumptions about selectivity (and maturation rates). The age-structured model, while not accepted by the SSC due to stock structure concerns, could be argued to represent an alternative method to set ABCs and subsequent TACs. In practice, all of these approaches undergo scientific review each year in light of available data. The NPFMC has a record of being very conservative and setting a low ABC level and NMFS has responded by prohibiting any directed pollock fishery in this region.

Literature cited

Honkakehto, T., D. McKelvey, and N. Williamson. 2005. Results of the March 2005 echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) in the southeastern Aleutian Basin near Bogoslof Island, Cruise MF2005-03. AFSC Processed Rep. 2005-05, 37 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle WA 98115.

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 1:1-105.

Ianelli, J.N.,S. Barbeaux, G. Walters, T. Honkalehto, and N. Williamson. 2004. Bering Sea-Aleutian Islands Walleye Pollock Assessment for 2004. *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 1:37-126. http://www.afsc.noaa.gov/refm/docs/2004/EBSpollock.pdf

Table 1. Biomass of pollock as surveyed in the Bogoslof region, 1988-2005. Note that in 1999 the Fishery Agency of Japan conducted the survey.

Biomass (millions of t)

Year: 1988	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
2.4	2.1	-	1.3	0.9	0.6	0.49	1.1	0.68

Year: 1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
0.39	0.49	0.48	0.30	0.23	0.23	0.20	-	0.253

Year: 2006	**2007**
0.24	0.29

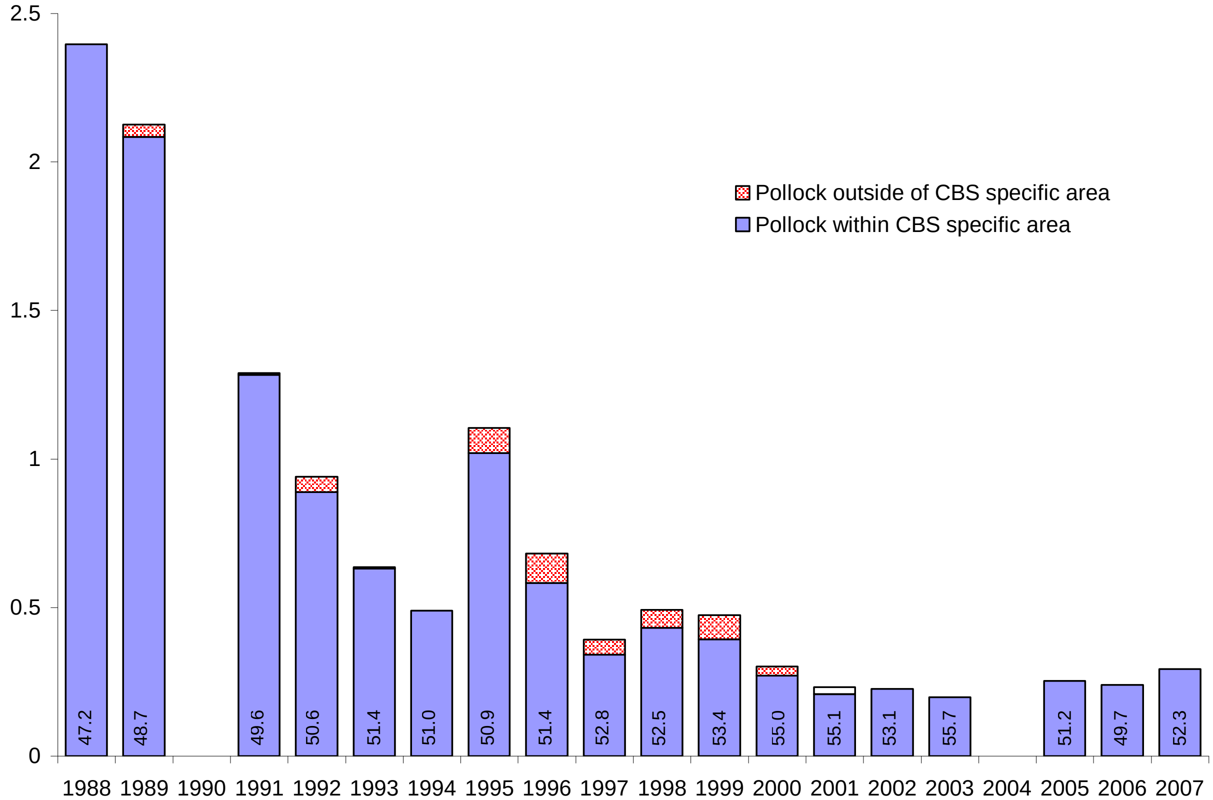


Figure 1. Pollock biomass estimates from the 1988-2005 Bogoslof Area EIT surveys in millions of tons. There were no surveys in 1990 and in 2004.

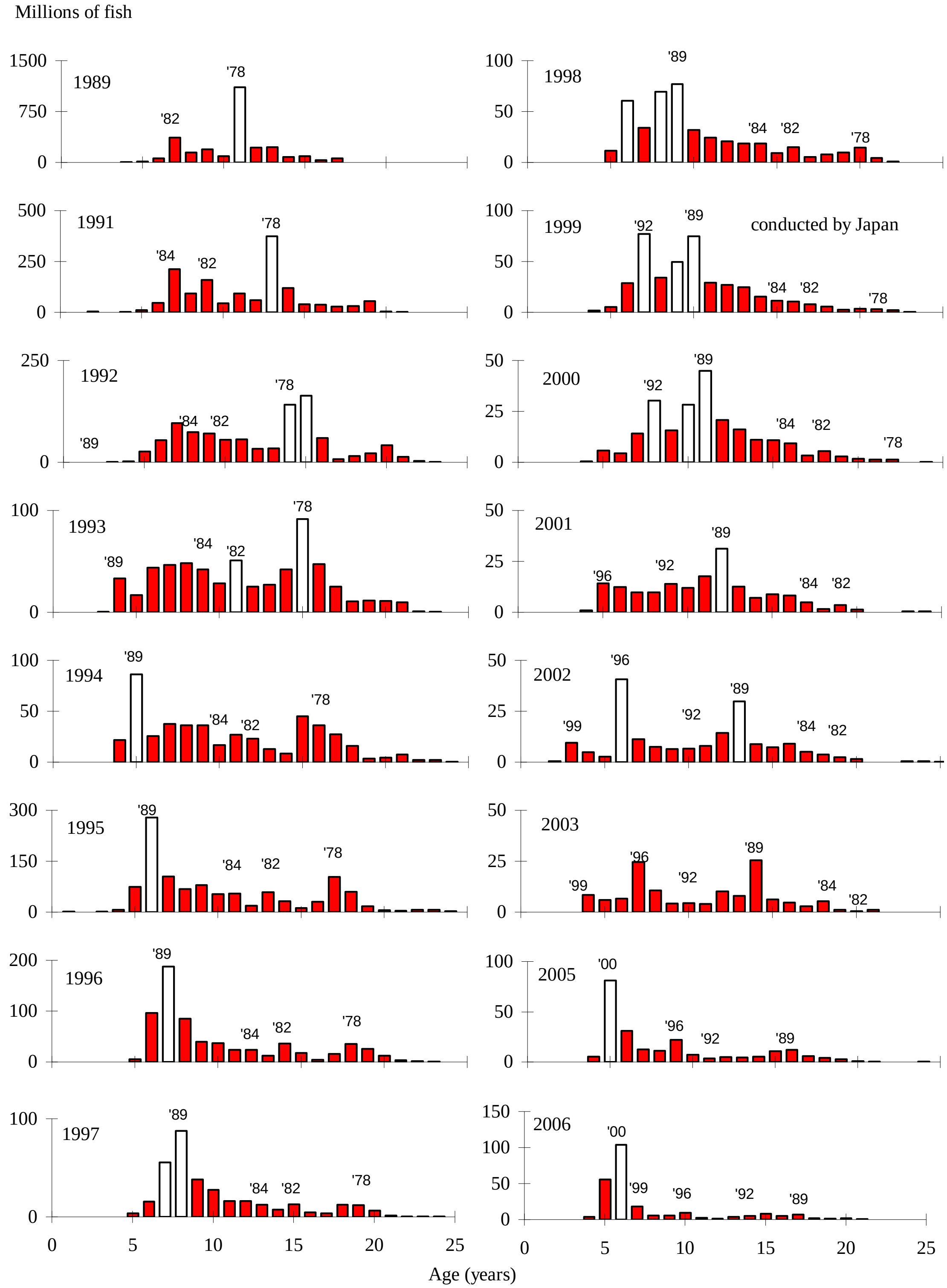


Figure 2. Numbers-at-age estimates (millions) obtained during echo integration-trawl surveys of walleye pollock near Bogoslof Island in winter 1988-2006. Major year classes are indicated. The United States conducted all but the 1999 survey (Japan). No survey was conducted in 1990. Note y-axis scales differ.

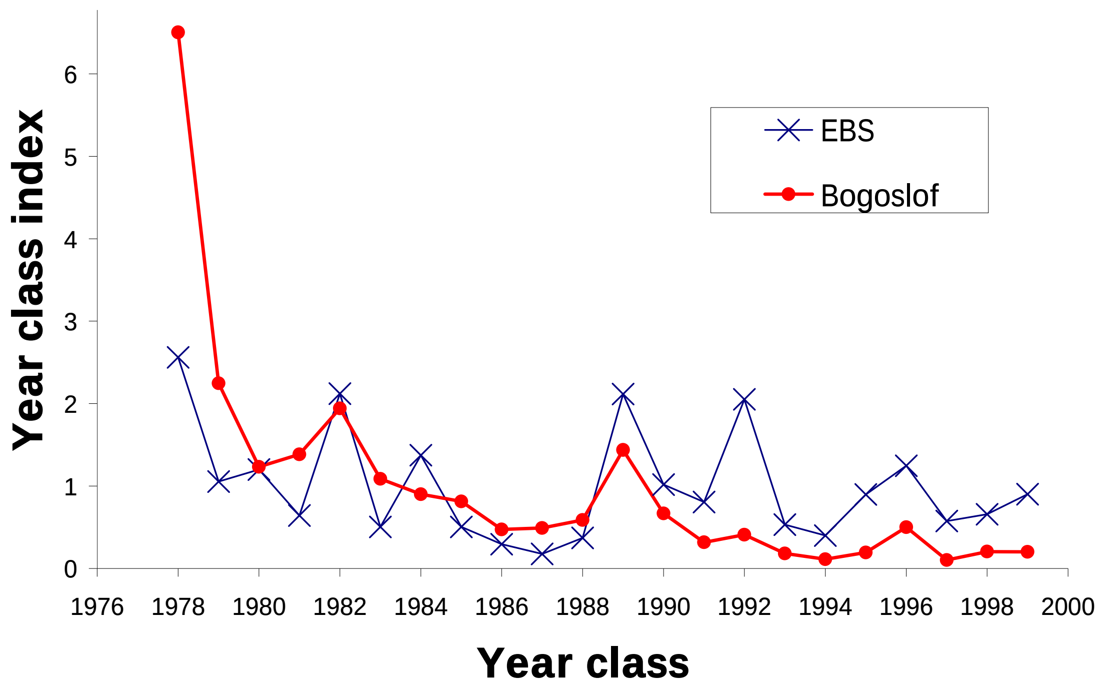


Figure 3. Relative year-class strengths (normalized to have a mean value of 1) for pollock as observed (averaged) from the Bogoslof EIT surveys and from a simple age-structured model for the Bogoslof Island stock compared with those observed from the main EBS pollock stock assessment model (Ianelli et al. 2004).

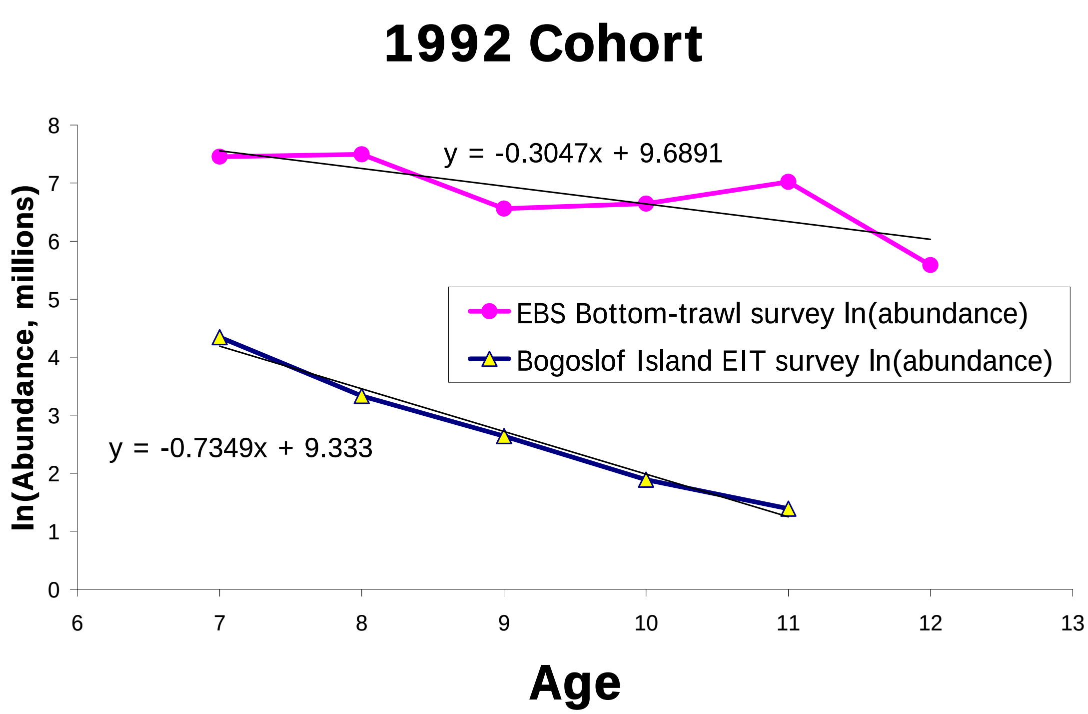


Figure 4. The 1992 pollock cohort abundances-at-age as observed from the EBS summer bottom trawl survey (top lines) and from the EIT survey in the Bogoslof region (lower lines).

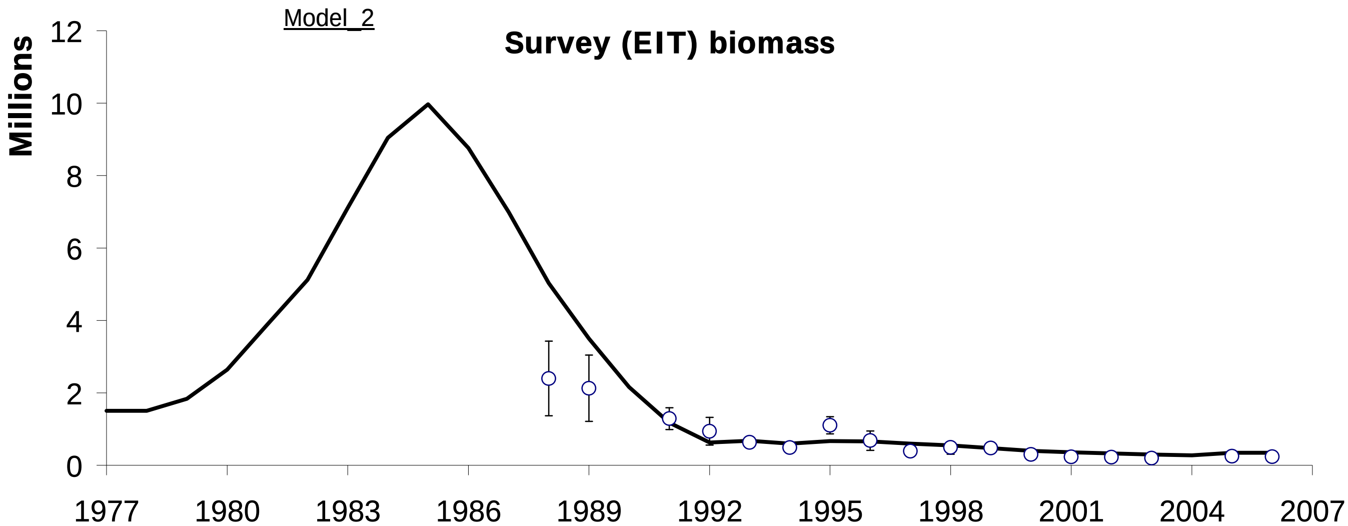


Figure 5. Simple age-structured model (line) tuned to the winter EIT Bogoslof pollock survey biomass estimates (points) 1984-2006.

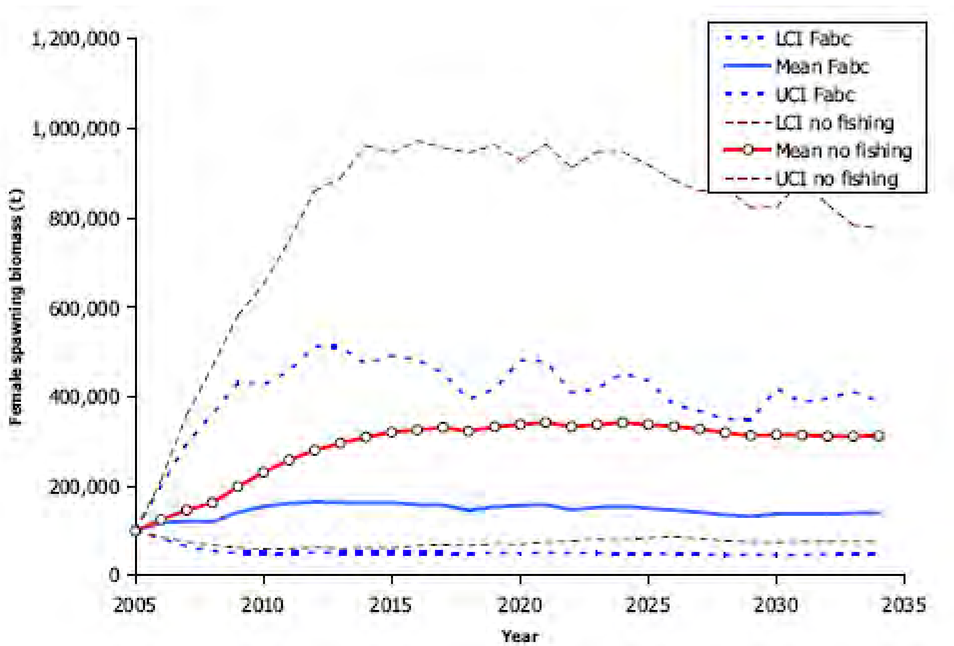


Figure 6. Projection simulations for Bogoslof region pollock based on the simple age structured model under no fishing and under fishing at the maximum permissible rate (as defined for the NPFMC for Tier 3 stocks).

Update on the status of Eastern Bering Sea pollock

August 2007

James Ianelli and Steve Barbeaux
AFSC NMFS/NOAA
Seattle WA 98115

The following is partly extracted from Ianelli et al. (2006). See http://www.afsc.noaa.gov/refm/docs/2006/EBSpollock.pdf for further details.

The pollock fishery in the Eastern Bering Sea (EBS) has averaged 1.41 million t of catch from 2000-2005 and stock levels have been above average. As the stock declines to average (or below) levels, the TAC and catch is anticipated to also decline as shown in the 2005 stock assessment (Ianelli et al. 2005).

In the summer of 2007, bottom trawl and echo-integration trawl surveys where conducted in the eastern Bering Sea and preliminary indications reflect the expected declines from recent high levels of pollock biomass. The biomass estimate from the 2005 NMFS summer bottom-trawl survey was 5.134 million tons, up 37% from the 2004 estimate of 3.756 million t. The 2006 bottom-trawl survey value was 2.85 million t down 44% from the 2005 estimate. The 2007 bottom-trawl values are not yet available for publication. The bottom temperatures collected from the 2006 and 2007 surveys indicate colder conditions than in recent years and the extent of the “cold pool” was greater in 2007 than 2006 (Fig. 1). This is thought to affect the distribution of pollock in the EBS (Fig 2, Fig. 3, and Fig. 4). The 2006 biomass estimate from echo-integration trawl survey indicates about 1.56 million t, down from 3.3 million t estimated in 2004 but only about 13% lower than the value projected in the 2005 assessment. Preliminary results from the 2007 echo-integration trawl survey shows levels slightly higher than the 2006 biomass estimates (2.0 to 2.15 million t). The 2007 survey found a larger proportion of the pollock biomass further north and west 83% of survey total was west of 175° W. Stock levels for EBS pollock appear to be lower overall than estimated in 2006 and is likely a result of the uncertainty and relative age distribution of biomass (Fig. 5). The 2000 year class appears to be above average and the main age group available to the fishery. Subsequent year classes are currently estimated to be below average and apparently result in further short-term declines in abundance (Fig. 6). Projections indicate the ABC will be around 0.9 million t by 2008 (Fig. 7). While current stock levels are quite high, given the expected recruitment and array of year-classes available to this fishery, the stock is expected to decline in the next few years to below target levels.

The 2007 Fishery

Preliminary results for the 2007 fishery indicate that production rates were lower than in the most recent three years. Winter catch rates were similar to that observed in 2003, but summer catch rates appear to be lower than even the 2003 season (Fig. 8).

Ecosystem Considerations

Currently, scientists at the AFSC are working on multi-species models and ecosystem indicators to provide additional information useful for managing groundfish fisheries in the U.S. EEZ. In comparisons of the Western Bering Sea (WBS) with the Eastern Bering Sea using mass-balance food-web models based on 1980-85 summer diet data, Aydin et al. (2002) found that the production in these two systems is quite different. On a per-unit-area measure, the western Bering Sea has higher productivity than the EBS. Also, the pathways of this productivity are different with much of the energy flowing through epifaunal species (e.g., sea urchins and brittlestars) in the WBS whereas for the EBS, crab and flatfish species play a similar role. In both regions, the keystone species in 1980-85 were pollock and Pacific cod. This study showed that the food web estimated for the EBS ecosystem appears to be relatively mature due to the large number of interconnections among species. In a more recent study based on 1990-93 diet data (Fig. 9). This study showed that the food web estimated for

the EBS ecosystem appears to be relatively mature due to the large number of interconnections among species. The diet of pollock is similar between adults and juveniles with the exception that adults become more piscivorous (with consumption of pollock by adult pollock representing their third largest prey item; Figs. 10). In terms of magnitude, pollock cannibalism may account for 2.5 million t to nearly 5 million t of pollock consumed (based on uncertainties in diet percentage and total consumption rate; Fig. 11).

In 2006 the EIT survey found an unusually low level of “other” backscatterers in the water column based on summaries of the data from acoustic-trawl surveys of the eastern Bering Sea shelf conducted in June-July of 1999, 2000, 2002, 2004 and 2006 (Fig. 12). They represent 38-kHz acoustic backscatter (sA, m2/nmi2) attributed to an undifferentiated invertebrate-fish species mixture, along with unidentified fish. For the 1999, 2000 and 2002 surveys, backscatter was measured between 14 m from the surface and 0.5 m off the bottom; in 2004 and 2006, it was measured between 12 m from the surface and 0.5 m off the bottom. These data should be interpreted with care because the exact biological composition of the non-pollock scatterers is unknown. Additionally, classification of non-pollock backscatter was not necessarily always performed as rigorously as classification of pollock, so non-pollock backscatter may contain small amounts of non-biological scatter. Trawl data suggest that biological components include jellyfish such as Chrysaora sp., macrozooplankton, age 0 pollock, and other fishes. Some scatterers, such as swimbladdered fishes and large medusae, are more easily detected at 38 kHz than small and poorly reflective organisms such as macrozooplankton (e.g. copepods and euphausiids). Because these scatterers all reflect sound at different target strengths, comparison of backscatter both within and between years is not strictly possible. However, it is obvious from the data presented below that the contribution from non-pollock scatterers in 2006 was quite a bit lower than that of preceding years. This suggests that the ecosystem, particularly in the southeastern region of the EBS, was anomalously different in the summer of 2006, although the nature of the difference cannot be inferred from these data. The impact of this is unknown but should continue to be closely monitored.

Furthermore, several other ecosystem indicators may give cause for concern. Zooplankton and non-pollock forage have been anomalously low in respective surveys. While cannibalism still occurs within age-0 pollock, cannibalism on age 1s by larger pollock has dropped since 1997 and may no longer be a main source of natural mortality for larger pollock.

Moreover, the impact of non-cannibalistic predation may have shifted considerably in recent years. In particular, the increasing population of arrowtooth flounder in the Bering Sea is worth examining, especially considering the large predation caused by these flatfish in the Gulf of Alaska. Overall, the total non-cannibal groundfish predator biomass has gone down in the Bering Sea according to current stock assessments, with the drop of Pacific cod in the 1980s exceeding the rise of arrowtooth in terms of biomass. This also represents a shift in the age of predation, with arrowtooth flounder consuming primarily age-2 pollock, while Pacific cod primarily consume larger pollock, according to length frequencies in summer diet data (Fig. 13). However, the dynamics of this predation interaction may be quite different than in the Gulf of Alaska. A comparison of 1990-94 natural mortality by predator for arrowtooth in the Bering Sea and the Gulf of Alaska shows that arrowtooth are truly a top predator in the Gulf of Alaska. However, in the Bering Sea, pollock, skates, and sharks all prey on arrowtooth, giving the species a relatively high predation mortality (Fig 14).

The predation on small arrowooth by large pollock gives rise to a specific concern for the Bering pollock stock. Walters and Kitchell (2001) describe a predator/prey system called “cultivation/depensation” whereby a species such as pollock “cultivates” its young by preying on species that would eat its young (for example, arrowtooth, Fig. 15). If these interactions are strong, the removal of the large pollock may lead to an accelerated decline, as the control it exerts on predators of its recruits is removed—this has been cited as a cause for a decline of cod in the Baltic Sea in the presence of herring feeding on cod young (Walters and Kitchell 2001). In situations like this, it is possible that predator culling (e.g. removing arrowtooth) may not have a strong effect towards controlling predation compared to applying additional caution to pollock harvest and thus preserving this natural control. At the moment, this concern for Bering Sea pollock is qualitative; we are currently collaborating in the development of a detailed, age-structured, multispecies statistical model (MSM; Jurado-Molina et al. 2005) to more completely model this complex interaction for pollock and arrowtooth; this model will be applied to the question in the near future.

Figures

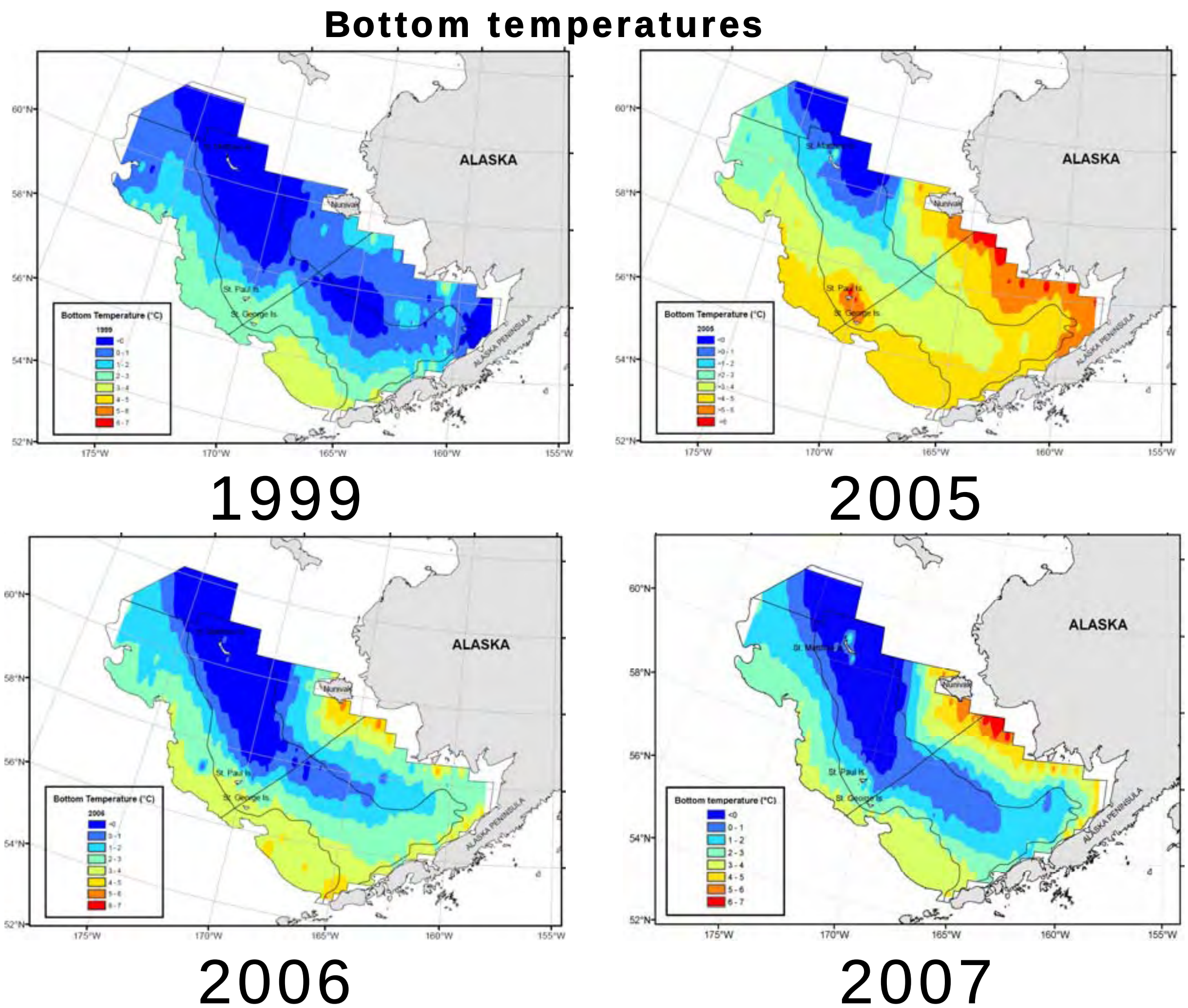


Figure 1. Summer bottom-temperature distributions observed during NMFS AFSC's bottom-trawl surveys for 1999 (the coldest year since 1982) compared to 2005, 2006, and 2007. Figure courtesy of Bob Lauth, NMFS Seattle.

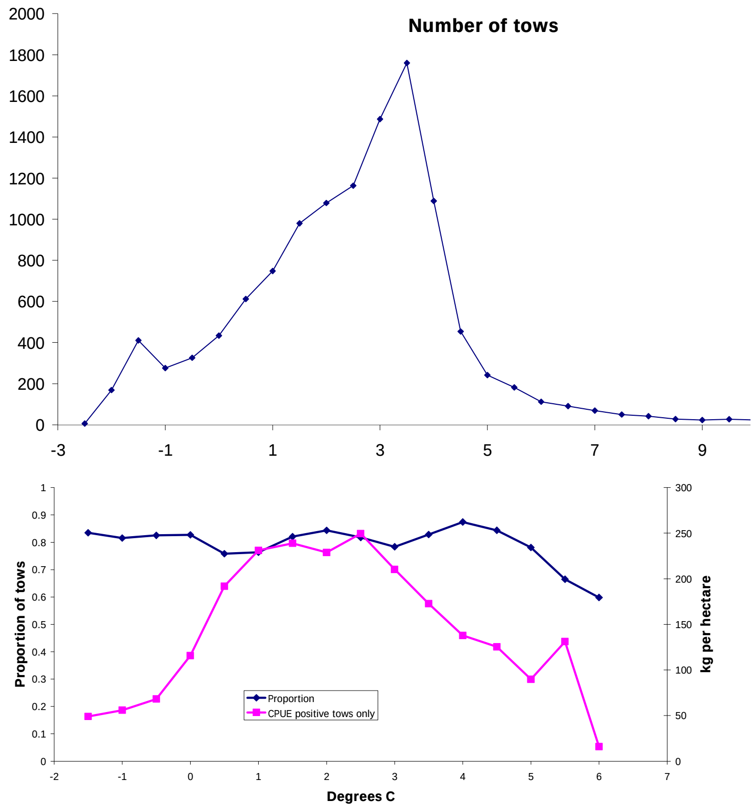


Figure 2. Numbers of EBS summer bottom-trawl survey tows with temperature (top panel) and proportion of those tows with pollock and the CPUE in kg per hectare (bottom panel) for all years, 1982-2006.

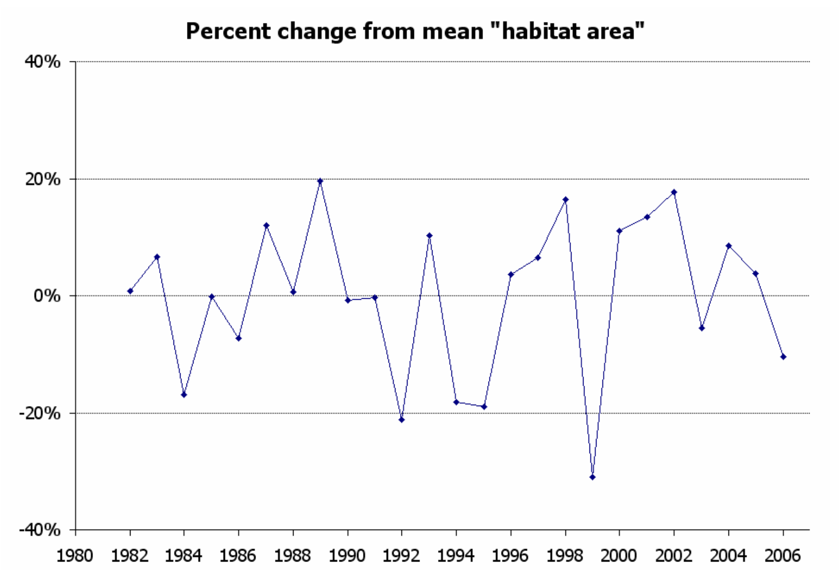


Figure 3. Index of suitable habitat area defined as the area of the bottom between the 0.5° and 4.5°C isotherms.

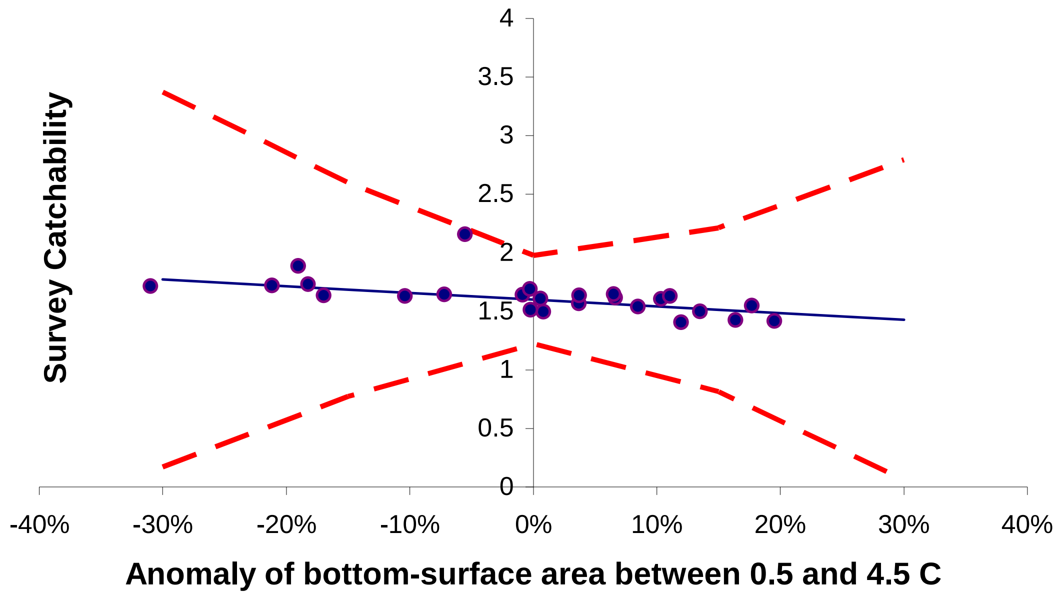


Figure 4. Estimated relationship between pollock bottom-trawl survey catchability and relative change in bottom surface area between 0.5° and 4.5° C (solid line). Values along horizontal axis were normalized to have a mean of 0.0 as under Model 4. Points represent residuals relative to survey estimates (i.e., $\hat{q}_t + \ln\left(\hat{I}_t / I_t\right)$ where $\hat{I}_t$ and I_t represent the predicted and observed survey indices respectively and $\hat{q}_t$ is the expected catchability given the surface area anomaly in year *t*. Dashed lines represent $\pm$ two standard deviations of the prediction given surface area anomaly. The largest positive outlier is from the 2003 survey year when the BTS estimate was over 8 million t.

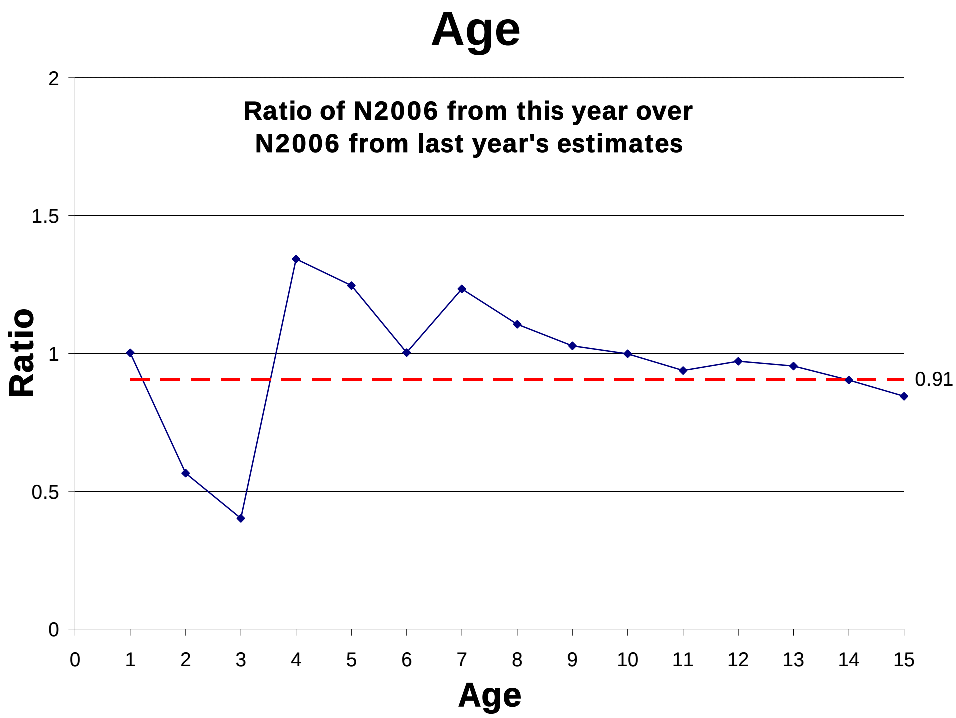


Figure 5. Estimates of the projected 2006 (from the 2006 EBS pollock assessment) compared to the estimates of the projected 2006 from the 2005 EBS stock assessment.

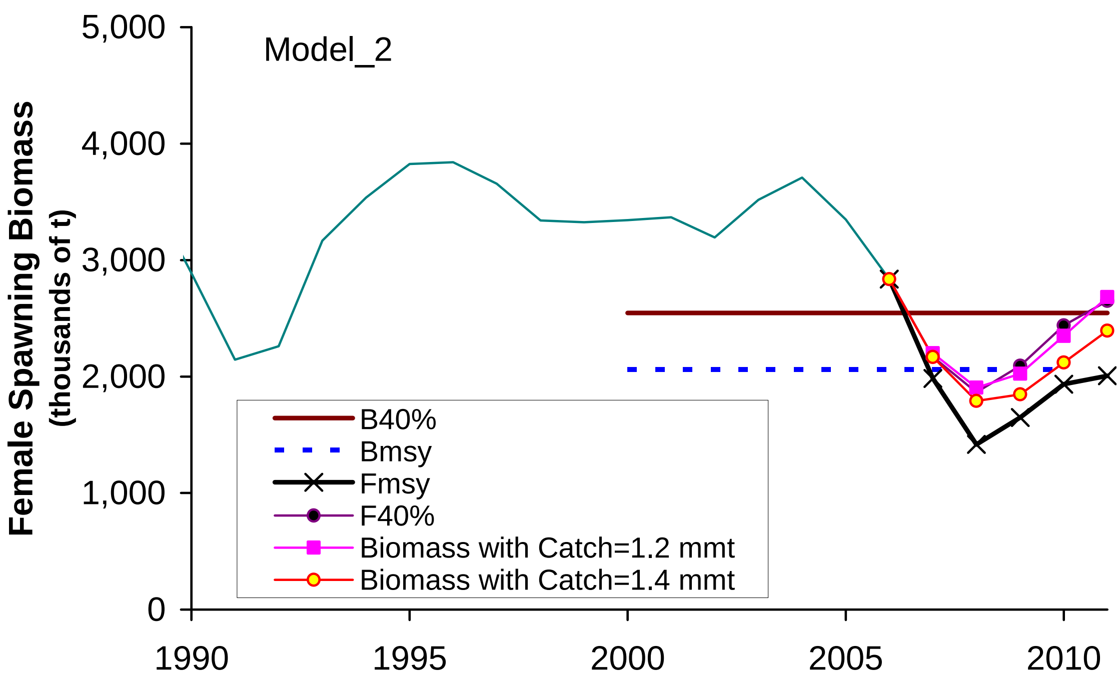
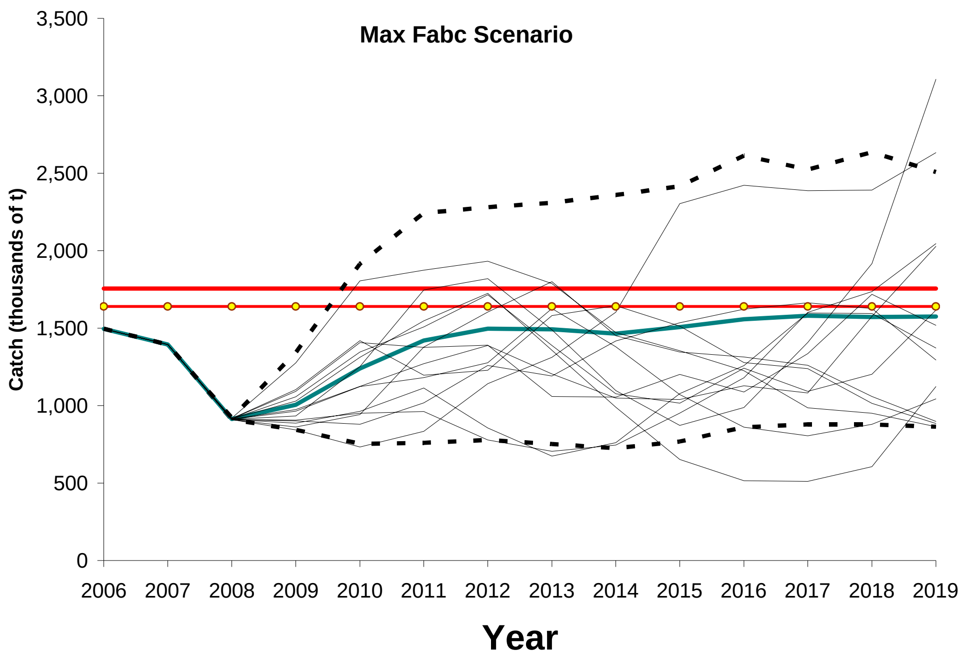


Figure 6. EBS walleye pollock female spawning biomass trends, 1990-2011 as estimated by Model 2 under different 2006-2010 harvest levels. Note that the F_{msy} catch levels represent unadjusted arithmetic mean fishing mortality rates. Horizontal solid and dashed lines represent the B_{msy}, and $B_{40\%}$ levels, respectively.



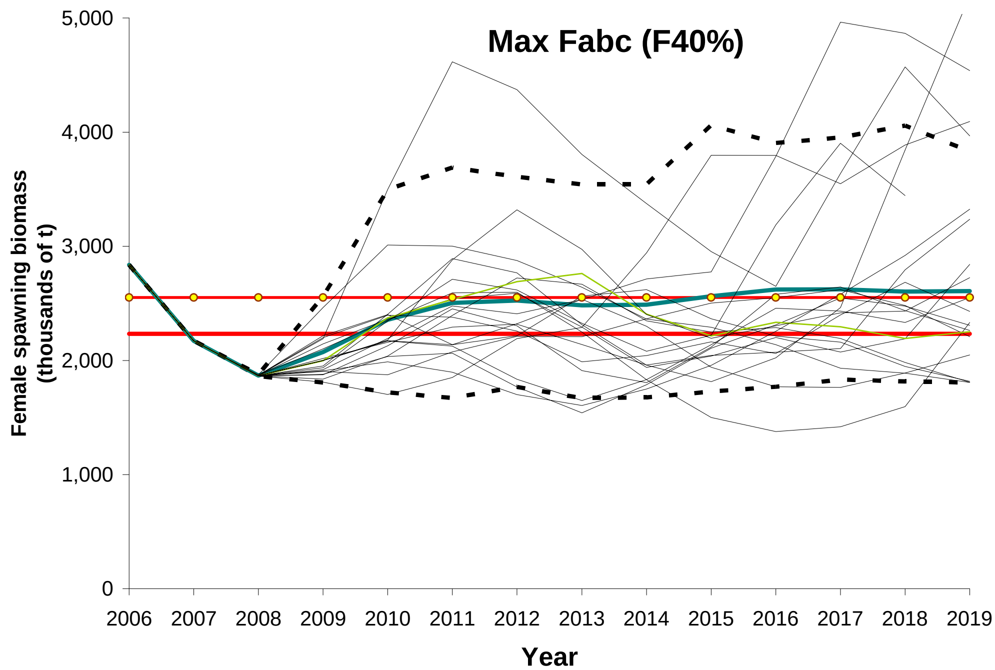
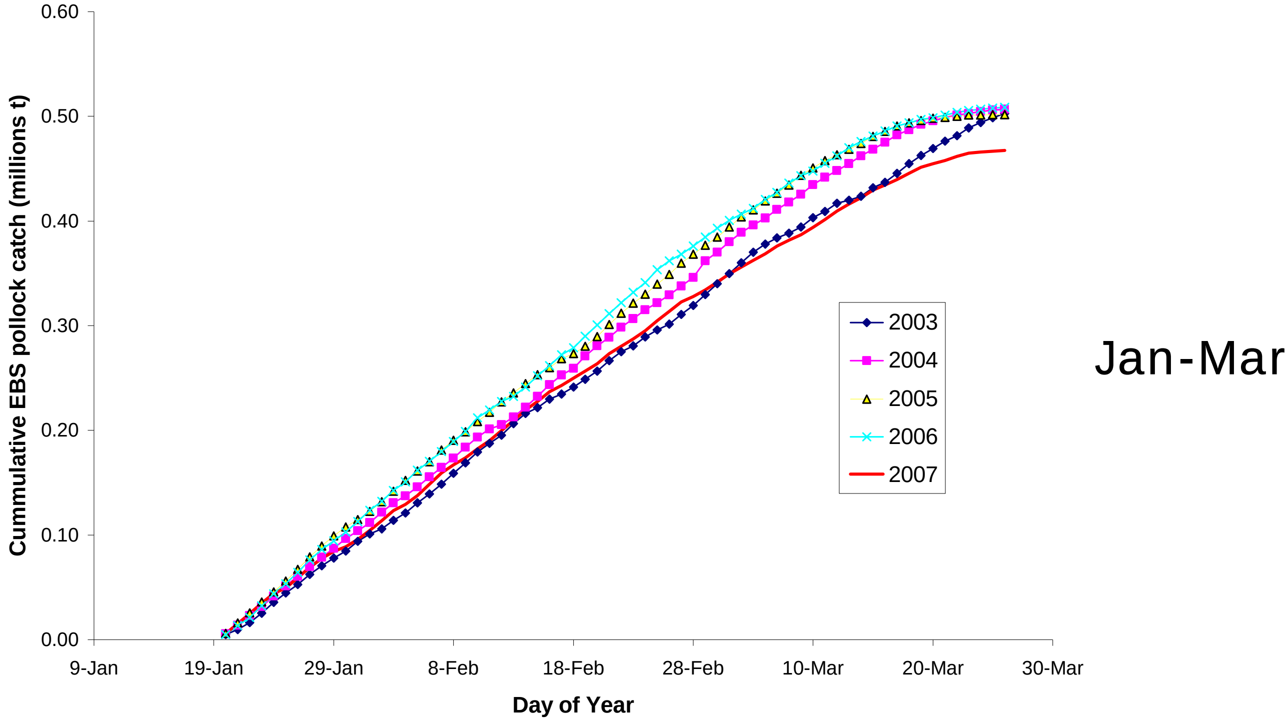


Figure 7. Projected EBS walleye pollock **yield** (top) and **Female spawning biomass** (bottom) relative to the long-term expected values under $F_{35\%}$ and $F_{40\%}$ (horizontal lines) for **Model 2**. $B_{40\%}$ is computed from average recruitment from 1978-2005. Future harvest rates follow the guidelines specified under Scenario 1, max F_{ABC} assuming $F_{ABC} = F_{40\%}$.



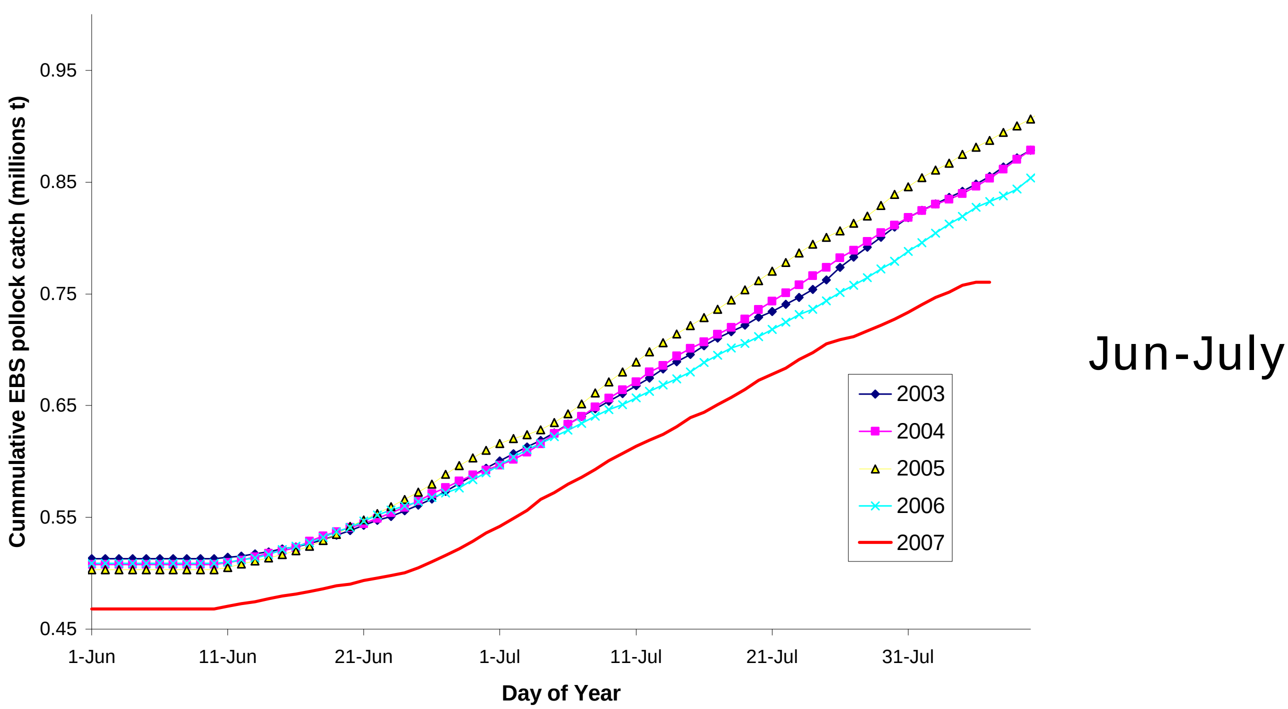


Figure 8. Cumulative catch levels for 2007 compared to recent years for the first season (top) and early summer season (bottom) based solely on observer data.

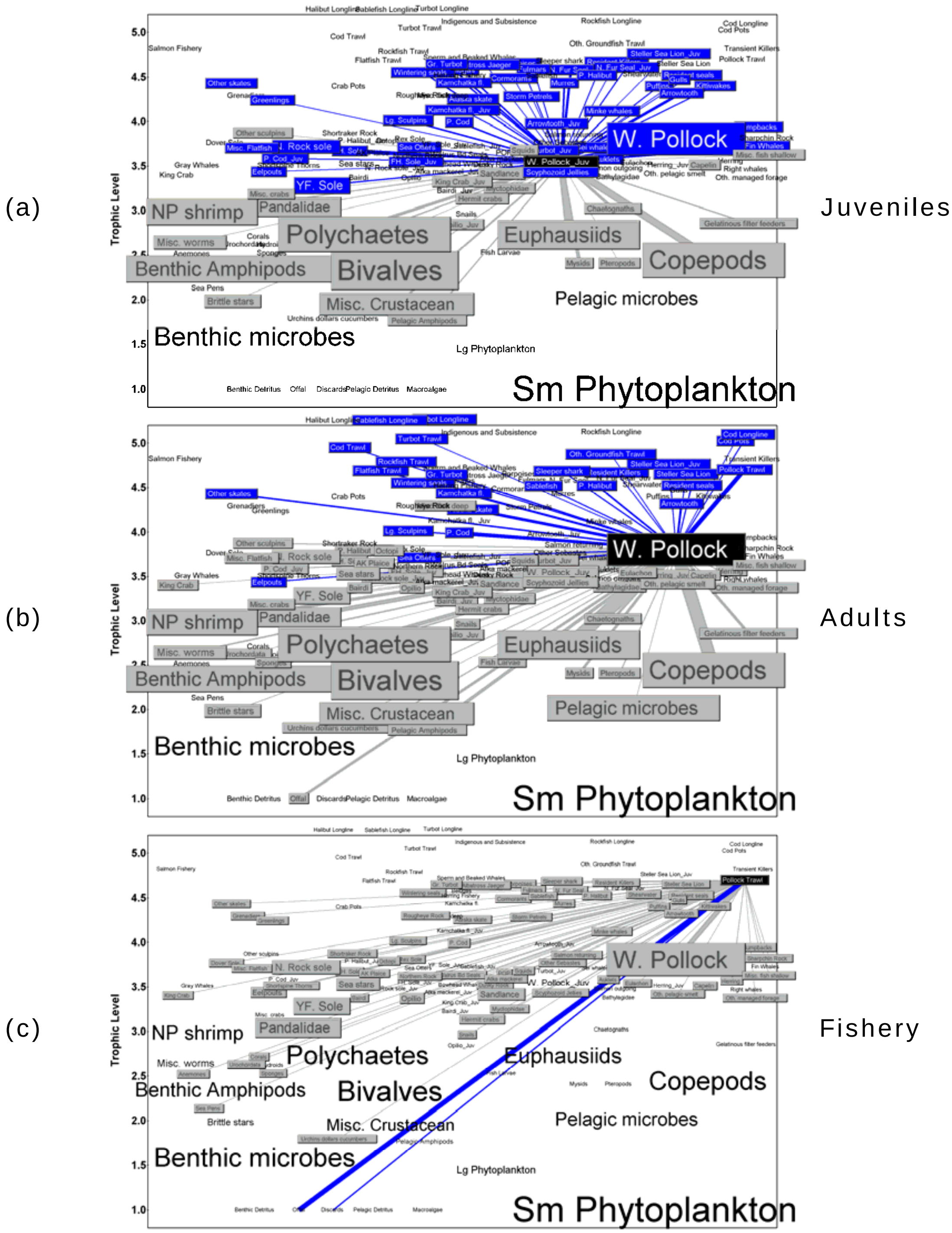


Figure 9. Food web pathways for the EBS region based on data from 1990-1994 emphasizing the position of EBS pollock juveniles (a), adults (b) and the pollock fishery (c). Outlined species and fisheries represent predators of pollock (dark box with light text) and prey of pollock (light boxes with dark text). Labels without boxes indicate no direct connection. Box and text size is proportional to each species' standing stock biomass, while the widths are proportional to the consumption between boxes (tons/year).

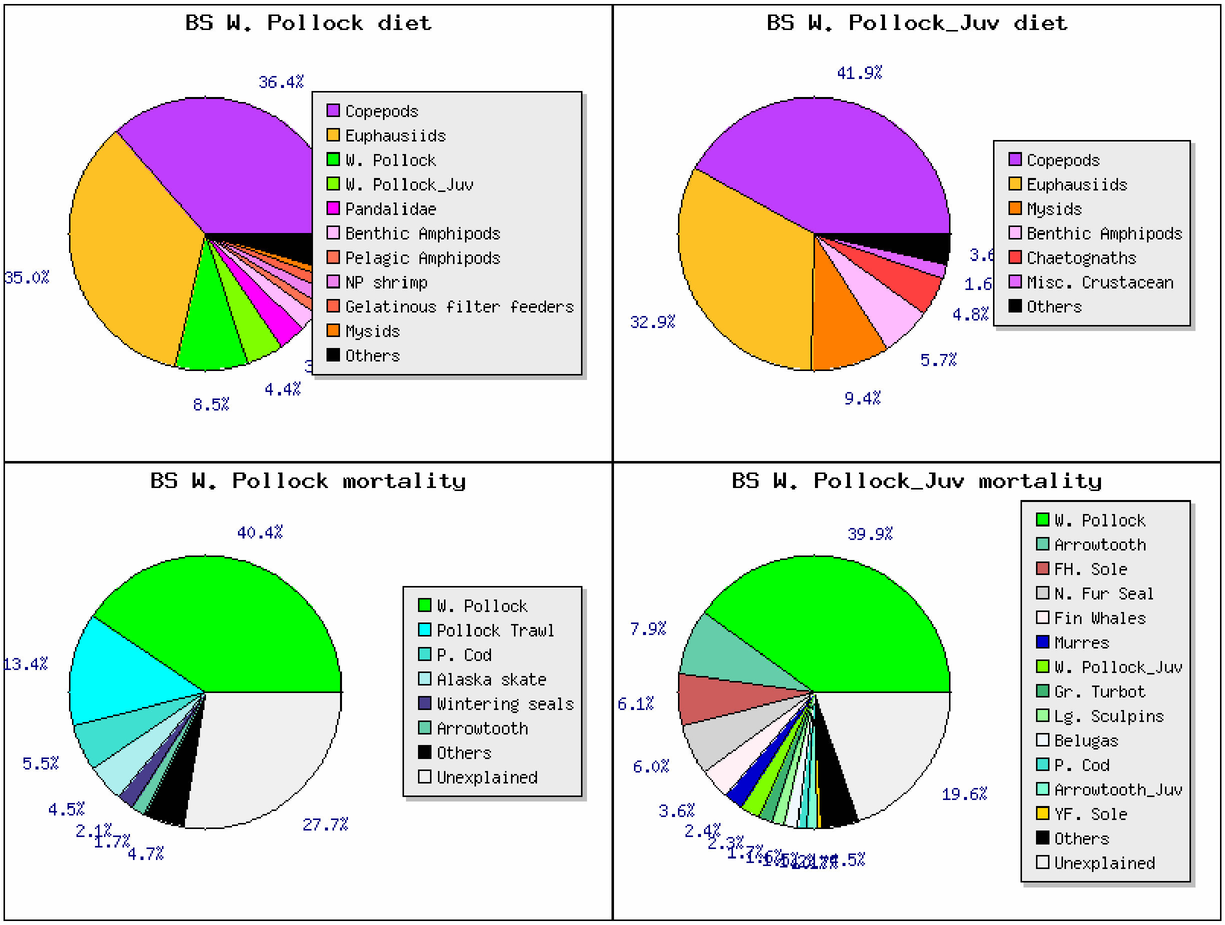


Figure 10. Diet (top) and mortality sources (bottom) for EBS pollock adults (left) and juveniles (right) based on data from 1990-1994. “Unexplained” mortality is the difference between the stock assessment total exploitation rate averaged for 1990-1994, and the predation and fishing mortality, which are calculated independently of the assessment, using predator diets, consumption rates, and fisheries catch.

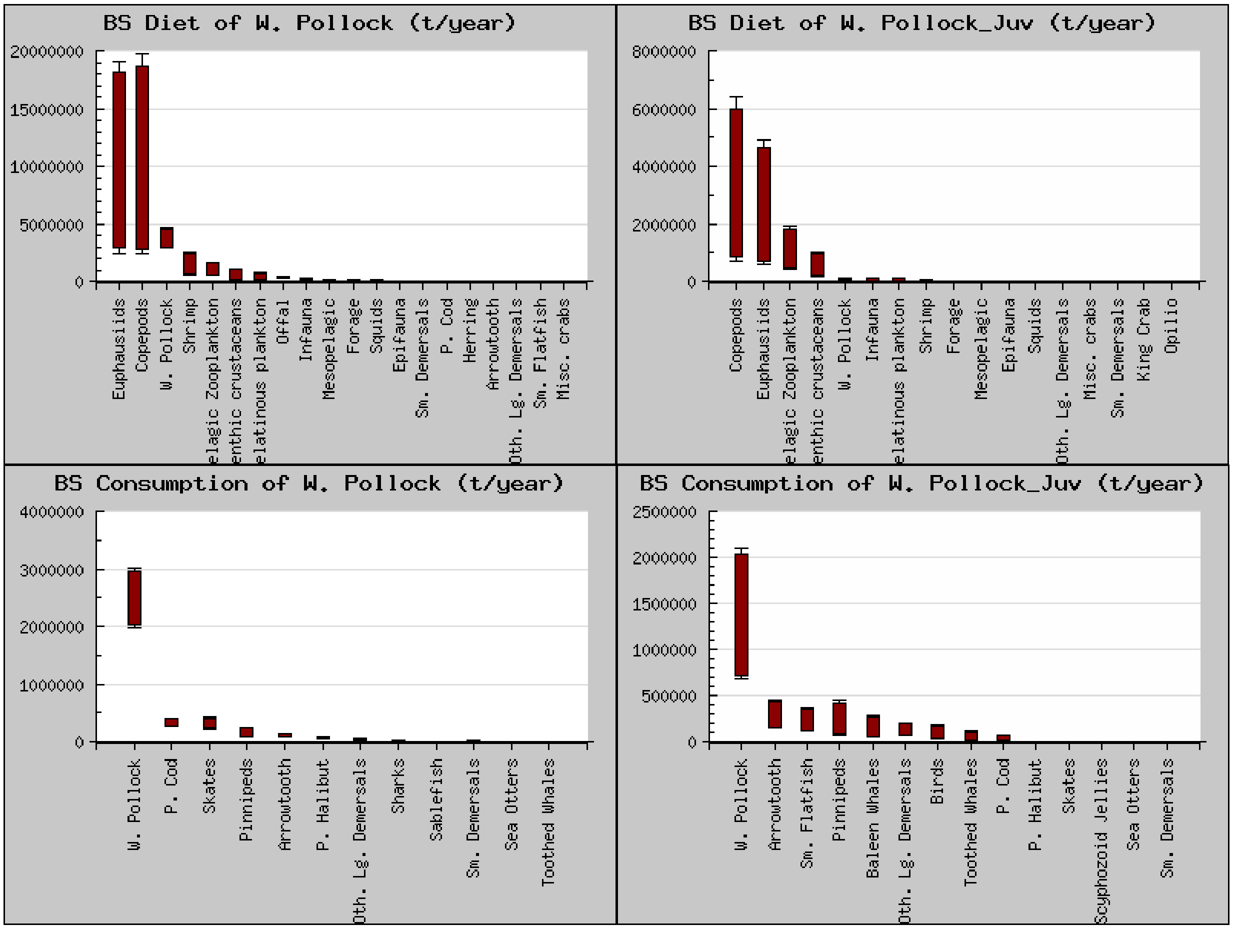


Figure 11. Diet (top) and mortality sources (bottom) for EBS pollock adults (left) and juveniles (right) based on data from 1990-1994. Error bars represent uncertainty of propagated consumption rates and population variance.

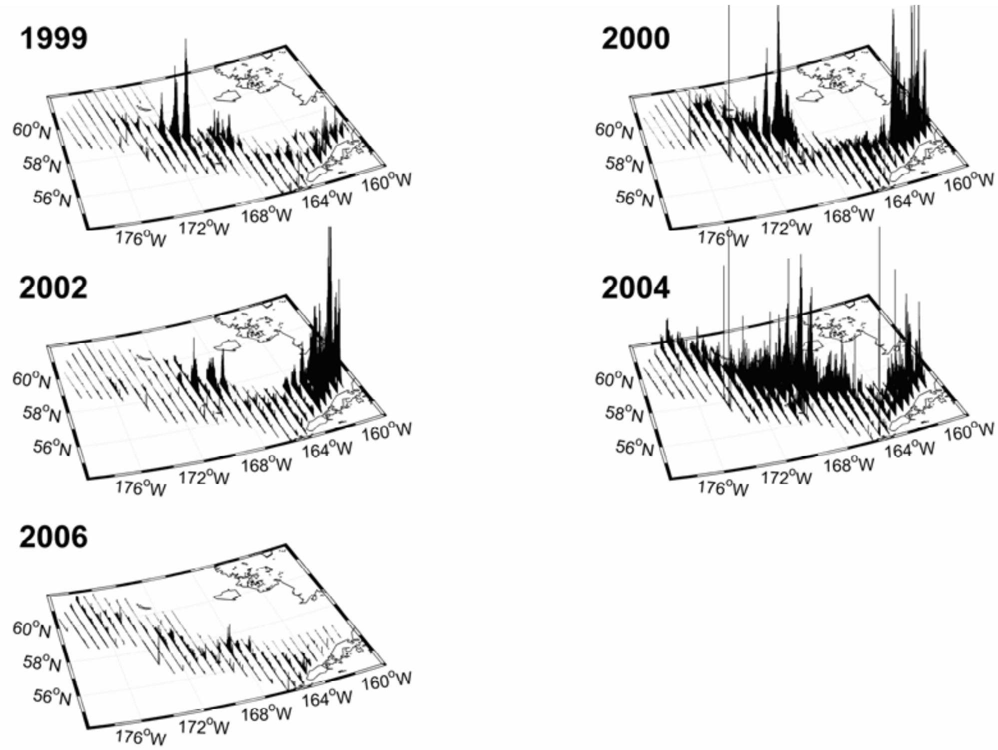


Figure 12. Geographic distribution of acoustic 38 kHz acoustic backscatter (s_A (m^2/nmi^2)) from species other than pollock (non-pollock, "other" backscatter) observed along tracklines during June-July eastern Bering Sea shelf acoustic-trawl surveys between 1999 and 2006.

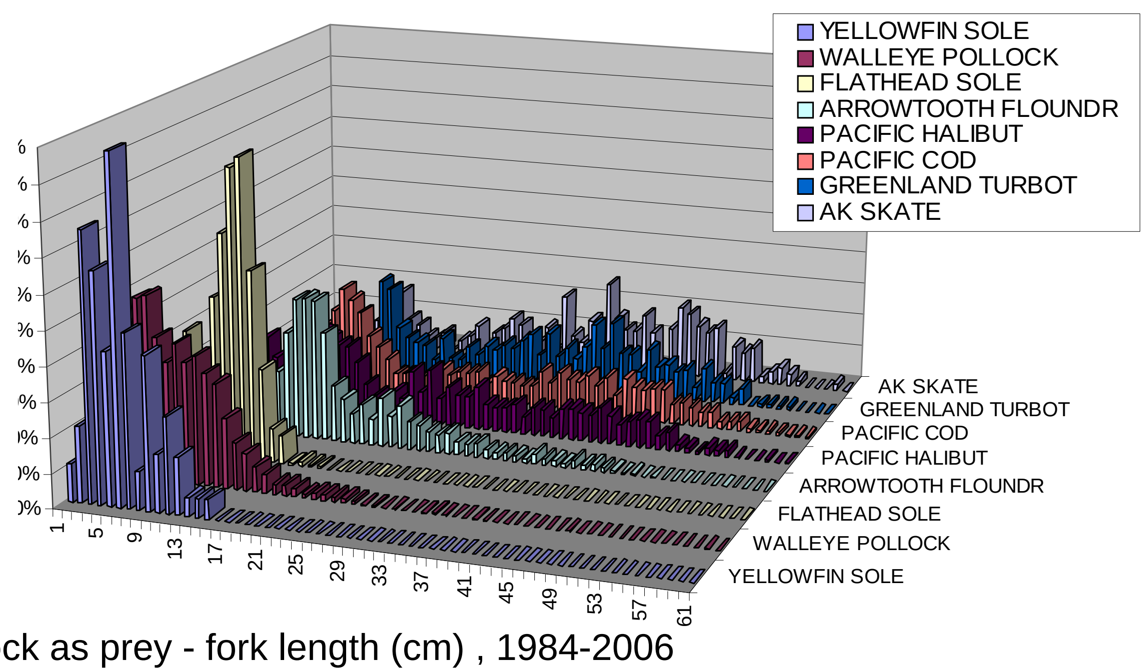
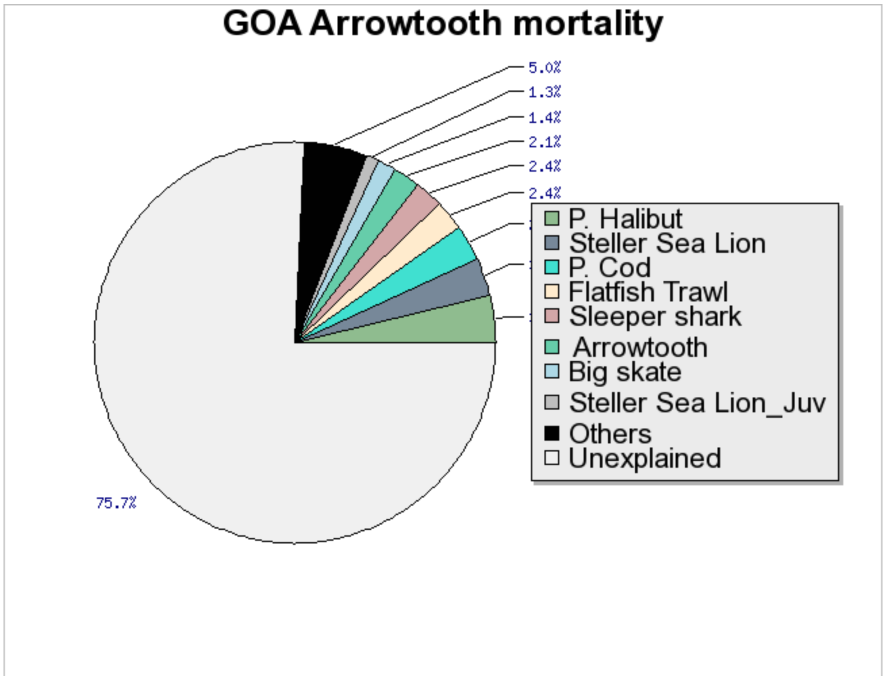


Figure 13. Length frequency of pollock found in stomachs, from groundfish food habits collected from 1984-2006 on AFSC summer trawl surveys in the eastern Bering Sea. Predators are sorted by median prey length of pollock in their stomachs. All lengths of predators are combined.



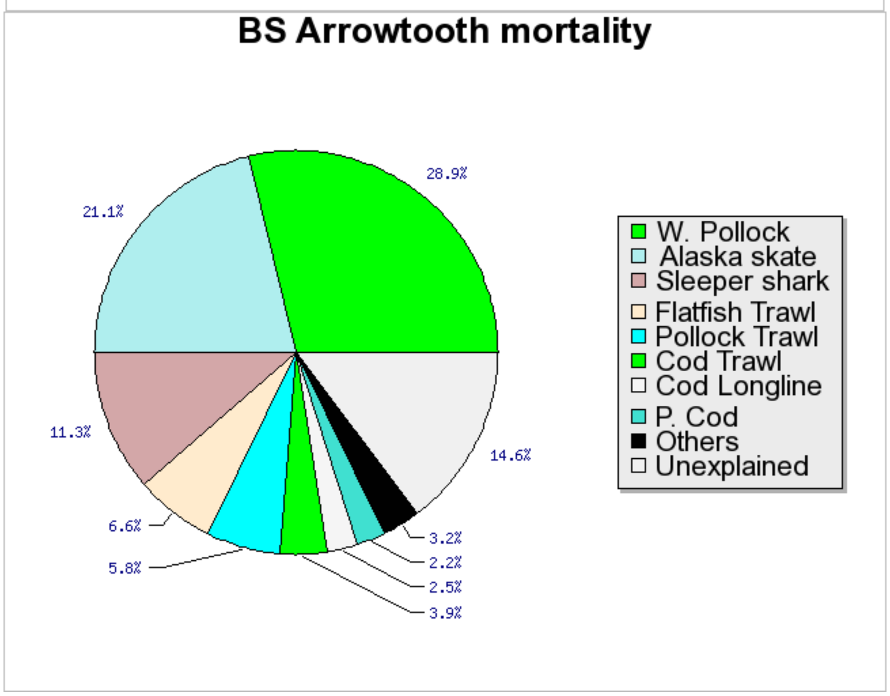


Figure 14. Mortality of arrowtooth flounder by predator or fishery as from predator ration and diet estimates, and fisheries catch data, 1990-94, as described in Appendix 1 of the Ecosystem Considerations chapter. “Unexplained” mortality is the difference between the stock assessment mortality and total predation; high unexplained mortality may indicate a top predator in an ecosystem. Top figure: eastern Bering Sea; Bottom figure, Gulf of Alaska.

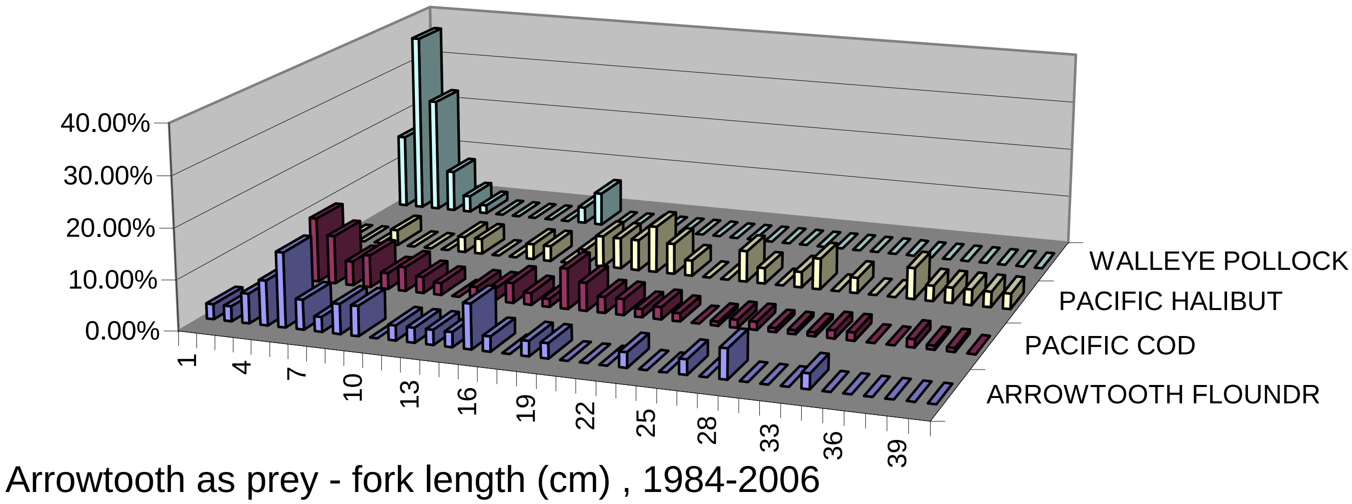


Figure 15. Length frequency of arrowtooth flounder found in stomachs, from groundfish food habits collected from 1984-2006 on AFSC summer trawl surveys in the eastern Bering Sea. Predators are sorted by median prey length of pollock in their stomachs. All lengths of predators are combined.

Update on the recent research activities and status of Aleutian Islands pollock

August 2007

Steve Barbeaux and James Ianelli
AFSC NMFS/NOAA
Seattle WA 98115

The following is largely extracted from Barbeaux et al. (2006). See http://www.afsc.noaa.gov/refm/docs/2006/AIpollock.pdf for further details.

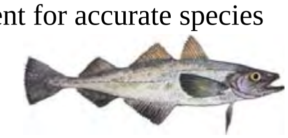
Walleye pollock are distributed throughout the Aleutian Islands with concentrations in areas and depths dependent on season. Generally, larger pollock occur in spawning aggregations during February – April. Three stocks of pollock are identified in the U.S. portion of the Bering Sea for management purposes. These are: eastern Bering Sea which consists of pollock occurring on the eastern Bering Sea shelf from Unimak Pass to the U.S.-Russia Convention line; the Aleutian Islands Region encompassing the Aleutian Islands shelf region from 170°W to the U.S.-Russia Convention line; and the Central Bering Sea—Bogoslof Island pollock. These three management stocks probably have some degree of exchange. The Bogoslof stock is a group that forms a distinct spawning aggregation that has some connection with the deep water region of the Aleutian Basin. Bailey et al. (1999) present a thorough review of population structure of pollock throughout the north Pacific region. Recent genetic studies using mitochondrial DNA methods have found the largest differences to be between pollock from the eastern and western sides of the north Pacific.

Previously, Ianelli et al. (1997) developed a model for Aleutian Islands pollock and concluded that the spatial overlap and the nature of the fisheries precluded a clearly defined “stock” since much of the catch was removed very close to the eastern edge of the region and appeared continuous with catch further to the east. In some years a large portion of the pollock removed in the Aleutian Islands Region was from deep-water regions and appear to be most aptly assigned as “Basin” pollock. This problem was confirmed and can be seen in the spatial distribution of historical catch patterns (Fig. 1). Hence, the data used here are organized to cover a region that is more consistent with survey observations and historical fishing patterns (Fig. 2).

The nature of the pollock fishery in the Aleutian Islands Region has varied considerably since 1977 due to changes in the fleet makeup and in regulations. During the late 1970s through the 1980s the fishing fleet was primarily foreign. In 1989, the domestic fleet began operating in earnest and has continued in the Aleutian Islands Region until 1999 when the North Pacific Fishery Management Council (NPFMC) recommended closing this region for directed pollock fishing due to concerns for Steller sea lion recovery. Length frequency data shows rather distinct characteristics when broken out by regions over this period (Fig. 3). There are notable similarities to the patterns over time for data from the eastern portion of the Aleutian Islands. This can also be seen from the mean-length of fish observed in the catch by these regions (Fig. 4). Another characteristic of the Aleutian Islands pollock is that mean length at age has changed substantially over time (Fig. 5). This pattern reflects the areas that are fished during these periods rather than actual changes in growth. I.e., during the early period, most of the pollock were caught towards the eastern edge of the Aleutian Islands region whereas the more recent period the pollock were from catch broadly distributed throughout the region.

The summer bottom trawl survey showed highly variable success in finding pollock in recent years, often with considerable concentrations toward the eastern edge (Fig. 6).

The R/V Kaiyo Maru conducted a survey between 170°W and 178°W longitude in the winter of 2002 after completing a survey of the Bogoslof region (Nishimura et al 2002). Due to difficulties in operating their large mid-water trawl on the steep slope area they felt their catches in this area were insufficient for accurate species



identification and biomass estimation. They did however come up with some preliminary biomass estimations. For the entire area from 170°W and 178°W longitudes they estimated a biomass of 93,000 mt of spawning pollock biomass with between 61,000 mt estimated in the NRA east of 173°W and 32,000 mt in the remainder of the survey area to 178°W longitude. The largest aggregations in the NRA area were observed at 174°W longitude north of Atka Island. Most of the pollock echo sign was observed along the slope of the Aleutian Islands relatively near shore.

The directed Aleutian pollock fishery was reopened in March 2005, but little pollock of the 19,000 t allocated annually has been harvested. In 2005 195 t were taken in the directed pollock fishery and 1,427 t were taken as bycatch in other fisheries. Reports from fishermen indicated that there was not adequate pollock sign outside of designated Steller sea lion critical habitat closure areas to justify continuation of the fishery. They also reported large quantities of Pacific Ocean perch in both the echosign and bycatch in the areas that vessels were allowed to fish. In 2006 and 2007 the majority of pollock catch was taken during cooperative research initiatives (962 t and 1,300 t respectively)

In 2006 and 2007 acoustic survey studies were completed aboard a 32m commercial trawler equipped with a 38kHz SIMRAD ES-60 acoustic system. The Aleutian Islands Cooperative Acoustic Survey Study (AICASS) was conducted to assess the feasibility of using a small commercial fishing vessel to estimate the abundance of pollock in waters off the central Aleutian Islands (Fig. 7). To verify the acoustic data and to support the study, 1,000 t and 3,000 t of groundfish were allocated to be harvested within an area that included waters within 20 nautical miles (nm) to 3 nm of Steller sea lion haulouts in 2006 and 2007 respectively. In 2006 six acoustic surveys were successfully conducted between 14 March and 4 April 2006. The area from North Cape of Atka Island to Koniuji Island (~ 1 degree longitude) was surveyed three times while a smaller subset of this area was surveyed on three other occasions. The three larger surveys (180 nm2 with transect spacing at 1.5 nm) were conducted in the beginning (Survey 2), middle (Survey 4), and end (Survey 8) of the study period. Survey 5 was conducted parallel to the shelf break and covered only 9 nm2 (with transects spaced at 0.5 nm). This survey provided data useful for geostatistical analyses. Surveys 6 and 7 covered 72 nm^2 with 1.0 nm transect and occurred in the middle of the large survey area coincident with the highest density of pollock. . Survey 2, conducted 14-15 March 2006, provided a biomass estimate for pollock of 8,910 t. The biomass estimate for subsequent surveys were lower (although not statistically significantly lower for Survey 4) and dropped significantly after Survey 4 to a low of 2,845 t for the final survey (Fig. 9). A total of 905t of pollock were harvested during the 2006 study, no other directed pollock fishing was conducted in the Aleutian Islands in 2006. In 2007 two acoustic surveys were conducted, the first was completed between March 18 and March 24 and the second between April 8 and April 15. For both surveys the region between 173° and 179° W longitude was surveyed at 2.5 nm transect spacing perpendicular to the shelf break one mile inland from the break and five mile offshore of the break or until pollock sign was no longer observed. Quantitative survey results are not yet available, but early qualitative evaluations suggest pollock abundance similar to the latter 2006 surveys. Of the 3,000 t allocated for the study only 1,300 t were harvested, further suggesting low pollock abundance in the central Aleutian Islands area.

For the 2006 stock assessment cycle the distribution patterns of pollock in relation to temperature and depth were examined. It was found that in comparison with pollock distribution observed in the 2004 Bering Sea and 2005 Gulf of Alaska bottom trawl surveys (BSBTS and GOABTS respectively), the distribution observed in the 2004 and 2006 Aleutian Islands bottom trawl surveys (AIBTS) was in a more limited temperature range and generally deeper (Fig.8). Overall the bottom temperature in the AIBTS was much less variable than in either the BSBTS or GOABTS at depth and ranged between the other surveys with the BSBTS generally cooler at depth and GOABTS warmer at depth. In the AIBTS the highest concentrations of pollock are encountered between 140 m and 300 m, while in the BSBTS the highest concentrations of pollock were above 100 m and above 150 m in the GOABTS. The 2006 AIBTS was colder at shallower depths than in 2004 and pollock concentrations appeared to shift towards deeper water (Fig. 9). The shift of pollock distribution to deeper waters with colder bottom temperatures is consistent with a shift observed in the Bering Sea between 1999, a cold year, and 2004, a warm year.

There are apparent differences in pollock length-at-age between the Aleutian Island, Bering Sea, and Gulf of Alaska between ages 2 and 9, with the Aleutian Islands pollock being largest, GOA next, then Bering Sea pollock the smallest at age (Fig. 10). The pollock length frequency collection from the 2006 AIBTS showed the primary mode between 56 and 66 cm similar to previous years and is thought to be primarily composed of 2000 and/or 1999 year-class fish (Fig. 11). There was a small mode between 15 and 25 cm that would be consistent with 1 or 2 year old fish, but much fewer than observed in 2004. The 2004 AIBT survey found a large proportion of small fish (between 10 and 25 cm, indicative of 1 or 2 year old fish) in the NRA area west of 174°W, but very few small fish east of 174°W. The 2002 AIBT survey did not find very many small fish anywhere in the Aleutians. There were a large number of small fish observed in the 1994 and 2000 surveys throughout the survey area. The large numbers of 1 or 2 year old size pollock observed in the these surveys were assumed to have entered the fishable population in 1996 and 2002, respectively, and should have stabilized or increased pollock biomass in the Aleutian Islands in recent years.

Process for setting ABC in Aleutian Islands

For many years, the Aleutian Islands pollock stock has lacked an age-structured model and the SSC has determined that the stock qualified for management under Tier 5. In the 2003 assessment, preliminary explorations of several age-structured models were provided, all of which focused on the portion of the stock to the west of 174°W. For the 2004 management cycle, five alternative age-structured models were developed and evaluated. The 2005 and 2006 assessment focused on two of these models, one of which (Model 1) uses data only from the portion of the stock to the west of 174°W, and the other (Model 2B) includes survey data from the entire Aleutian Islands management area .

In 2006 the SSC accepted Model 2B as the reference model (Fig. 12 and Fig. 13) and set ABC based on its recommendations. The recommended maximum permissible ABC for 2007 was 44,470 t, and OFL was 54,540 t. The TAC in the Aleutian Islands region is specified by congressional mandate at no more than 19,000 t. The associated long-term average female spawner biomass that would be expected under average estimated recruitment from 1978-2003 (67.49 million age 2 fish) and $F = F_{35\%}$, denoted $B_{35\%}$ is estimated to be 35,331 t. This value ($B_{35\%}$), is used in the status determination criteria. Female spawning biomass for 2007 (82,210 t) is projected to be above $B_{35\%}$ thus, the NRA pollock stock would be determined to be *above* its minimum stock size threshold (MSST) and is *not overfished*. Female spawning biomass for 2009 is projected to be above $B_{35\%}$ in scenario 7, thus the NRA pollock stock is *not* expected to fall below its MSST in two years and is *not approaching an overfished condition*.

2006 Aleutian Islands Stock Assessment Model Summary

Natural Morality: M = 0.235
Initial Biomass (1978): B_0 = 280,040 t

Equilibrium female spawning biomass and 2007 biomass projections:

$B_{100\%}$	=	100,945 t	Age 3+ biomass	= 167,581 t
$B_{40\%}$	=	40,378 t	Female spawning biomass	= 82,210 t
$B_{35\%}$	=	35,331 t		

Maximum permissible ABC:	Model 2B $F_{40\%}$ = 0.29	yield = 44,470 t
Overfishing (OFL):	Model 2B $F_{35\%}$ = 0.38	yield = 54,540 t
Congressionally Mandated TAC:		TAC<= 19,000 t

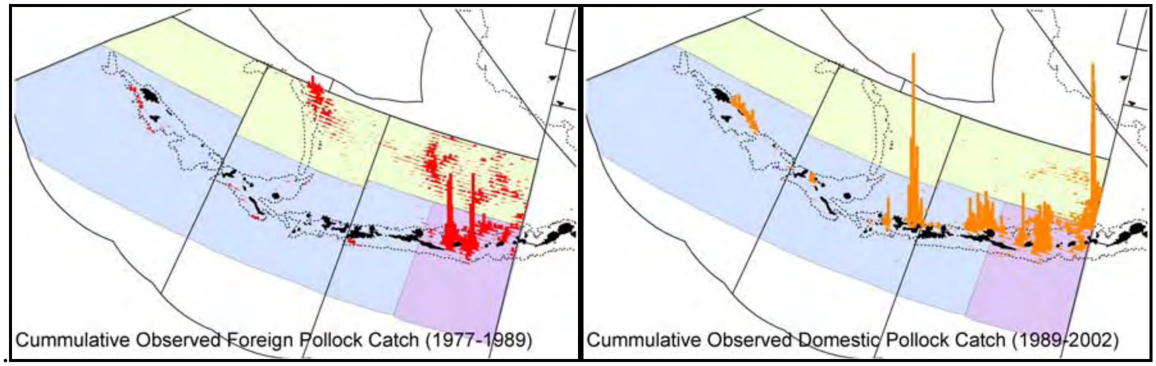


Figure 1. Observed foreign and J.V. (1978-1989), and domestic (1989-2002) pollock catch in the Aleutian Islands Area summed over all years and 10 minute latitude and longitude blocks. Both maps use the same scale (maximum observed catch per 10 minute block: foreign and J.V. 8,000 t and Domestic 19,000 t). Catches of less than 1 t were excluded from cumulative totals.

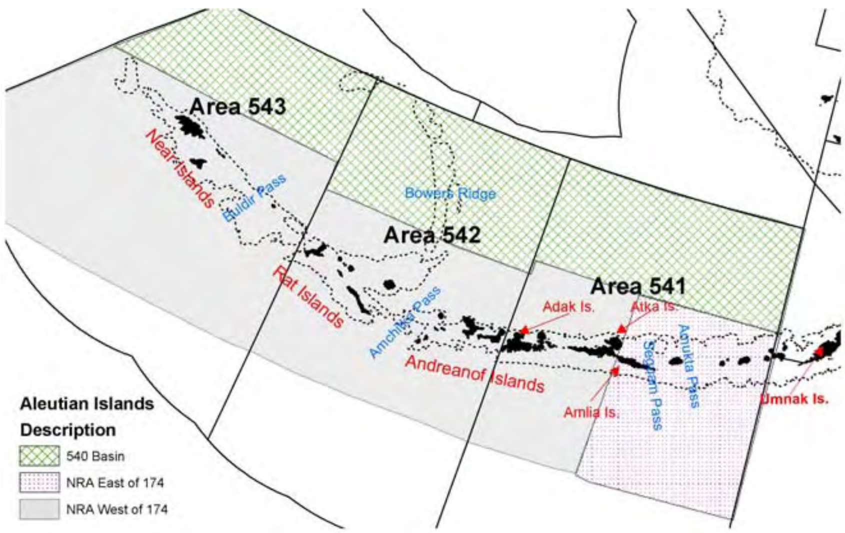


Figure 2. Regions defined for consideration of alternative data partitions for Aleutian Islands Region pollock. The abbreviation "NRA" represents the Near, Rat, and Andreanof Island groups.

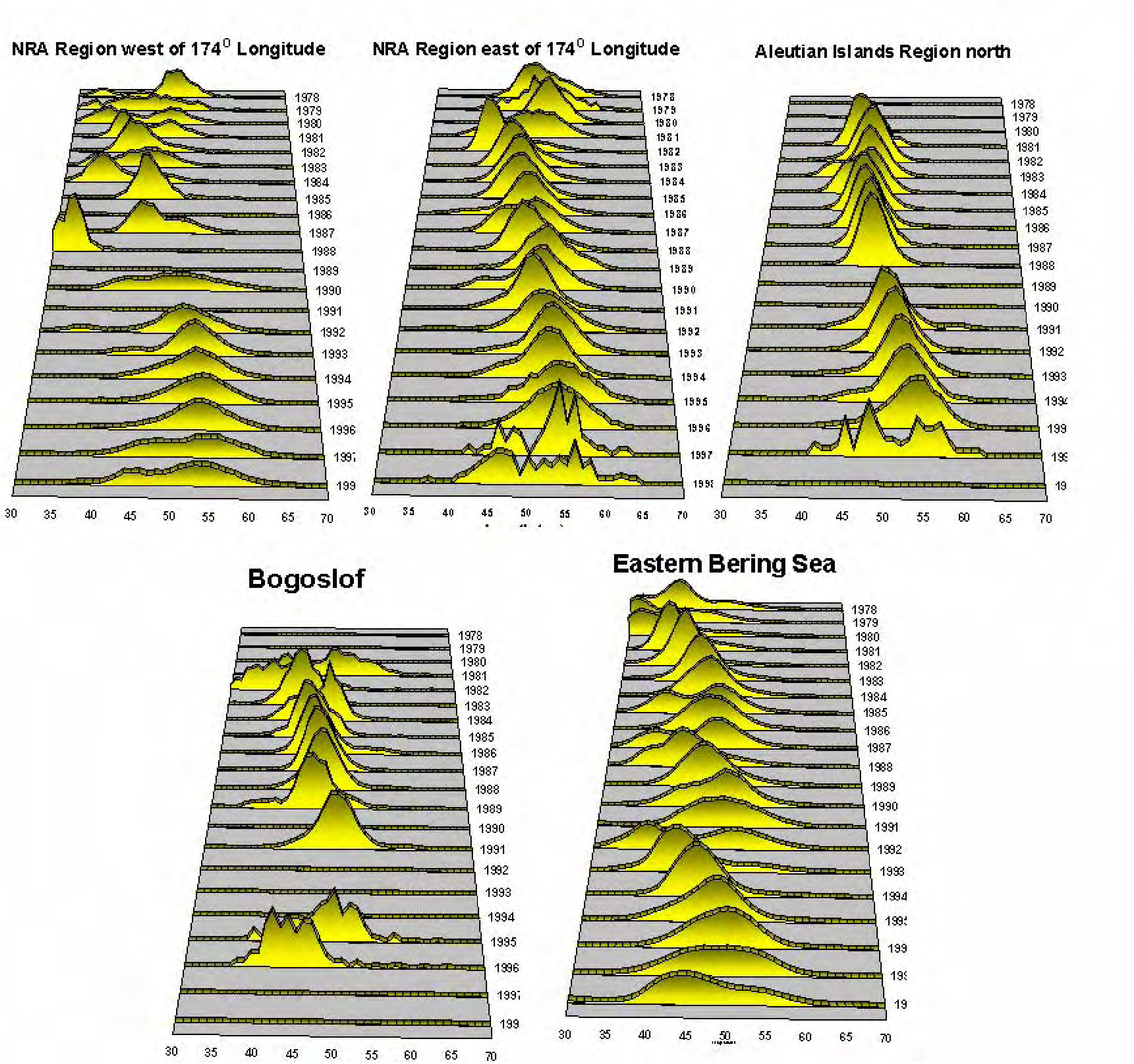


Figure 3. Pollock length frequency distributions by region.

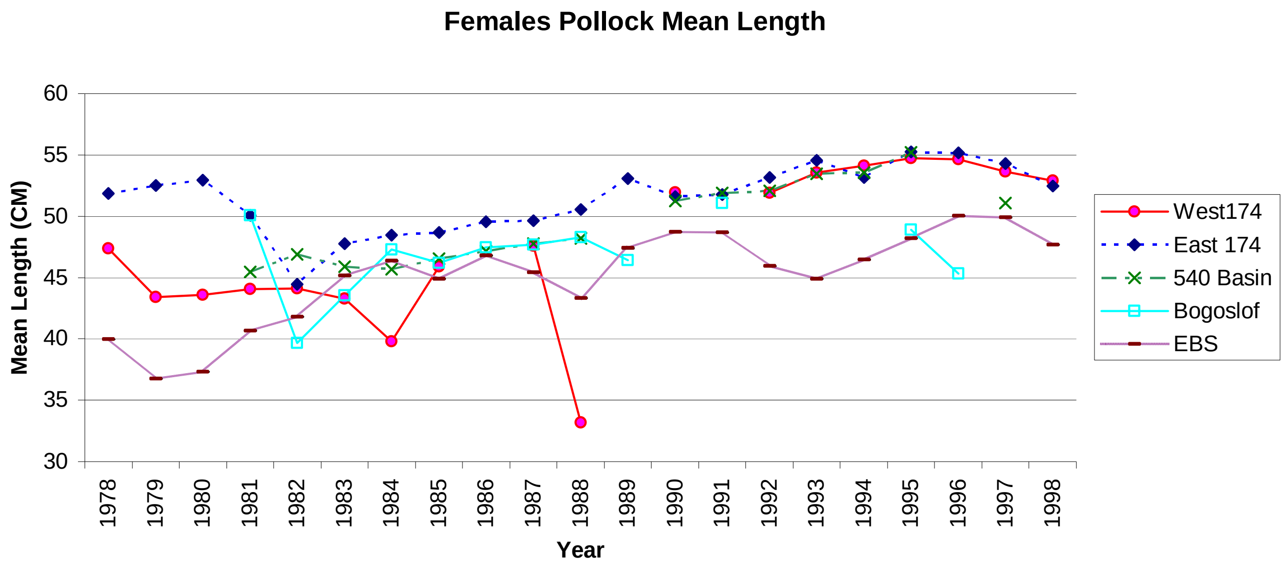


Figure 4. Mean length of female pollock in the catch from various areas based on observer data.

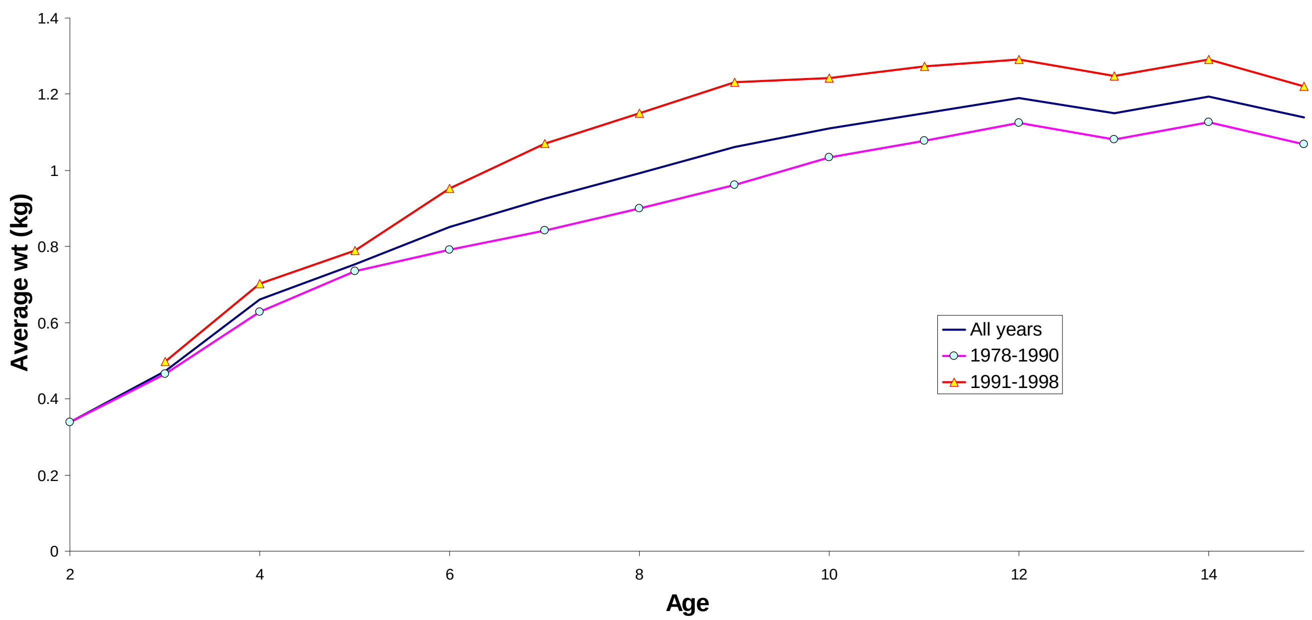


Figure 5. Average weight-at-age for Aleutian Islands pollock for all years combined, 1978-1990, and 1991-1998.

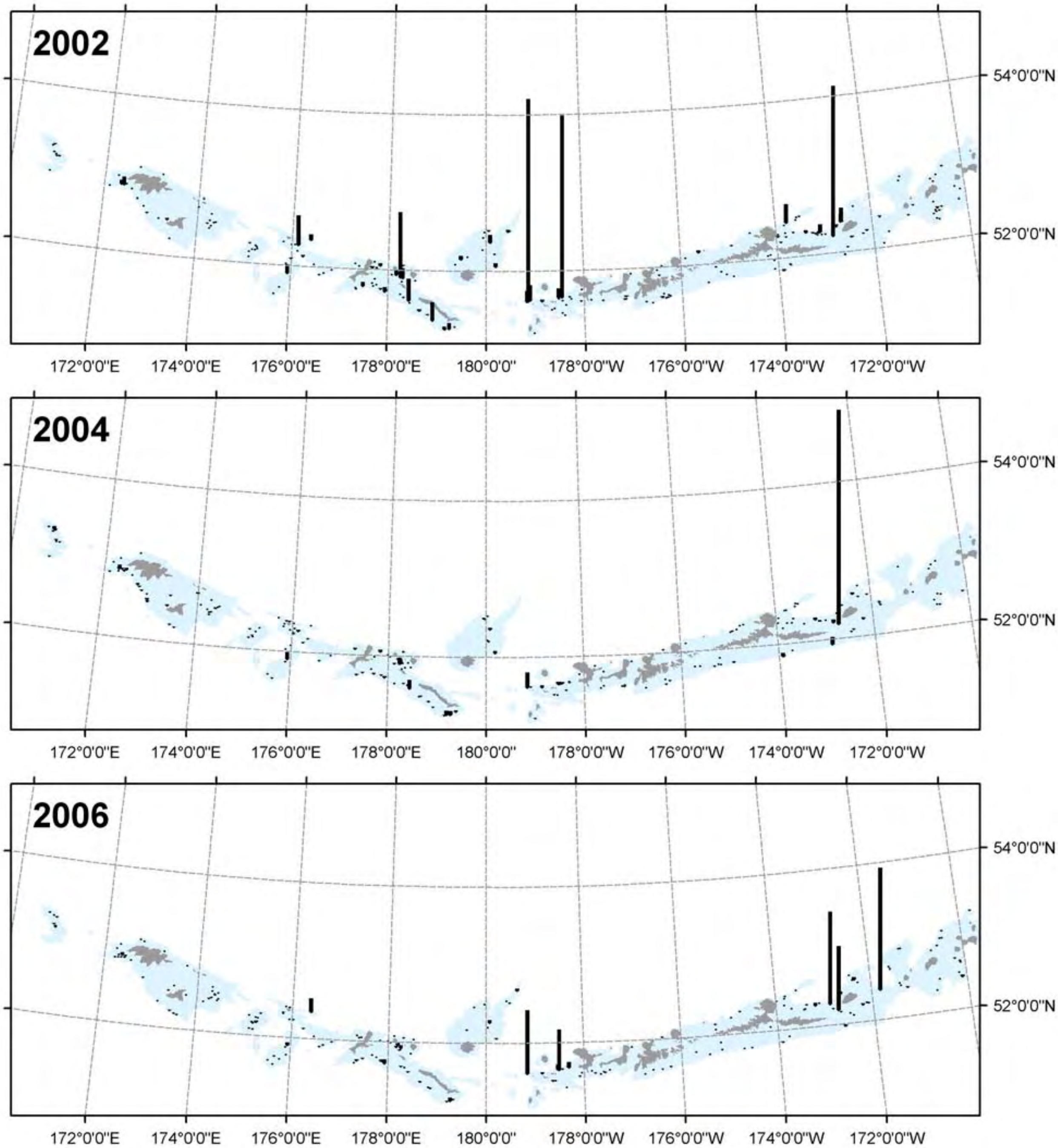


Figure 6. Catch per unit effort (kg per m^3) for surveys of pollock in the Aleutian Islands Region, 2002-2006. The shaded area is the region surveyed.

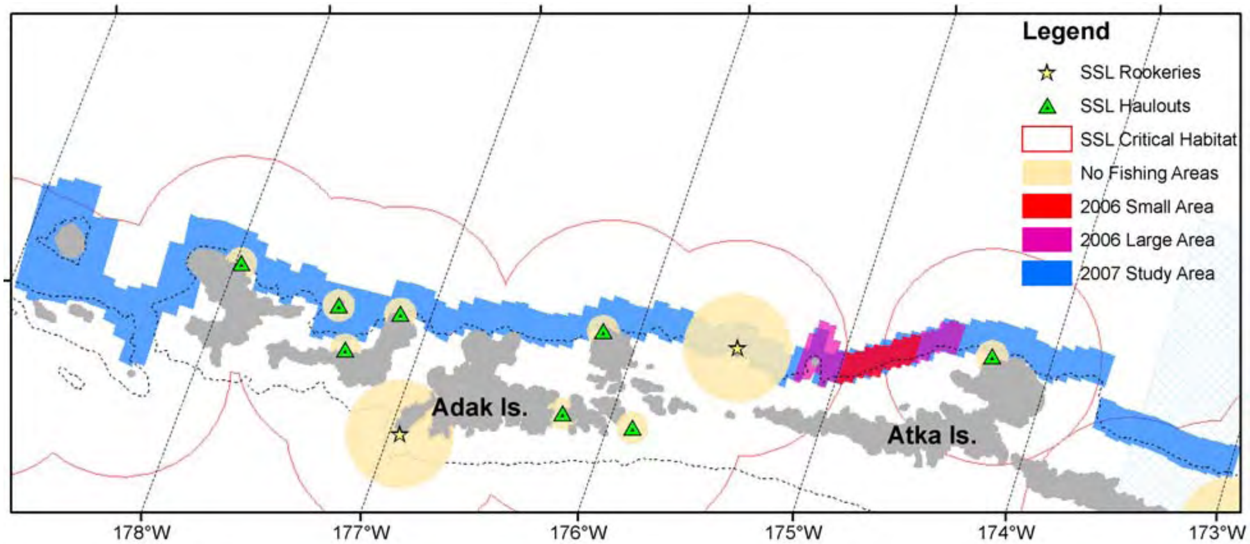


Figure 7. 2006 and 2007 Aleutian Islands Cooperative Acoustic Survey Study sites within the central Aleutian Islands with pertinent Steller Sea lion areas.

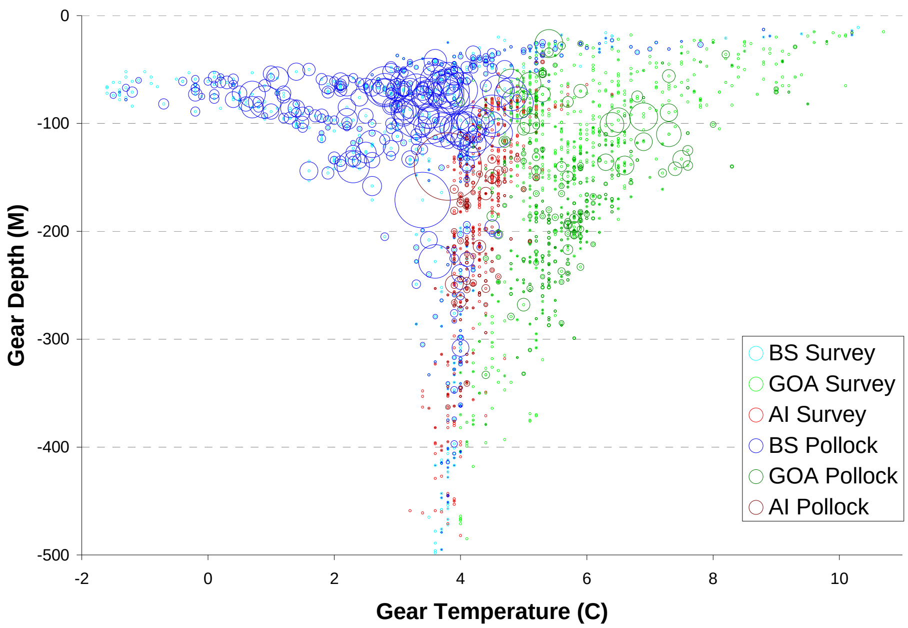


Figure 8. Pollock CPUE (KG per m^3) by depth and temperature from the 2004 Aleutian Islands and Bering Sea and 2005 Gulf of Alaska bottom trawl surveys. Circle area is proportional to CPUE.

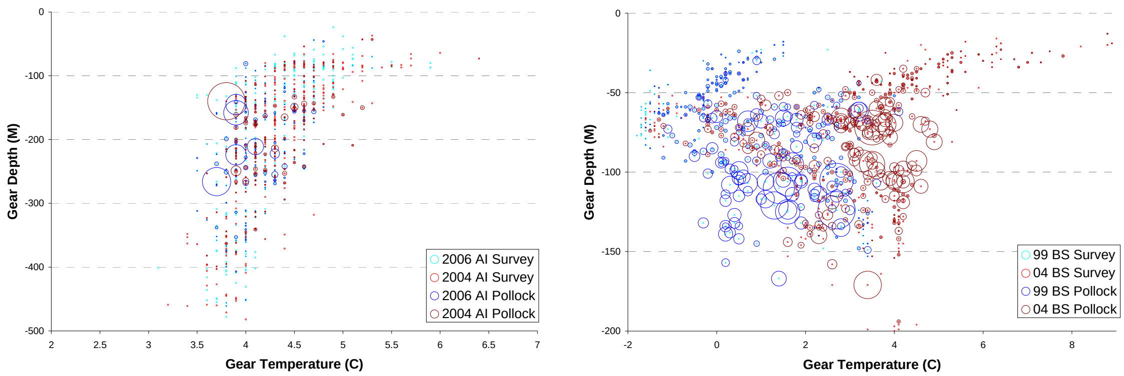


Figure 9. Pollock CPUE (KG per m^3) by depth and temperature from the (left) 2004 (red) and 2006 (blue) Aleutian Islands bottom trawl surveys and (right) 1999 (blue) and 2004 (red) Bering Sea bottom trawl surveys. Circle area is proportion to CPUE.

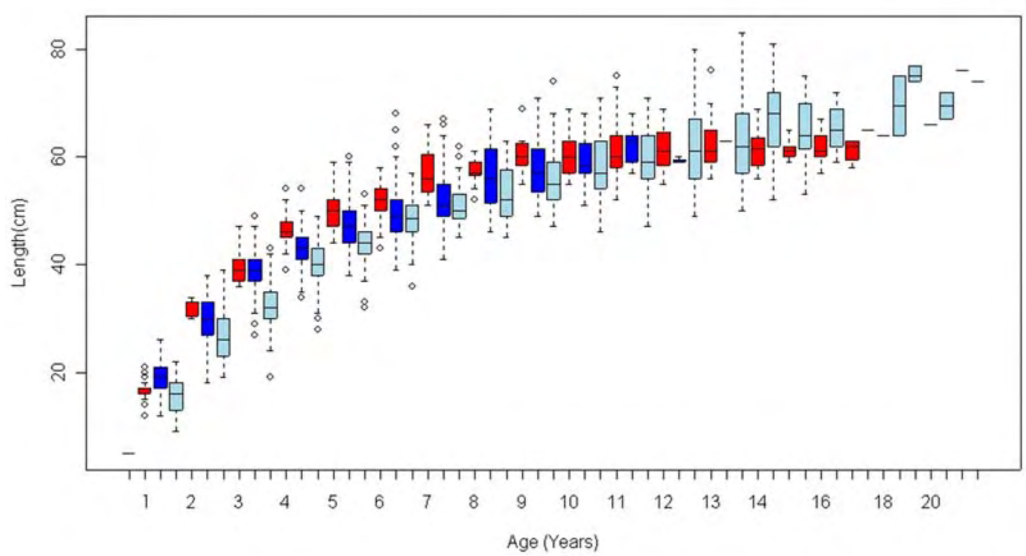


Figure 10. Length at age for Aleutian Islands (red), Gulf of Alaska (blue), and Bering Sea (grey) pollock from the 2004 Aleutian Islands, 2004 Bering Sea, and 2005 Gulf of Alaska bottom trawl surveys.

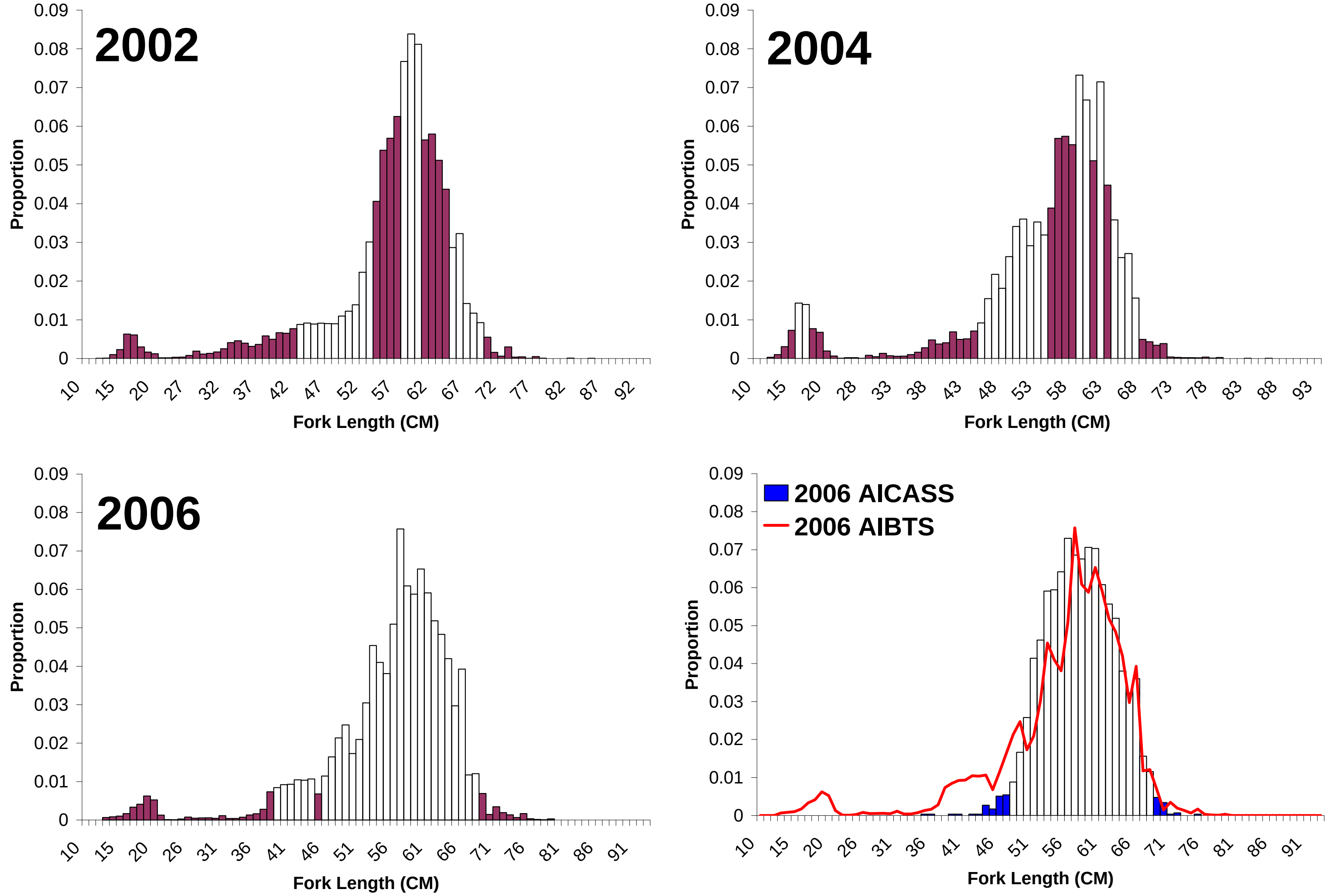


Figure 11. Pollock length distributions for 2002-2006 Aleutian Islands bottom trawl surveys and the 2006 Aleutian Islands cooperative acoustic survey study.

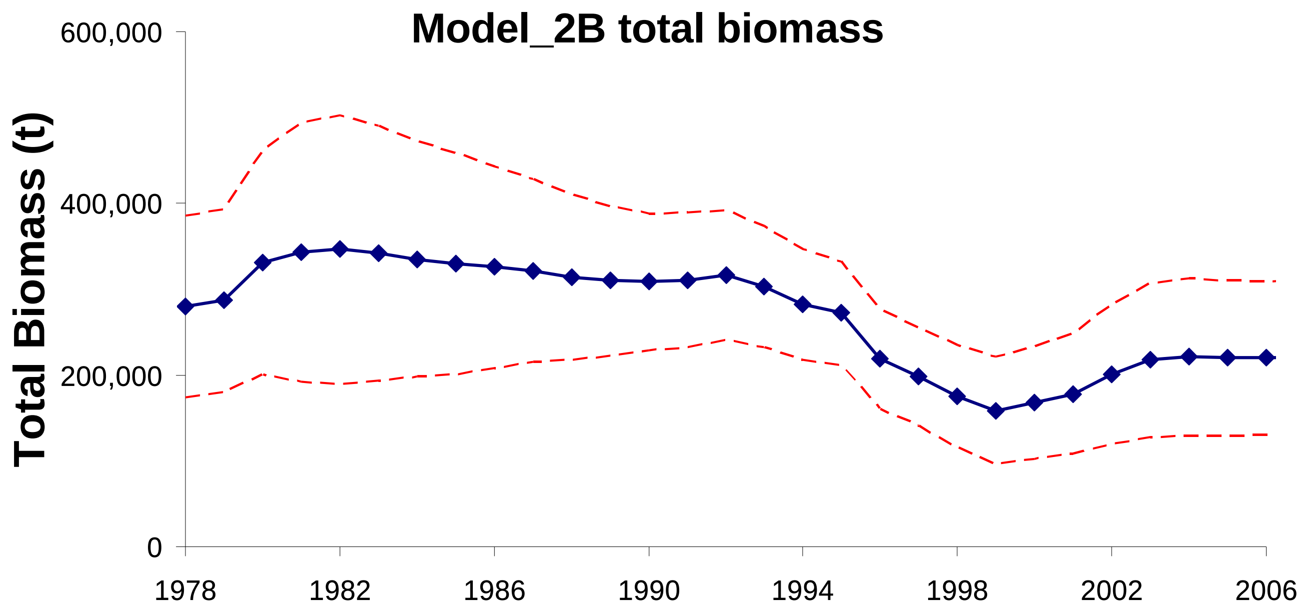


Figure 12. Model 2B estimates of Aleutian Islands pollock age 2+ total biomass (in tons); dashed lines represent approximate upper and lower confidence bounds.

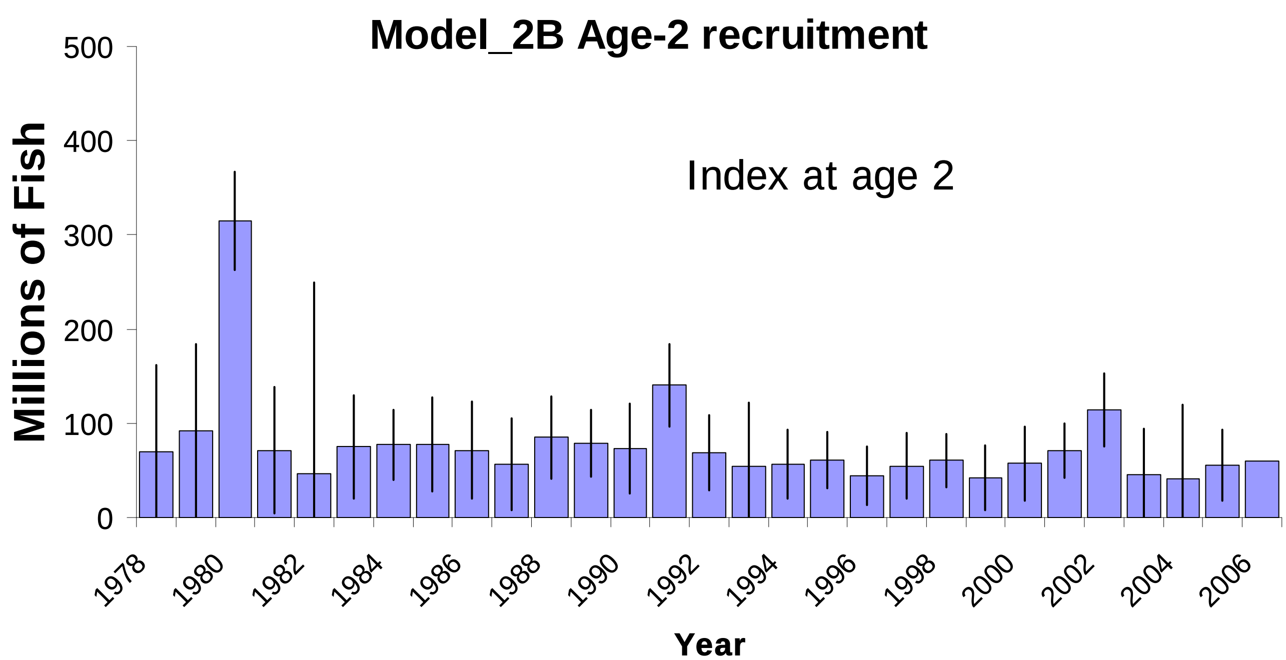


Figure 13. Model 2B estimates of Aleutian Islands pollock year-class estimates; vertical bars represent approximate upper and lower confidence bounds.

Results of the March 2007 Echo Integration-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise MF2007-03

by Taina Honkalehto, Neal Williamson, Denise McKelvey and Kresimir Williams

2007

INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering Program of the Alaska Fisheries Science Center (AFSC) regularly conduct echo integration-trawl (EIT) surveys to estimate pre-spawning walleye pollock (*Theragra chalcogramma*) abundance in the southeastern Aleutian Basin (McKelvey et al. 2006). These surveys were conducted annually between 1988 and 2007 with the exception of 1990 and 2004. The biomass estimate for pollock within the Central Bering Sea (CBS) Convention Specific Area obtained during these surveys provides an index of abundance for the Aleutian Basin pollock stock[1]. The results presented here are from the EIT survey carried out 1-10 March 2007 aboard the NOAA ship *Miller Freeman*, Cruise MF2007-03. This report summarizes observed pollock distribution and biological composition, and provides a biomass estimate. It also summarizes physical oceanographic observations and acoustic system calibration results.

METHODS

<u>Itinerary</u>

28 Feb	Embark scientists in Dutch Harbor, AK.
1 Mar	Calibration of acoustic system in Captains Bay.
2-7 Mar	EIT survey of the southeastern Aleutian Basin near Bogoslof Island and inter-vessel comparison transects with NOAA ship *Oscar Dyson.*
8-10 Mar	Inter-vessel comparison transects and calibration of acoustic system in Anderson Bay.
10 Mar	In port Dutch Harbor, AK.

[1] Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea, Annex (Part 1), Treaty Doc. 103-27. 1994. Hearing before the Committee on Foreign Relations U.S. Senate, 103rd Congress, 2nd Session. Washington: U.S. Government Printing Office.

Acoustic Equipment

Acoustic data were collected with a Simrad ER60[2] quantitative echo sounding system using 18, 38, 120, and 200 kHz split beam transducers (Simrad 1997,2004; Bodholt and Solli 1992). The transducers were installed on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research, on the bottom of a retractable centerboard extending 9 m below the water surface. Data from all four frequencies were logged with SonarData EchoLog 500 (v. 3.50). Raw data for each frequency were also logged using ER60 software (v.2.1.2). Echo integration-trawl survey methods were similar to those described in Simmonds and MacLennan (2005). Results presented here were based on the 38 kHz data, which were analyzed using SonarData Echoview (v. 3.50.54) PC-based post-processing software.

Trawl Gear

The *Miller Freeman* was equipped with an Aleutian wing 30/26 trawl (AWT). This trawl was constructed with full-mesh nylon wings, and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measured 81.7 m (268 ft). Mesh sizes tapered from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codend. The net was fitted with a 32-mm (1.25-in) nylon mesh codend liner. The AWT was fished with 82.3 m (270 ft) of 1.9-cm (0.75-in) diameter (8 H19 wire) non-rotational dandylines, 226.8-kg (500-lb) or 340.2-kg (750-lb) tom weights on each side, and 5 m^2 Fishbuster trawl doors [1,247 kg (2,750 lb) each]. Vertical net opening and depth were monitored with a WESMAR third wire netsounder system attached to the trawl headrope. The net opening ranged from 30 to 42 m and averaged 38.1 m while fishing. The average net opening was wider than it was during previous Bogoslof surveys. This may have resulted from the WESMAR kite flying at a steeper angle.

Oceanographic Equipment

Physical oceanographic data collected during the cruise included temperature profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope, and

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[2] Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

conductivity, temperature, and depth (CTD) measurements collected with a Sea-Bird CTD system at calibration sites. Continuous sea surface temperature and salinity data were measured using the *Miller Freeman's* Sea-Bird Electronics SBE-21 probe located mid-ship, approximately 5 m below the water line. These and other environmental data were recorded using the ship's sensors interfaced with the ship's Scientific Computing System (SCS). Sea surface temperature data were subsampled for graphical representation.

Survey Design

The survey began 1 March north of Unalaska Island at about 167°W longitude, proceeded west to the Islands of Four Mountains near 170°W, and concluded on 10 March (Fig. 1). A random start position was generated for the first transect, which resulted in a new start location 1.6 nautical miles (nmi) west of the start location used in 2003, the last year that start positions were not randomized. From that point, the survey followed 35 north-south parallel transects spaced 3 nmi apart that covered 1870 nmi^2 of the CBS Convention Specific Area. The average transecting speed was 10.9 knots.

Trawl hauls were conducted to identify acoustic scattering layers and to provide biological samples. Average trawling speed was approximately 3.3 knots. Pollock were sampled to determine sex, fork length (FL), body weight, age, maturity, and ovary weight of selected females. Pollock fork lengths were measured to the nearest centimeter (cm). Smaller forage fish such as lanternfish (family Myctophidae) were measured to the nearest millimeter (mm) standard length (SL). An electronic motion-compensating scale (Marel M60) was used to weigh individual pollock specimens to the nearest 2 g. For age determinations, pollock otoliths were collected and stored in 50% ethanol-water solution. Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning[3]. All data were recorded electronically using the Fisheries Scientific Computing System (FSCS) v.1.6 and stored in a relational database. Live, fertilized walleye pollock eggs were spawned from adults collected during the cruise to

[3] ADP Codebook. 2005. Unpublished document. Resource Assessment and Conservation Engineering Division, Alaska Fisheries Science Center, NMFS, NOAA; 7600 Sand Point Way NE, Seattle, WA 98115

examine larval pollock feeding, behavior, physiology, and predation. Visual counts of seabird species were made after most trawl hauls.

Standard sphere acoustic system calibrations (Foote et al. 1987) were made before and after the Bogoslof Island area survey to measure acoustic system performance. During calibration, the *Miller Freeman* was anchored at the bow and stern. Weather, sea state conditions, and acoustic system settings were recorded. A tungsten carbide sphere (38.1 mm diameter) and a copper sphere (64 mm diameter) were suspended below the centerboard-mounted transducers. The tungsten carbide sphere was used to calibrate the 38, 120 and 200 kHz systems. The copper sphere was used to calibrate the 18 kHz system. After each sphere was centered on the acoustic axis, split beam target strength and echo integration data were collected. Transducer beam characteristics were confirmed by moving each sphere through the acoustic beam while collecting target strength data using Simrad EKLOBES software. Acoustic system settings used during the survey (Table 1) were based on 38- kHz results obtained during the 2 March acoustic system calibration.

An additional objective of the 2007 Bogoslof survey was the collection of inter-vessel comparison (IVC) acoustic data for the NOAA ships *Miller Freeman* and *Oscar Dyson*. The experimental design used during the Bogoslof survey consisted of both side-by-side data collection with the vessels separated by 0.5-0.7 nmi, and follow-the-leader data collection with the following vessel 1.0 nmi behind and 0.1 nmi to starboard. Approximately 250 nmi of north-south oriented side-by-side acoustic data and approximately 250 nmi of east-west follow-the-leader acoustic data were collected with fish present during the survey. These data will allow us to determine if there are significant differences in the acoustic backscatter observed by the two vessels.

Data Analysis

Echo integration data were collected 24 hours a day between 16 m from the surface and 0.5 m off the bottom, unless the bottom exceeded 1,000 m, the lower limit of data collection. Backscattering identified as pollock was binned at 0.5 nmi horizontal by 20 m vertical resolution, and stored in a database. Pollock length data from the 8 hauls that captured sufficient numbers of pollock (more than 75 individuals/haul) were combined into two length strata based on geographic proximity of hauls, and similarity in size composition data. Estimates of walleye pollock backscattering strength for each stratum were calculated using an S_v threshold of –70 decibels (dB). Mean target strength per fish (dB) was estimated for each stratum by using the pollock target strength (TS) to length relationship (TS = 20 log FL – 66, where FL is fork length (cm); Traynor 1996). Mean fish weight-at-length for each length interval (cm) was estimated from the trawl data when there were more than five pollock for that length interval; otherwise weight at a given length interval was estimated from a linear regression of the natural logs of all the length and weight data. Numbers and biomass for each stratum were estimated as:

$$\text{Numbers} = \sum N_i = \sum \frac{\bar{s}_A \times A}{4 \times \pi \times 10^{\overline{TS_i}/10}}, \text{ for length } i, \text{ and}$$

$$\text{Biomass} = \sum \left(N_i \times \frac{\overline{W_i}}{1000} \right), \quad \text{metric tons,}$$

where N_i is numbers at length i, $\bar{s}_A$ (m^2/nmi^2, nautical area scattering coefficient, NASC; MacLennan et al. 2002) is echo integrated backscatter from pollock in the water column, A is length stratum area (nmi^2), $\overline{TS}_i$ is mean target strength (dB, per fish) of pollock for length i (cm), and $\overline{W}\,i$ is mean weight of individual fish (kg) for length i. Total biomass or numbers were estimated by summing the strata estimates.

In the Bogoslof Island area, pre-spawning pollock aggregations are often densely packed and vertically and/or horizontally stratified by sex (Schabetsberger et al. 1999). Therefore it is rarely possible to obtain an unbiased sample of lengths from these aggregations to estimate population size composition. Typically, females are densely schooled across the top of the aggregation and the trawl hauls contain mostly females and few males even though males were abundant in lower layers. At ages older than about 5 years, female pollock are longer than male pollock. Thus, biased estimates of sex composition from trawl hauls can result in biased estimates of population size and age composition. As in previous Bogoslof surveys, the sample sex ratio was assumed to be 50:50. A male size composition was derived by averaging proportions-at-length for each haul in the length stratum. The same was done for female fish. The two resultant size compositions were averaged to provide a stratum (sexes combined) size composition.

Mean weighted depth of pollock was computed for each 0.5 nmi along the transects by multiplying the pollock biomass in each 20 m vertical layer of water column by mean layer depth, then dividing by the sum of biomass for the corresponding 0.5 nmi. Pollock vertical distribution in Umnak area transects was compared with that in Samalga area transects.

Relative estimation errors for the acoustic-based estimates were derived using a one-dimensional (1D) geostatistical method (Petitgas 1993, Williamson and Traynor 1996, and Rivoirard et al. 2000). Relative estimation error is defined as the ratio of the square root of the estimation variance to the estimate of biomass. Geostatistical methods were used for computation of error because they account for the observed spatial structure. These errors quantify only transect sampling variability. Other sources of error (e.g., target strength, trawl sampling) are not included.

RESULTS

Calibration

Calibration results showed that the estimated gain parameters and transducer beam pattern characteristics for the ER60 38-kHz were similar to the system settings both before and after the Bogoslof Island area survey, confirming that the acoustic system was stable throughout the survey (Table 1).

Physical Oceanographic Conditions

Mean surface temperatures where most of the fish aggregations were observed ranged from 3.6-3.9ºC (Fig. 1), on the warm end of the range of surface temperatures observed during the survey (3.3-3.9ºC). Water temperature profiles at trawl haul sites indicated a well-mixed water column with little variation in temperature between the surface and deeper waters. Temperatures measured in the water column between 300 and 600 m, covering most of the vertical distribution of pollock observed in the Bogoslof area in 2007 averaged between 3.7º and 3.9ºC (Fig. 2).

Trawl Sampling

Biological data and specimens were collected from 9 trawl hauls (Tables 2 and 3; Fig. 1). Walleye pollock dominated all trawl catches and represented 99.5% of the total catch by weight and 72.2% by number (Table 4). Myctophids were the most common bycatch and contributed 24.3% by number.

Length measurements ranging between 39 and 72 cm FL were collected from 2715 pollock specimens (Table 3) to create the two length strata for scaling the acoustic data and computing size-specific population estimates. Pollock from hauls 2-4 ranged between 39-71 cm FL and were characterized by a dominant mode at 48 cm FL, and a lesser mode at 61 cm. These hauls were used to scale the acoustic data in transects 1-18, the “Umnak” stratum. Pollock from hauls 5-9 ranged between 41-72 cm FL and had higher proportions of fish larger than 48 cm FL generating a bi-modal distribution with major modes at approximately 50 and 62 cm FL. These hauls were used to scale the acoustic data in transects 19 through 35, the “Samalga” stratum. Trawl catch sex ratios among hauls capturing more than 75 pollock ranged from 14% to 54% male. As observed in previous years, higher proportions of male pollock were captured in deeper layers of the water column.

Maturity stage data and length-weight data were collected for 870 pollock specimens, and otoliths from 753 specimens (Table 3). No immature fish and very few developing fish were observed (Fig. 3a). In the Umnak area, the unweighted maturity composition for males was 18% pre-spawning, 80% spawning, and 2% spent. The female maturity composition was 73% pre-spawning, 22% spawning, and 5% spent. In the Samalga area, the unweighted maturity composition for males was <1% developing, 24% pre-spawning, 66% spawning, and 10% spent. The female maturity composition was <1% developing, 78% pre-spawning, 14% spawning, and 8% spent. The average gonado-somatic index (GSI: ovary weight/body weight) for pre-spawning mature female pollock was 0.186 for Umnak and 0.173 for Samalga (Fig. 3b). The two areas’ GSIs were significantly different from one another (two-tailed Student’s T-test, p=0.00247), although average GSI did not appear to vary significantly with length in either area. Overall, GSIs were similar to that observed during recent years (0.17 – 0.18 for the entire area, between 2002 and 2006), suggesting that the survey's timing was similar in relation to peak spawning. The mean body weight-at-length for sexes combined was estimated using observed measurements for all but nine length intervals (Fig. 3c). The mean weight-at-length for the remaining length intervals was estimated by Weight (g) = $0.0018442 \times$ Fork Length (cm) $^{3.3725}$, corrected for a small bias due to back transformation from logarithmic space (Miller 1984).

Pollock Distribution and Abundance

As in recent years, walleye pollock were mainly concentrated in two regions, northeast of Umnak Island and Umnak Pass, and just north of Samalga Pass (Fig. 4). About 35% of the survey biomass was observed in the Umnak area and 65% in the Samalga Pass area. In each region, pollock were concentrated mainly along 4 transects. Pollock were distributed in midwater between about 300 and 750 m (Fig. 5). They tended to stay close to the sea floor in both regions until bottom depths reached about 400 m. As the seafloor descended, fish depths continued to increase slightly with increasing bottom depths, until they were between about 475-650 m, where most remained. This was deeper than most pollock observed in 2006 (~400-550 m), particularly in the Umnak area. Also in the Umnak area few pollock were encountered where bottom depths exceeded 1,000 m, whereas in the Samalga area, many pollock were encountered beyond 1000 m bottom depths (Figs. 4,5).

The abundance estimate for pollock in the Bogoslof area was 236 million fish weighing 0.292 million metric tons (Tables 5, 6, 7; Fig. 6). The size composition was bimodal (Figs. 7 and 8) with major modes at 48 and 61-62 cm FL. The average fork length for the population was 52.3 cm, (Fig. 6). Based on the 1D analysis, the relative estimation error of the abundance estimate was 11.5% (Table 5).

Age composition data from the 2002, 2003, 2005 and 2006 Bogoslof Island area surveys (Fig. 9) showed that average length at age was greater for females than males for most ages. After about age 10, Bogoslof pollock growth slowed with increasing age, the difference in size between females and males appeared to become more pronounced, and pollock of both sexes gradually increased in average length at age over time. The estimated 2006 age composition (Tables 8 and 9, Fig. 10) illustrated increased recruitment of the 2000 year class. The remainder of the population comprised the 2001 and 1999 year classes, with some contribution from older year classes.

DISCUSSION

The 2007 survey results revealed both similarities and differences compared with results from 2006 and 2005. In 2007, the estimated total biomass (0.292 million t) increased over that in both 2006 and 2005 (0.240 and 0.253 million t, respectively), but the biomass growth did not correspond to an increase in numbers of fish—estimated numbers remained the same as in 2006. However, in 2006, a 38% increase in numbers for pollock less than 50 cm FL, was observed compared to 2005 (148.3 and 107.5 million, respectively). This was largely due to continued recruitment of the 2000 year class (Tables 8, 9, and Fig. 10), a major year class on the eastern Bering Sea shelf, which in 2006 contributed an estimated 104.0 million fish compared to 81.0 million in 2005. Peak recruitment for dominant year classes to the Bogoslof spawning area has typically occurred at ages 6 to 7 (Fig. 11). At age 6, the 2000 year class appeared to be stronger in Bogoslof than recent strong year classes (1999, 1996, 1992), but it was surpassed by the 1989 and older strong year classes. Based upon mean length at age data from previous surveys in the Bogoslof time series, pollock from the 2000 year class would have been roughly 50 cm FL in 2007 (Fig. 9). Estimated numbers of pollock less than 53 cm FL (thus including seven-year olds) were 131.74 million (2005), 173.19 million (2006) and 138.94 million (2007), suggesting that recruitment of the 2000 year class peaked in 2006. This should be corroborated by future results from the 2007 age data.

The estimated pollock biomass inside the CBS convention area has been increasingly focused into two main regions since the late 1990s; off the northeast end of Umnak Island, and inside Samalga Pass. In the 2000-2003 surveys, the Umnak component accounted for a relatively small portion ($\leq$26%) of the CBS Convention Specific Area biomass. In 2005, Umnak accounted for 34%, and in 2006, 58% of the biomass. In 2007, estimated Umnak biomass decreased to 35% of the population and there was a decrease in numbers of pollock smaller than 53 cm FL as compared with

2006, noted above. In 2006, the Umnak area had smaller pollock with a higher proportion of spent individuals than the Samalga area. This was likely due to a greater proportion of the 2000 year class (74% of the total number) recruiting to the Umnak area than to Samalga. In 2007 the female maturity composition was similar between the two areas (Figs. 3a, 12), but the GSIs were slightly higher in the Umnak area (Fig. 3b), suggesting that as in 2006 the Umnak pollock were farther along in their spawning cycle than the Samalga pollock. Whether or not the 2000 year class continued to recruit more to the Umnak area could be confirmed with the 2007 age data.

In 2007 the pollock aggregations' depth distribution seemed to have shifted somewhat compared with that in 2006, both in relation to bottom depth and in estimated vertical location in midwater (weighted by biomass). Pollock tended to be more offshore in 2007 than in 2006. This could be partially explained by the shift in biomass distribution back to Samalga Pass, where with more fish present the range of bottom depths they inhabited was expanded from that in 2006. In 2006 we noted that the vertical fish depths and their relationship to bottom depth appeared to be different between the two areas (Umnak aggregations' vertical distribution was shallower than Samalga's). In 2007, fish depth distribution in both areas was similar to Samalga's in 2006. Thus in the Umnak area, pollock aggregations appeared to be centered ~100 m deeper (and a little farther offshore) than they were in 2006. Perhaps this difference in pollock depth distribution was somehow related to spawning progression—there were proportionally more pre-spawning than spent Umnak females sampled in 2007 whereas there were more spent than pre-spawning females sampled there in 2006. This could be tested by examination of maturity composition and weighted depth distribution from prior Bogoslof surveys.

ACKNOWLEDGMENTS

The authors would like to thank the officers and crew of the NOAA ship *Miller Freeman* for their contribution to the successful completion of this work.

CITATIONS

Bodholt, H., and H. Solli. 1992. Split beam techniques used in Simrad EK500 to measure target strength, p.16-31. *In* World Fisheries Congress, May 1992, Athens, Greece.

Honkalehto, T., D. McKelvey, and N. Williamson. 2005. Results of the March echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) conducted in the southeastern Aleutian Basin near Bogoslof Island, cruise MF2005-03. AFSC Processed Rept. 2005-05, 37 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE., Seattle WA 98115.

Foote, K. G., H. P. Knudsen, G. Vestnes, D. N. MacLennan, and E. J. Simmonds. 1987. Calibration of acoustic instruments for fish density estimation: a practical guide. ICES Coop. Res. Rep., No. 144, 69 p.

Ianelli, J. N., S. Barbeaux, T. Honkalehto, B. Lauth, and N. Williamson. 2005. Assessment of Alaska pollock stock in the Eastern Bering Sea. *In* Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pac. Fish. Mgmt. Council, 605 W. 4th Ave., STE 306, Anchorage, AK 99501-2252, Section 1:31-118.

MacLennan, D.N., P. G. Fernandez, and J. Dalen. 2002. A consistent approach to definitions and symbols in fisheries acoustics. ICES J. Mar. Sci. 59:365-369.

Miller, D. M. 1984. Reducing transformation bias in curve fitting. The American Statistician 38:124-126.

Petitgas, P. 1993. Geostatistics for fish stock assessments: a review and an acoustic application. ICES J. Mar. Sci. 50: 285-298.

Rivoirard, J., J. Simmonds, K.G. Foote, P. Fernandez, and N. Bez. 2000. Geostatistics for estimating fish abundance. Blackwell Science Ltd., Osney Mead, Oxford, England. 206 p.

Schabetsberger, R., R.D. Brodeur, T. Honkalehto, and K. L. Mier. 1999. Sex-biased cannibalism in spawning walleye pollock: the role of reproductive behavior. Environ. Biol. Fishes 54:175-190.

Simmonds, E.J., and D. N. MacLennan. 2005. Fisheries acoustics: theory and practice, 2nd ed. Fish and Aquatic Resources Series 10. Blackwell Science, Oxford. 456 pp.

Simrad. 2004. Operator manual for Simrad ER60 Scientific echo sounder application. Simrad AS, Strandpromenenaden 50, Box 111, N-3191 Horten, Norway.

Simrad. 1997. Operator Manual for Simrad EK500 Scientific echo sounder – Base version. Simrad AS, Strandpromenenaden 50, Box 111, N-3191 Horten, Norway.

Traynor, J. J. 1996. Target strength measurements of walleye pollock (*Theragra chalcogramma*) and Pacific whiting (*Merluccius productus*). ICES J. Mar. Sci. 53: 253-258.

Williamson, N., and J. Traynor. 1996. Application of a one-dimensional geostatistical procedure to fisheries acoustic surveys of Alaskan pollock. ICES J. Mar. Sci. 53: 423-428.

SCIENTIFIC PERSONNEL

Name	Nationality	Position	Organization
Taina Honkalehto	USA	Chief Scientist	AFSC
Denise McKelvey	USA	Fishery Biologist	AFSC
Scott Furnish	USA	Computer Specialist	AFSC

Annette Dougherty	USA	Fishery Biologist	AFSC
William Floering	USA	Fishery Biologist	AFSC
Sun-Do Hwan	Korea	Fishery Biologist	NFRDI
Tian Siquan	China	Fishery Biologist	SFU

AFSC - Alaska Fisheries Science Center, Seattle, WA

NFRDI - National Fisheries Research and Development Institute, Distant Water Fisheries Resources Team, Busan City, Republic of Korea

SFU – Shanghi Fisheries University, Shanghi, China.

Table 1.--Simrad ER60 38 kHz acoustic system description and settings during the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area and results from standard sphere acoustic system calibrations conducted before and after the survey.

	Survey system settings	Calibrations 7-Feb Three Saints Bay, Alaska	2-Mar Captains Bay, Alaska	9-Mar Anderson Bay, Alaska	23-Mar Uyak Bay, Alaska
Echosounder:	Simrad ER 60	--	--	--	--
Transducer:	ES38B	--	--	--	--
Frequency (kHz):	38	--	--	--	--
Transducer depth (m):	9.15	--	--	--	--
Pulse length (ms):	1.024	--	--	--	--
Transmitted power (W):	2000	--	--	--	--
Angle sensitivity:	21.9	--	--	--	--
2-Way beam angle (dB):	-21.0	--	--	--	--
Gain (dB)	26.41	26.43	26.41	26.40	26.43
Sa correction (dB)	-0.57	-0.58	-0.57	-0.58	-0.60
3 dB beamwidth (deg)					
Along:	7.00	7.06	7.00	7.04	7.02
Athwart:	7.08	7.04	7.08	6.97	7.00
Angle offset (deg)					
Along:	0.03	0.02	0.03	0.03	0.02
Athwart:	0.02	0.00	0.02	0.03	0.02
Post-processing S_v threshold (dB):	-70	--	--	--	
Reference standard sphere TS (dB):	--	-42.13	-42.14	-42.14	-42.10
Sphere range from transducer (m):	--	21.57	19.41	18.91	20.12
Absorption coefficient (dB/m):	0.009931	0.0099028	0.0099783	0.0100013	0.0099079
Sound velocity (m/s)	1467.0	1459.1	1460.7	1460.0	1455.8
Water temp at transducer (^{o}C):	--	3.0	3.1	3.2	2.3

Note: Gain and Beam pattern terms are defined in the "Operator Manual for Simrad ER60 Scientific echo sounder application (2004)" available from Simrad AS, Strandpromenaden 50, Box 111, N-3191 Horten, Norway.

Table 2.--Trawl station and catch data summary from the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area

Haul No.	Gear Type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Latitude (N)	Start position Longitude (W)	Depth (m) Footrope	Depth (m) Bottom	Water temp. (°C) Gear depth[2]	Water temp. (°C) Surface[3]	Profile No.	Catch Pollock (kg)	Catch Pollock Number	Catch Other (kg)
1	AWT	3-Mar	10:09	4.5	53 35.78	167 39.78	435	927	4.0	3.7	301	5	4	5
2	AWT	4-Mar	2:22	6.0	53 37.06	167 47.45	442	806	4.0	3.7	301	408	404	7
3	AWT	4-Mar	4:48	6.7	53 34.67	167 48.84	478	722	4.0	3.6	301	3,991	3,323	9
4	AWT	4-Mar	9:28	16.5	53 35.13	167 43.41	587	939	3.7	3.7	301	1,737	947	51
5	AWT	5-Mar	23:16	11.3	53 07.46	169 08.04	451	878	3.9	3.7	301	1,415	1,256	13
6	AWT	6-Mar	1:21	2.5	53 09.58	169 05.97	466	1069	3.7	3.8	301	12,500	9,871	-
7	AWT	6-Mar	9:35	15.6	53 00.76	169 16.60	528	913	3.6	3.8	301	1,000	670	23
8	AWT	6-Mar	15:35	23.7	53 02.14	169 16.37	460	826	3.8	3.8	301	466	308	5
9	AWT	7-Mar	10:18	8.6	53 05.68	169 09.91	434	853	3.9	3.8	301	869	542	5

[1]Gear type: AWT = Aleutian wing trawl

[2]Average Sea-Bird Electronics (SBE) temperature measured at the trawl headrope depth (about 29 m above the footrope) while fishing.

[3]SBE temperature measured at 1 m.

Table 3.--Numbers of biological samples and measurements collected during the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

	Walleye pollock				Fertilized		
Haul no.	Random lengths	Weights & maturities	Age	Ovary weights	pollock eggs	Seabird counts[1]	Myctophid lengths
1	4	4	4	2	-	-	96
2	404	195	195	99	8000	-	-
3	343	76	76	42	-	x	-
4	235	97	97	-	-	-	-
5	458	130	80	60	-	x	-
6	362	123	91	49	-	x	-
7	306	77	77	39	-	-	-
8	308	90	55	63	-	-	-
9	299	78	78	34	-	-	-
Totals	2719	870	753	388	8000		96

[1]"x" indicates counts were taken

Table 4.--Catch by species from 9 midwater trawl hauls during the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Species Name	Scientific name	Weight (kg)	%	Number	%
walleye pollock	*Theragra chalcogramma*	22,390.3	99.5	17,325	72.2
lanternfish unidentified	Myctophidae (family)	89.3	0.4	5,830	24.3
chum salmon	*Oncorhynchus keta*	8.8	<0.1	6	<0.1
northern smoothtongue	*Leuroglossus schmidti*	4.1	<0.1	546	2.3
squid unidentified	Teuthoidea (order)	4.1	<0.1	72	0.3
smooth lumpsucker	*Aptocyclus ventricosus*	4	<0.1	2	<0.1
Pacific lamprey	*Lampetra tridentata*	3	<0.1	10	<0.1
jellyfish unident	Scyphozoa (class)	1.4	<0.1	24	0.1
salmon and trouts unident	Salmonidae (family)	1.2	<0.1	5	<0.1
salps unident	Thaliacea (family)	1	<0.1	38	0.2
arrowtooth flounder	*Atheresthes stomias*	0.5	<0.1	1	<0.1
Viperfish spp.	Chauliodus (genus)	0.4	<0.1	18	<0.1
shrimp unident.	Decapoda (order)	0.2	<0.1	109	0.5
eulachon	*Thaleichthys pacificus*	<0.1	<0.1	1	<0.1
Totals		22,508.3		23989	

Table 5.--Estimates of walleye pollock biomass (in metric tons (t)) by survey area and management area from February-March echo integration-trawl surveys in the Bogoslof Island area between 1988 and 2007.

Bogoslof Survey Area				**Central Bering Sea Specific Area**	
Year	**Biomass (million t)**	**Area (nmi^2)**	**Relative estimation error (%)**	**Biomass (million t)**	**Relative estimation error (%)**
1988	2.396	--	--	2.396	--
1989	2.126	--	--	2.084	--
1990	--	No survey	--	--	--
1991	1.289	8,411	11.7	1.283	--
1992	0.940	8,794	20.4	0.888	--
1993	0.635	7,743	9.2	0.631	--
1994	0.490	6,412	11.6	0.490	--
1995	1.104	7,781	10.7	1.020	--
1996	0.682	7,898	19.6	0.582	--
1997	0.392	8,321	14.0	0.342	--
1998	0.492	8,796	19.0	0.432	19.0
1999	0.475	Conducted by Japan Fisheries Agency		0.393	--
2000	0.301	7,863	14.3	0.270	12.7
2001	0.232	5,573	10.2	0.208	11.8
2002	0.226	2,903	12.2	0.226	12.2
2003	0.198	2,993	21.5	0.198	21.5
2004	--	No survey	--	--	--
2005	0.253	3,112	16.7	0.253	16.7
2006	0.240	1,803	11.8	0.240	11.8
2007	0.292	1,871	11.5	0.292	11.5

Table 6.--Numbers-at-length estimates (millions) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency. Lengths are in centimeters.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0
11	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0
12	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0	--	0	0	0
13	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0
14	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0
15	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
16	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
17	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
18	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
19	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
20	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
21	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
22	0	0	--	<1	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
23	0	0	--	2	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0
24	0	0	--	1	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
26	0	0	--	<1	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
27	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
28	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
29	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0
31	0	0	--	0	<1	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
32	0	0	--	0	<1	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
33	0	0	--	0	<1	0	0	0	0	0	0	0	0	0	<1	<1	--	0	0	0
34	0	0	--	0	0	0	0	<1	<1	0	<1	0	0	0	<1	<1	--	0	0	0
35	0	0	--	0	0	0	0	<1	0	<1	0	0	0	0	<1	0	--	0	0	0
36	0	0	--	0	<1	0	0	<1	<1	<1	<1	0	0	0	1	0	--	0	0	0
37	9	3	--	<1	0	0	0	<1	<1	<1	<1	0	0	0	1	<1	--	<1	0	0
38	6	0	--	2	<1	1	0	1	1	<1	1	0	0	<1	1	<1	--	1	<1	0
39	16	4	--	5	0	2	<1	4	1	1	3	<1	<1	<1	2	<1	--	2	<1	<1
40	24	3	--	7	1	4	3	12	4	1	7	1	<1	1	3	<1	--	7	2	0
41	27	4	--	19	3	5	6	20	8	2	9	6	1	1	4	<1	--	11	5	1
42	48	23	--	23	7	7	9	40	14	3	11	8	1	1	2	<1	--	12	10	2
43	118	33	--	31	14	6	14	40	17	4	11	13	3	1	5	1	--	11	16	4
44	179	54	--	36	18	7	21	41	21	5	10	13	3	2	5	2	--	11	20	8
45	329	159	--	46	28	8	21	50	23	7	9	17	4	3	7	3	--	13	23	11
46	488	177	--	55	32	13	21	53	31	10	11	19	5	4	5	5	--	11	23	17
47	547	389	--	79	42	22	18	40	36	14	9	14	6	5	9	5	--	11	18	17
48	476	434	--	130	68	28	17	55	36	15	12	11	6	5	7	7	--	10	17	20
49	389	431	--	168	102	46	16	47	37	18	15	10	5	6	6	6	--	8	14	14
50	248	366	--	205	129	69	39	52	40	21	20	16	6	6	5	7	--	8	9	18
51	162	279	--	189	144	76	46	58	45	24	23	11	8	6	5	4	--	9	9	15
52	80	168	--	160	118	73	52	78	52	26	28	20	10	7	4	4	--	7	7	13

Table 6.--Continued.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
53	48	85	--	122	106	73	49	81	52	26	35	17	13	8	6	4	--	7	5	12
54	19	50	--	63	67	66	43	88	53	31	41	21	16	9	7	3	--	7	5	10
55	12	13	--	40	41	50	37	81	48	28	38	33	21	13	9	5	--	8	3	9
56	4	5	--	17	27	29	26	69	40	24	35	38	20	13	12	7	--	6	6	8
57	3	8	--	8	13	14	17	58	37	22	30	33	24	16	13	7	--	7	5	6
58	1	1	--	4	6	9	10	47	28	17	27	36	23	14	14	10	--	6	7	7
59	0	0	--	1	5	3	6	31	19	13	18	23	16	12	12	9	--	8	5	7
60	0	0	--	1	1	1	3	17	12	12	13	15	13	12	12	13	--	7	7	6
61	2	0	--	1	<1	1	2	7	6	6	8	18	10	10	8	9	--	9	5	8
62	0	0	--	<1	<1	<1	1	4	2	3	5	13	7	6	6	7	--	7	5	7
63	0	0	--	0	0	0	<1	2	1	1	3	4	4	4	4	5	--	7	4	4
64	0	0	--	0	1	<1	0	1	<1	1	1	3	2	3	3	5	--	5	2	4
65	0	0	--	<1	0	0	0	<1	<1	<1	1	1	1	1	1	3	--	4	2	3
66	0	0	--	0	0	0	0	<1	0	<1	1	<1	<1	<1	1	1	--	2	2	3
67	0	0	--	0	0	0	0	0	0	0	0	1	<1	<1	<1	1	--	2	1	2
68	0	0	--	0	0	0	0	1	0	0	<1	0	<1	<1	<1	<1	--	1	1	1
69	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	0	<1	--	<1	<1	1
70	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	<1	0	--	<1	<1	<1
71	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1	<1	<1
72	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1	0	<1
73	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1	0	0
Total	3,236	2,687	--	1,419	975	613	478	1,081	666	337	435	416	229	170	181	134	--	225	239	236

Table 7.--Biomass-at-length estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency. Lengths are in centimeters.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0
11	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0	--	0	0	0
12	0	0	--	0	0	0	0	5	0	0	0	0	0	0	0	0	--	0	0	0
13	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0	--	0	0	0
14	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0	--	0	0	0
15	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
16	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
17	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
18	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
19	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
20	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
21	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
22	0	0	--	13	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
23	0	0	--	70	0	0	0	0	0	0	0	0	0	0	37	0	--	0	0	0
24	0	0	--	61	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
26	0	0	--	26	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
27	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
28	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
29	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	6	0	--	0	0	0
31	0	0	--	0	37	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
32	0	0	--	0	42	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0
33	0	0	--	0	48	0	0	0	0	0	0	0	0	0	9	2	--	0	0	0
34	0	0	--	0	0	0	0	53	35	0	29	0	0	0	47	2	--	0	0	0
35	0	0	--	0	0	0	0	93	0	29	0	0	0	0	72	0	--	0	0	0
36	0	0	--	0	68	0	0	42	96	18	32	0	0	0	202	0	--	0	0	0
37	3,199	846	--	115	0	0	0	113	109	84	92	0	0	0	451	16	--	39	0	0
38	2,304	0	--	768	84	260	0	435	465	173	395	0	0	19	503	6	--	323	29	0
39	6,365	1,461	--	1,843	0	634	202	1,697	562	507	1,250	258	168	149	814	7	--	942	145	214
40	10,573	1,116	--	2,801	451	1,776	1,190	5,510	1,857	634	3,208	1,242	195	307	1,699	80	--	3,143	869	0
41	12,697	1,532	--	7,940	1,235	2,276	2,855	9,777	3,637	851	4,484	5,598	575	419	1,899	170	--	5,257	2,326	402

Table 7.--Continued

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
42	24,360	10,704	--	10,812	3,316	3,571	4,990	20,730	7,012	1,387	5,652	7,223	674	469	1,299	251	--	6,158	5,378	1,231
43	64,253	16,516	--	15,540	6,760	3,089	8,021	22,332	9,190	2,158	6,407	12,079	1,511	857	2,855	436	--	6,318	9,034	2,426
44	104,733	29,588	--	20,103	9,877	4,006	12,963	24,863	12,735	3,018	6,048	11,877	1,622	1,546	3,609	1,163	--	6,398	11,836	5,213
45	206,586	93,899	--	28,059	16,329	4,818	13,823	32,817	14,927	4,824	5,592	16,278	2,848	2,362	5,071	2,123	--	8,145	15,091	7,254
46	328,735	113,092	--	36,235	20,645	8,835	15,081	37,303	21,637	7,399	7,774	17,678	3,289	3,071	4,101	4,069	--	8,122	16,667	12,192
47	394,741	268,496	--	56,880	29,146	16,669	13,565	30,184	26,425	10,786	6,653	13,933	5,002	4,338	7,361	3,814	--	8,682	14,277	13,072
48	367,368	323,170	--	101,488	51,983	22,214	13,658	44,572	28,658	12,233	9,528	11,280	5,191	4,275	6,022	5,859	--	7,934	14,524	16,572
49	320,630	345,632	--	141,399	84,329	39,811	14,414	40,477	31,599	15,951	12,766	10,698	4,659	5,443	5,611	5,733	--	7,115	12,801	12,604
50	217,890	314,778	--	187,006	115,614	63,571	36,256	47,785	35,907	19,593	18,837	18,373	5,466	5,617	4,865	6,939	--	7,453	8,940	17,819
51	152,084	258,067	--	186,358	140,004	75,524	46,297	57,291	43,272	23,896	23,203	12,204	8,364	5,794	4,973	4,221	--	9,035	9,558	16,112
52	79,654	166,322	--	170,855	124,034	77,721	55,851	81,793	53,696	28,549	29,109	23,427	10,816	7,683	3,970	4,871	--	7,711	7,312	15,141
53	50,739	89,721	--	139,671	120,309	83,189	55,151	90,342	57,294	29,783	39,234	20,486	14,509	8,970	6,471	4,752	--	8,074	5,941	15,492
54	21,211	56,681	--	77,905	82,110	79,461	52,329	104,021	61,504	38,168	48,567	25,270	19,059	11,429	8,210	4,104	--	8,735	6,430	12,804
55	14,191	16,270	--	52,506	53,286	64,342	47,770	102,318	59,033	35,853	47,461	39,463	27,179	17,342	12,450	6,418	--	11,061	4,877	12,723
56	5,580	6,059	--	23,541	38,564	39,556	35,451	91,962	52,765	33,144	47,627	46,764	27,212	17,388	16,211	10,715	--	8,930	9,602	13,235
57	3,886	10,681	--	12,470	19,710	20,781	24,453	81,885	52,000	31,736	42,594	40,641	34,562	24,019	19,343	10,821	--	9,814	6,813	9,537
58	1,395	1,220	--	6,603	9,188	14,391	15,826	70,522	40,581	26,309	41,160	44,788	34,255	22,069	21,745	15,656	--	9,735	10,528	11,442
59	0	0	--	1,284	7,872	4,376	9,546	48,878	28,918	21,031	28,241	28,362	26,252	19,904	19,100	14,863	--	13,976	8,888	10,445
60	0	0	--	2,743	2,631	1,989	4,716	28,240	19,749	20,509	21,604	18,174	22,075	20,044	20,516	22,945	--	13,186	11,377	12,562
61	2,561	0	--	2,195	562	1,756	3,644	11,855	10,762	11,428	14,301	22,618	18,519	17,588	14,619	17,276	--	16,771	8,337	14,111
62	0	0	--	780	600	372	1,826	7,951	3,578	6,439	9,748	15,120	12,972	11,689	12,279	14,910	--	13,268	9,718	14,699
63	0	0	--	0	0	0	200	3,978	2,835	2,999	6,344	5,181	7,033	8,482	8,188	11,207	--	14,025	7,997	9,066
64	0	0	--	0	1,363	415	0	1,074	863	1,489	1,777	3,198	4,277	5,940	5,711	10,509	--	10,001	5,553	9,172
65	0	0	--	938	0	0	0	495	578	1,096	1,156	1,833	1,660	2,860	2,465	7,259	--	9,033	4,367	7,187
66	0	0	--	0	0	0	0	163	0	329	1,251	403	534	1,095	1,509	3,571	--	5,120	4,679	5,988
67	0	0	--	0	0	0	0	0	0	0	0	863	520	420	591	1,948	--	5,161	3,264	5,323
68	0	0	--	0	0	0	0	2,570	0	0	276	0	403	426	765	744	--	2,157	1,716	2,716
69	0	0	--	0	0	0	0	0	0	0	0	0	0	63	0	390	--	933	644	2,774
70	0	0	--	0	0	0	0	0	0	0	0	0	0	95	64	0	--	381	467	880
71	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	99	74	796
72	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	118	0	375
73	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	109	0	0
Total	2,395,735	2,125,851	--	1,289,008	940,197	635,403	490,078	1,104,118	682,279	392,403	492,398	475,311	301,402	232,170	225,712	197,851	--	253,459	240,059	291,580

Table 8.--Numbers-at-age estimates (millions) from February-March echo integration-trawl
No surveys were conducted in

surveys of walleye pollock in the Bogoslof Island area.
1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0
1	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0	--	0	0
2	0	0	--	4	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0
3	0	0	--	0	1	1	0	2	0	0	0	0	0	0	9	<1	--	0	0
4	0	6	--	2	2	33	21	6	<1	<1	<1	2	1	1	5	8	--	5	4
5	28	15	--	12	27	17	86	75	6	4	11	5	6	14	3	6	--	81	55
6	327	58	--	46	54	44	26	278	96	16	61	29	4	12	41	7	--	31	104
7	247	363	--	213	97	46	38	105	187	55	34	77	14	10	11	25	--	13	18
8	164	147	--	93	74	48	36	68	85	88	70	34	30	10	8	11	--	11	6
9	350	194	--	160	71	42	36	80	40	38	77	50	16	14	6	4	--	22	6
10	1,201	91	--	44	55	28	17	53	37	28	32	75	28	12	7	5	--	7	9
11	288	1,105	--	92	57	51	27	54	24	16	25	29	45	18	8	4	--	3	3
12	287	222	--	60	33	25	23	19	24	16	21	27	21	31	14	10	--	5	2
13	202	223	--	373	34	27	13	59	12	13	19	25	16	13	30	8	--	4	4
14	89	82	--	119	142	42	9	32	36	7	18	16	11	7	9	26	--	5	5
15	27	90	--	41	164	92	45	12	18	13	9	12	11	9	7	6	--	11	8
16	17	30	--	38	59	47	36	31	4	5	15	10	9	8	9	5	--	12	5
17	7	60	--	29	8	25	28	103	16	4	5	8	3	5	5	3	--	6	7
18	3	0	--	32	15	11	16	60	35	12	8	6	6	1	4	5	--	4	2
19	0	0	--	56	22	11	4	18	26	12	10	3	3	3	2	1	--	3	1
20	0	0	--	4	42	11	4	5	12	7	15	4	2	1	2	<1	--	1	2
21	0	0	--	2	13	10	8	5	3	2	4	3	1	0	0	1	--	<1	<1
22	0	0	--	0	3	1	2	6	2	1	1	2	1	0	0	0	--	0	0
23	0	0	--	0	1	1	2	6	1	<1	0	<1	0	<1	<1	0	--	0	0
24	0	0	--	0	0	0	1	2	0	1	0	0	<1	<1	<1	0	--	<1	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0
Total	3,236	2,687	--	1,419	975	613	478	1,081	666	336	435	416	229	170	181	134	--	225	239

Table 9.--Biomass-at-age estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0
1	0	0	--	0	0	0	0	10	0	0	0	0	0	0	0	0	--	0	0
2	0	0	--	170	0	0	0	0	0	0	0	0	0	0	40	0	--	0	0
3	0	0	--	0	162	284	0	681	0	0	0	0	0	0	4,598	4	--	0	0
4	0	2,184	--	715	782	18,809	13,028	3,411	322	87	78	1,809	324	437	2,551	7,084	--	3,176	1,986
5	14,997	7,275	--	6,067	21,455	11,939	59,938	48,690	3,668	2,083	6,771	5,688	4,060	11,581	2,004	5,348	--	52,268	35,924
6	192,324	41,140	--	24,911	38,081	39,100	21,530	208,409	69,106	10,598	37,697	28,096	2,884	11,166	34,118	6,229	--	25,162	85,399
7	155,569	241,301	--	143,024	67,027	43,049	39,768	82,680	165,354	49,598	29,637	77,751	12,065	9,698	10,107	26,066	--	13,540	18,570
8	114,725	111,156	--	74,575	59,445	46,874	39,107	72,294	75,658	94,580	73,714	37,210	30,361	11,576	8,993	12,179	--	14,542	7,315
9	251,417	149,143	--	149,035	67,358	43,976	39,539	96,260	45,732	44,076	94,394	59,688	17,797	18,033	8,020	6,085	--	28,927	8,428
10	910,016	68,495	--	43,519	56,969	30,688	20,520	64,202	45,360	37,822	40,417	90,284	39,852	16,273	9,149	8,361	--	10,152	14,591
11	226,380	894,895	--	94,020	61,394	59,294	31,589	70,646	31,116	22,942	35,706	35,240	63,335	26,491	12,298	7,257	--	5,999	3,996
12	232,810	187,280	--	59,273	36,293	27,008	27,506	26,482	33,262	22,497	29,180	32,724	31,891	49,843	22,821	18,366	--	9,132	3,110
13	167,054	193,548	--	377,521	37,218	29,947	17,038	77,225	16,950	18,074	26,690	29,864	24,979	20,032	47,965	14,288	--	7,966	6,417
14	81,596	71,920	--	116,171	150,237	46,997	10,896	42,417	48,990	10,713	26,304	18,915	17,620	11,025	14,573	47,035	--	9,890	8,615
15	22,969	81,447	--	38,750	168,966	107,062	52,899	16,595	24,443	19,768	13,230	14,207	16,150	14,340	12,209	11,354	--	20,887	14,806
16	16,336	24,342	--	37,870	63,304	54,401	42,771	37,907	5,538	6,659	21,631	12,723	14,740	13,925	14,701	8,207	--	24,633	9,190
17	6,681	51,725	--	30,696	9,342	27,577	32,128	131,396	20,782	5,470	8,218	9,635	5,637	7,351	8,186	5,448	--	11,130	12,900
18	2,863	0	--	32,392	15,467	10,736	17,911	74,010	43,092	16,894	10,212	7,020	8,460	2,106	6,112	10,134	--	8,390	3,459
19	0	0	--	55,116	23,380	13,607	4,768	22,292	31,760	17,174	13,047	3,357	4,798	5,264	3,425	1,804	--	5,338	1,696
20	0	0	--	3,840	43,605	11,963	5,081	5,902	14,486	9,228	19,016	4,343	2,547	2,043	2,545	782	--	1,464	3,115
21	0	0	--	1,341	15,240	10,167	8,866	5,433	4,023	1,885	5,376	3,574	1,566	0	0	1,820	--	425	542
22	0	0	--	0	3,186	1,329	2,011	7,728	1,974	947	1,078	2,668	1,810	0	0	0	--	0	0
23	0	0	--	0	1,287	598	2,323	6,696	661	419	0	514	0	493	470	0	--	0	0
24	0	0	--	0	0	0	860	2,758	0	888	0	0	526	493	572	0	--	437	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	255	0	--	0	0
Total	2,395,737	2,125,851	--	1,289,006	940,198	635,405	490,077	1,104,124	682,277	392,402	492,396	475,311	301,402	232,170	225,712	197,851	--	253,459	240,059

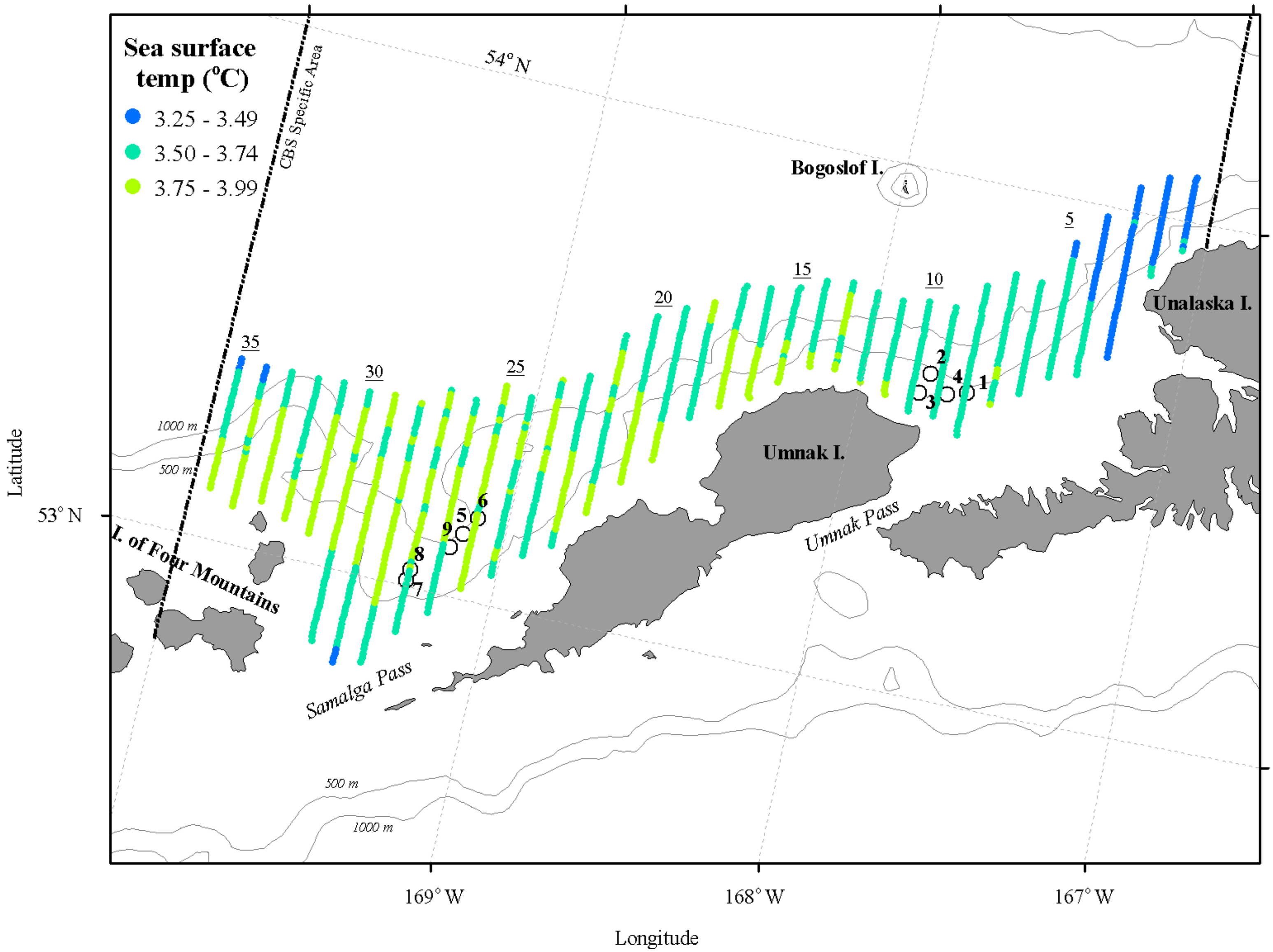


Figure 1.-- Transects, haul locations, and sea surface temperatures measured from the ship's sensor and recorded during the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area. Hauls are indicated by circles and transect numbers are underlined. The dash-dotted line indicates the Central Bering Sea Specific Area.

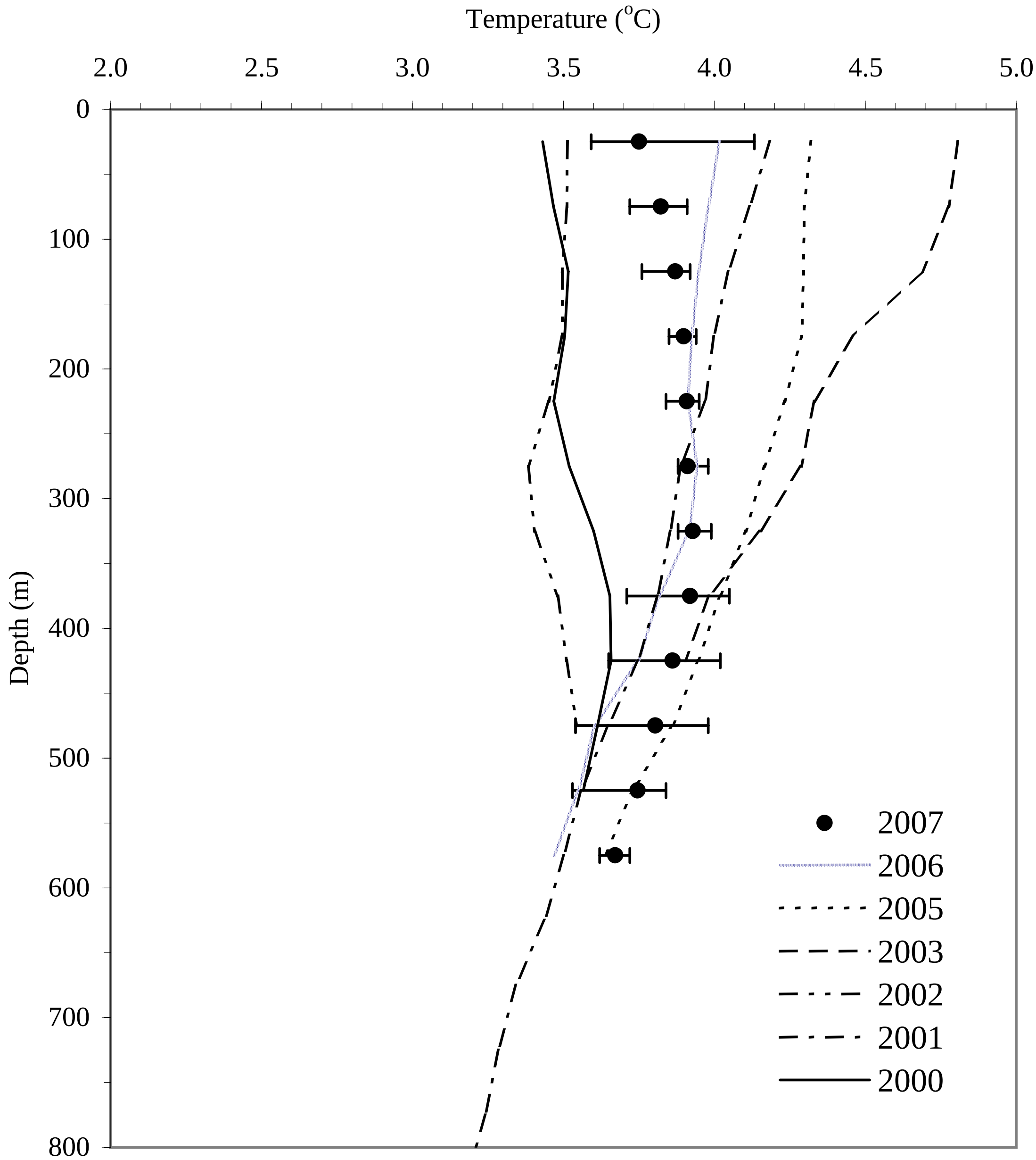


Figure 2.--Average temperature (^{o}C) (symbols) by 50-m depth intervals observed during hauls from the winter 2000-2003, and 2005-2007 echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. The horizontal bars represent temperature range observed during the 2007 survey.
Note: Temperature data from the 2003 survey were collected from only three locations.

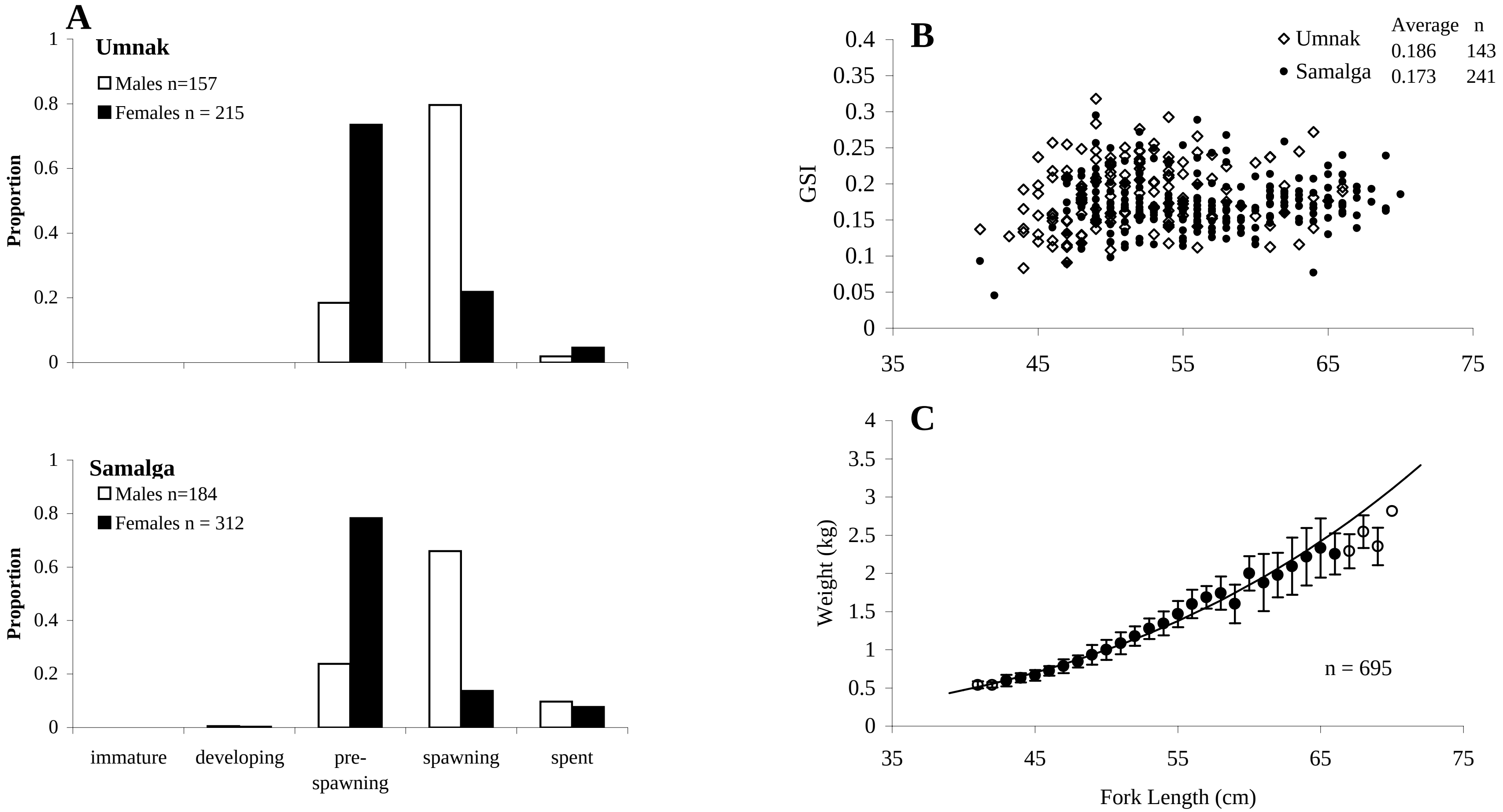


Figure 3.--Pollock maturity stages for Umnak and Samalga length strata (A), gonado-somatic index (GSI) for pre-spawning females as a function of fork length (cm) (B), and observed mean weight-at-length with a fitted regression line (sexes combined; hollow circles indicate fewer than six fish were measured) (C) observed during the winter 2007 echo integration-trawl Vertical bars indicate +/- one standard deviation.

survey of the Bogoslof Island area.

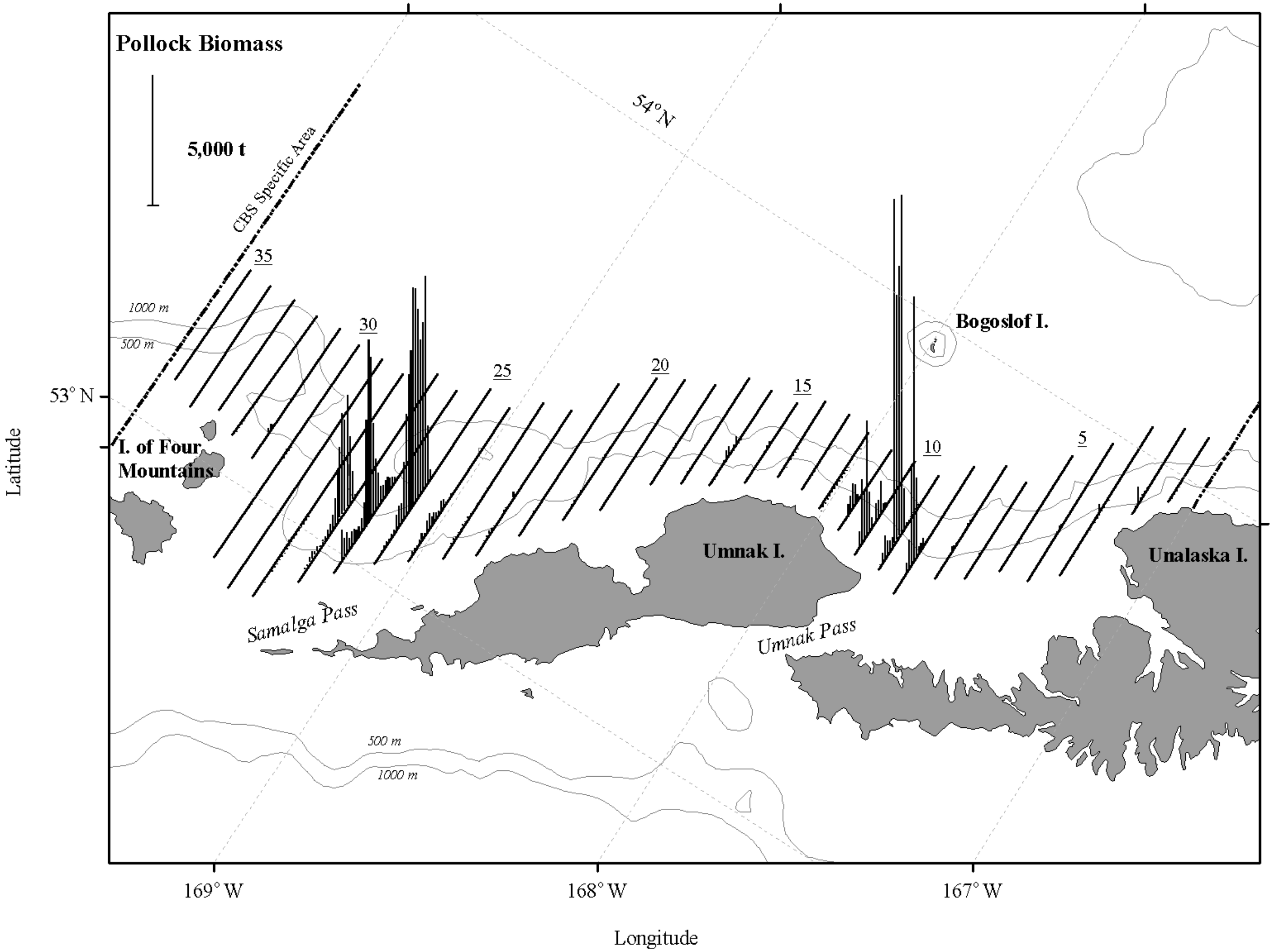


Figure 4.--Pollock biomass in metric tons (t) along tracklines during the winter 2007 echo integration-trawl survey of walleye pollock in the Bogoslof Island area. The dash-dotted line indicates the Central Bering Sea Specific Area.

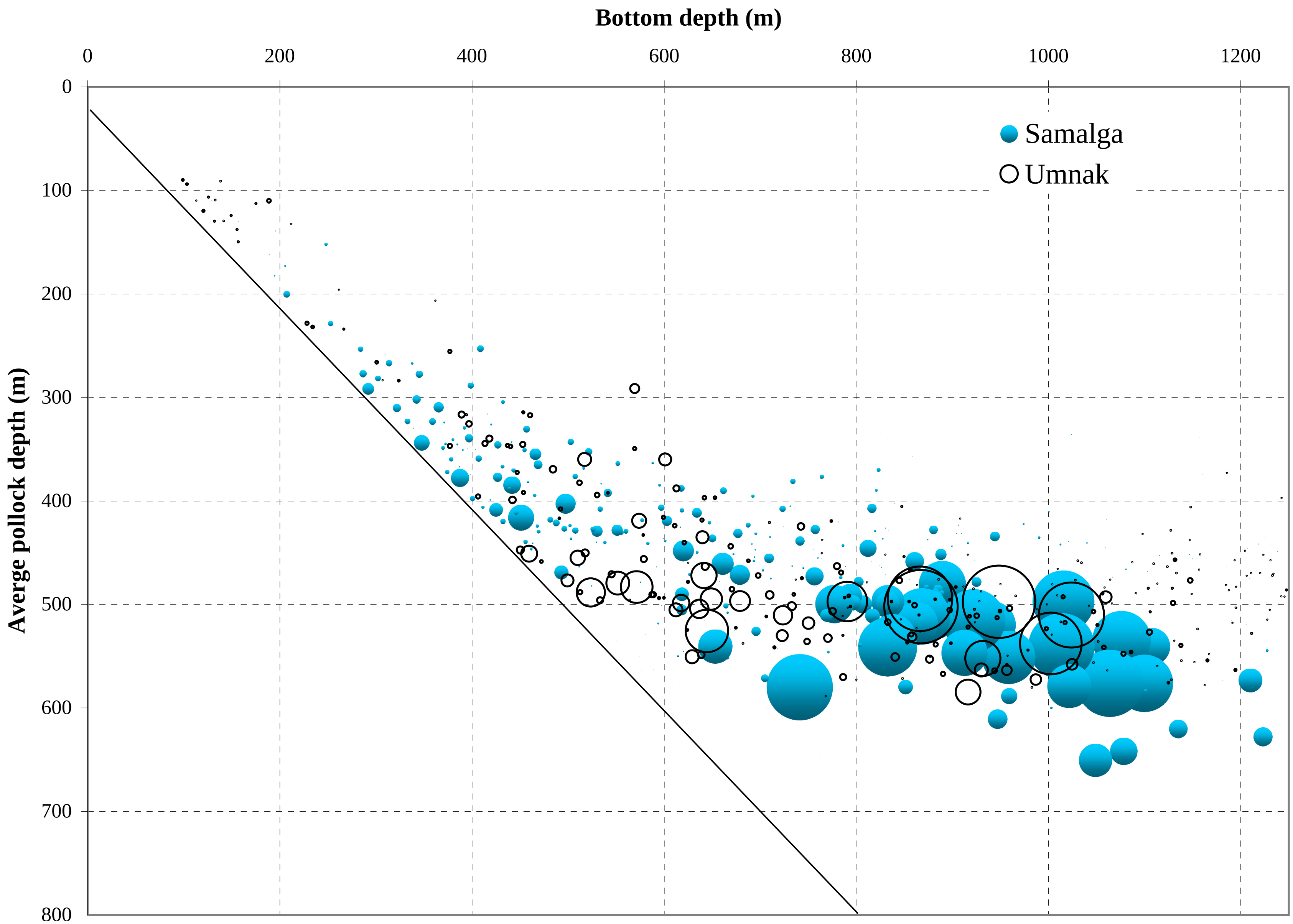


Figure 5.--Average pollock depth (weighted by biomass) versus bottom depth (m), per 0.5 nmi sailed distance for the

Bubble size was scaled to the maximum biomass/0.5 nmi interval (Umnak region,
). The diagonal line indicates where the average pollock depth equals bottom depth.
Umnak and Samalga regions during the winter 2007 echo integration-trawl survey of walleye pollock in the
Bogoslof Island area.
13,710 t

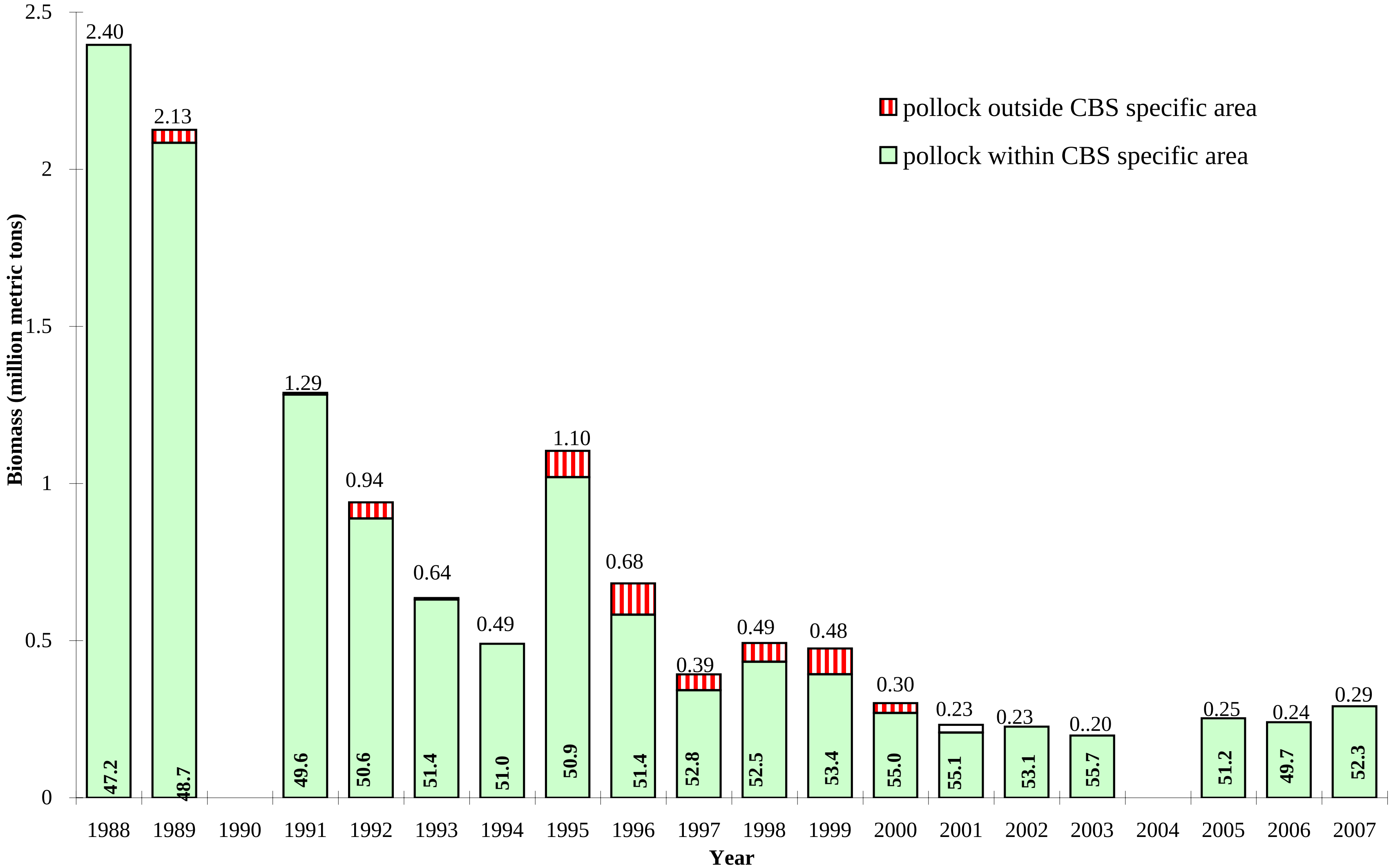


Figure 6.--Biomass estimates and average fork lengths obtained during winter echo integration-trawl surveys for walleye pollock The United States conducted all but the 1999 survey, which was conducted by There were no surveys in 1990 or 2004. Total pollock biomass for each survey year is indicated on top of

in the Bogoslof Island area, 1988-2007.
Japan.
each bar and average fork length (cm) is indicated inside each bar.

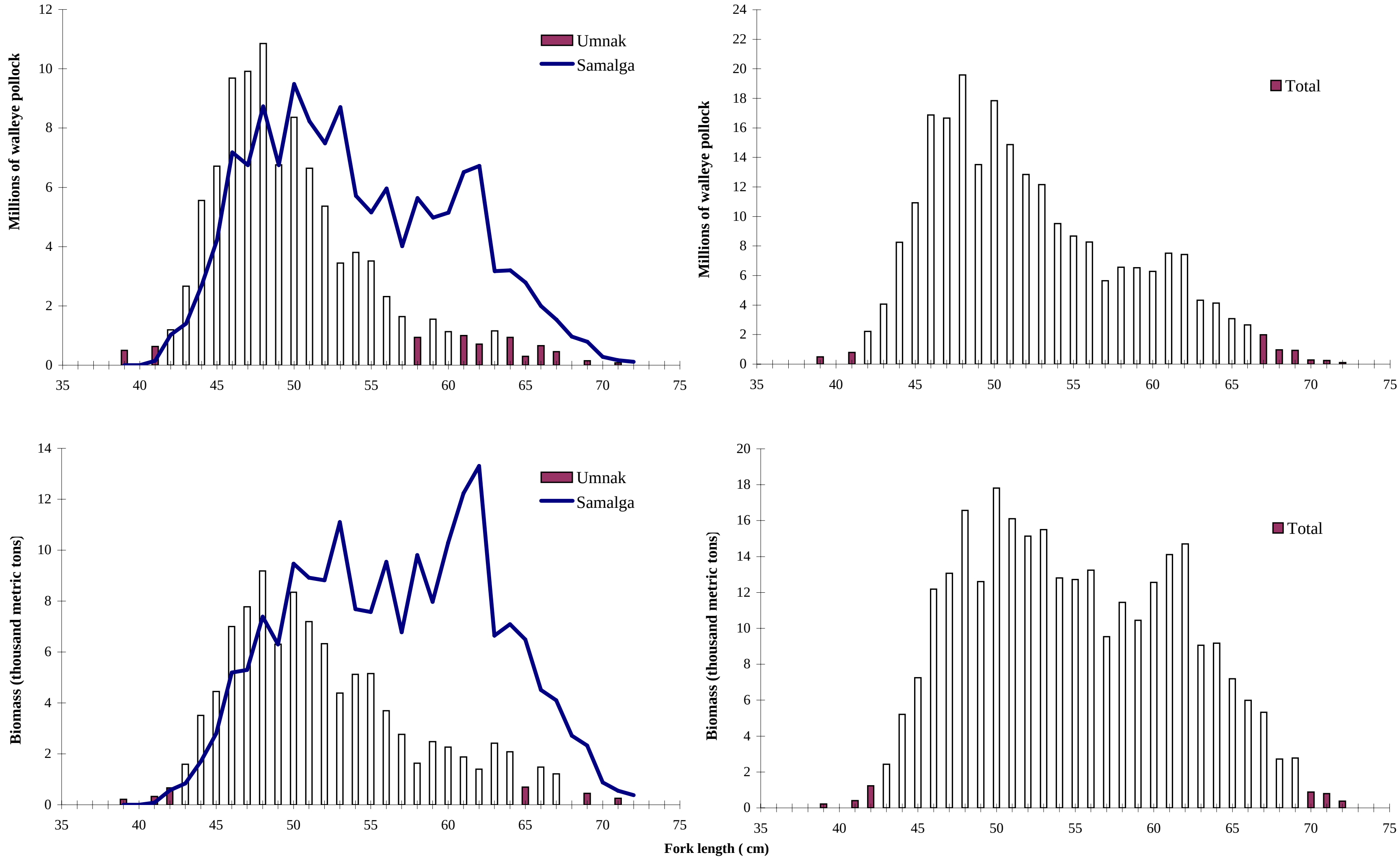


Figure 7.--Population at length (top) and biomass at length (bottom) estimates from the winter 2007 echo integration-trawl survey of
Note Y-axis differences.

walleye pollock in the Bogoslof Island area.

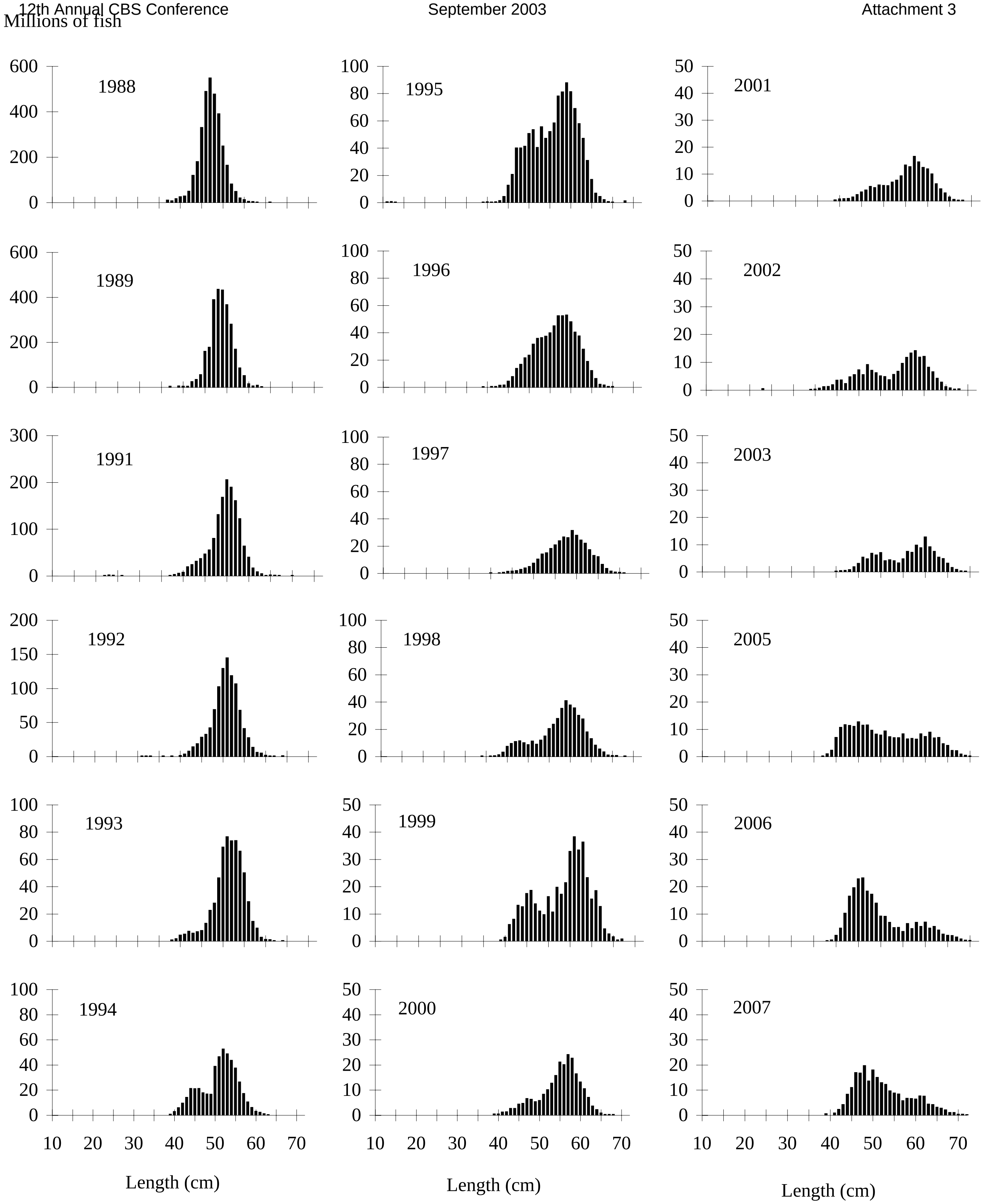


Figure 8.--Numbers-at-length estimates (millions) from winter echo integration-trawl surveys of spawning pollock near Bogoslof Island. The United States conducted all but the 1999 survey, which was conducted by Japan. There were no surveys in 1990 or 2004. Note Y-axis scales differ.

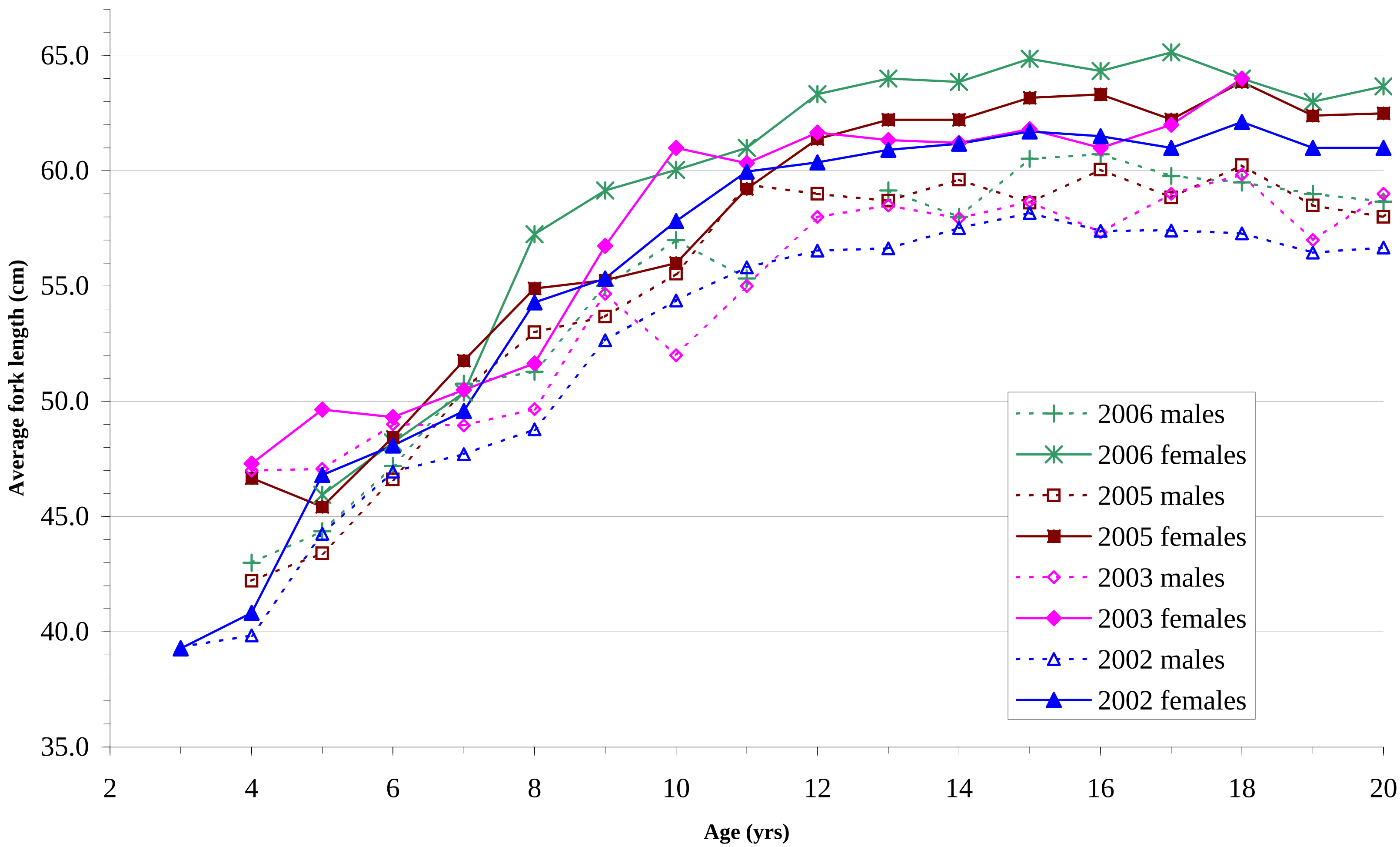


Figure 9.--Average length at age for pollock from the winter 2002, 2003, 2005 and 2006 echo integration-trawl surveys of the Bogoslof Island area.

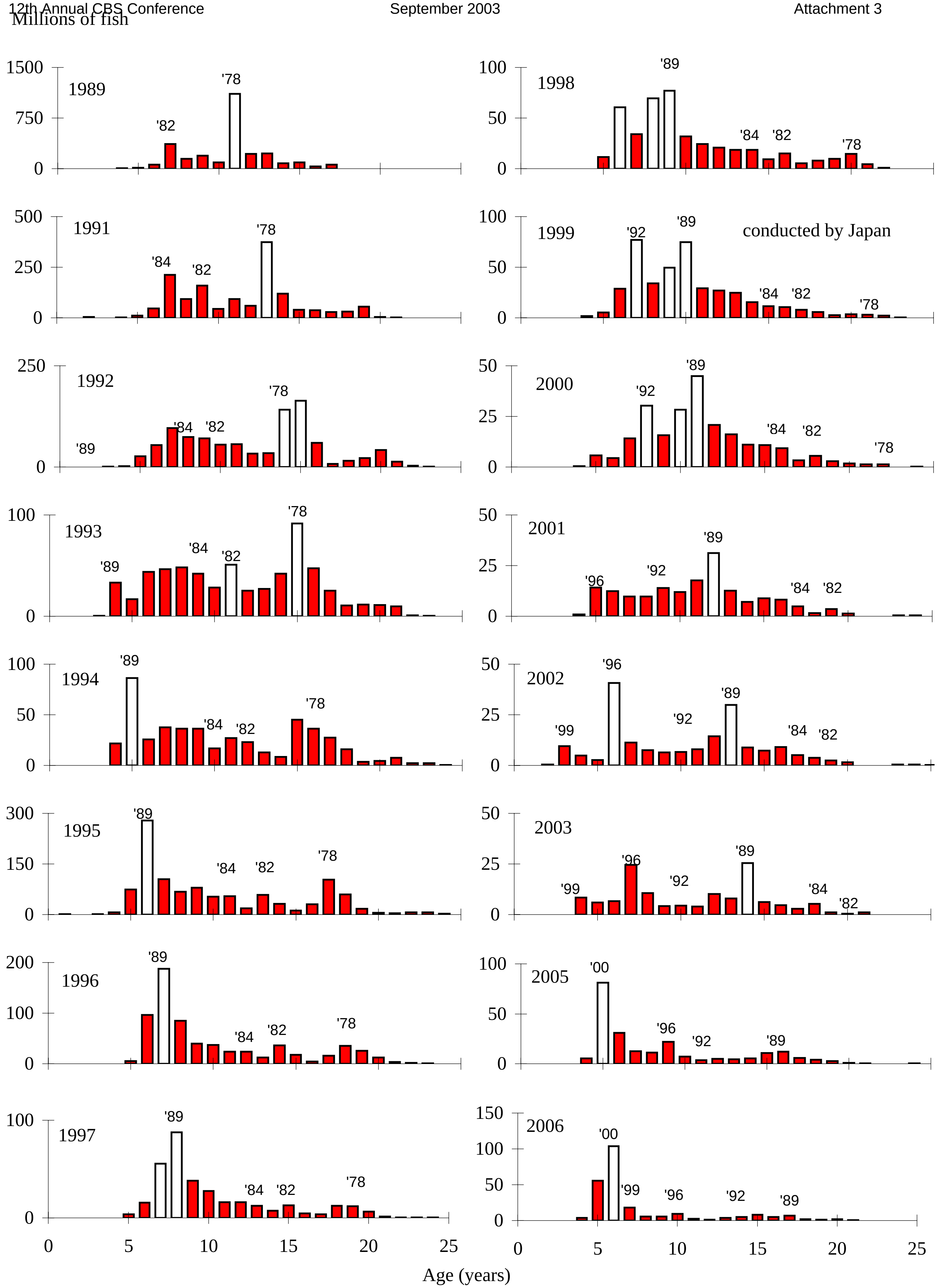


Figure 10.--Numbers-at-age estimates (millions) from echo integration-trawl surveys of pollock near Bogoslof Island. Major year classes on the E. Bering Sea shelf are indicated. No surveys were conducted in 1990 or 2004.

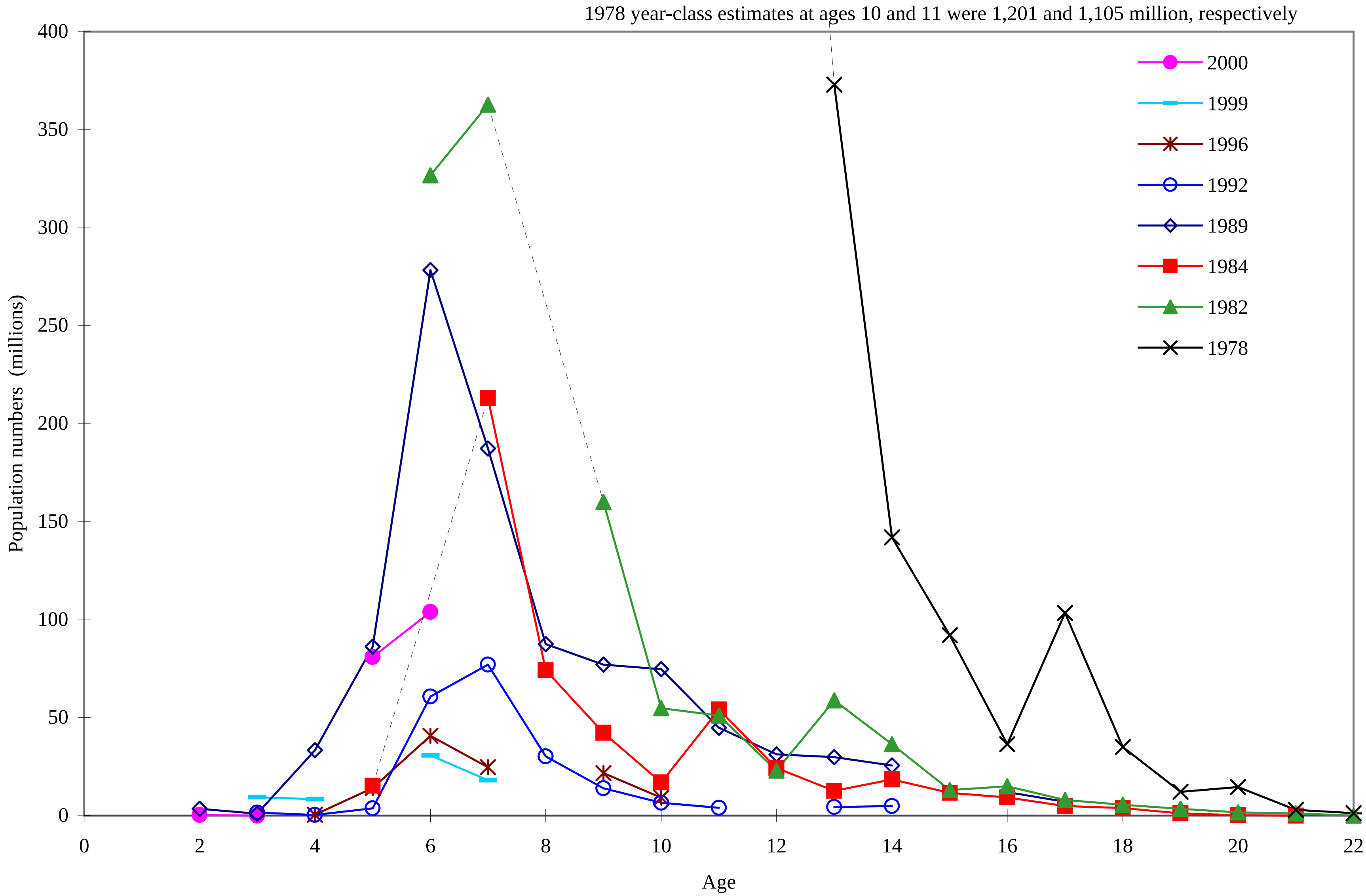


Figure 11.--Estimated population numbers at age for dominant year classes observed in winter echo integration-
Data are from surveys conducted between
The United States conducted all but the 1999 survey, which was conducted by
No surveys were conducted in 1990 (dashed lines) or 2004.

trawl surveys of Bogoslof Island area spawning pollock.
1988 and 2006.

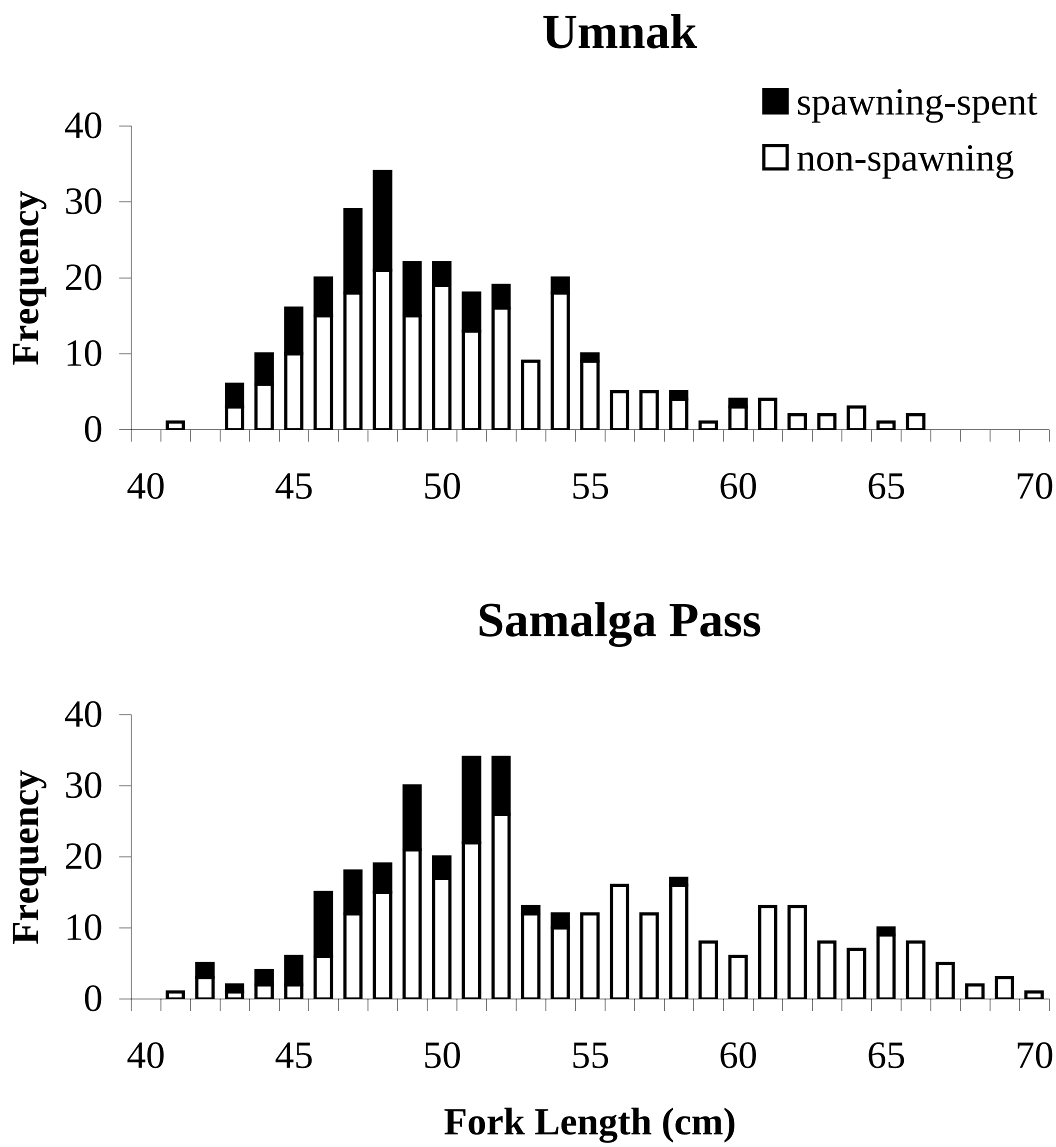


Figure 12.--Unweighted female pollock maturity at length for non-spawning and spawning-spent maturity stages observed in the Umnak and Samalga Pass regions during the winter 2007 echo integration-trawl survey of the Bogoslof Island area.

Report on the Korean Trial Fishing for Walleye Pollock in the convention area of the Bering Sea in 2006.

Hyun-Su JO

Distant- water Fisheries Resources Team, National Fisheries Research & Development

Institute, Busan 619-902, Korea

The trial fishing in the convention area of the Bering Sea (Donut hole) was conducted by three Korean commercial fishing vessels in 2006. First vessel, it was conducted by NAMBUK HO (5,549.02 G/T) in the convention area during 9 days (Jul. 31 ~ Aug. 8. 2006). Second vessel, ORIENTAL ANGEL (5,210 G/T) of stern trawler conducted in the convention area during 6 days (Jul. 31 ~ Aug. 5. 2006). Third vessel, JOONSUNG HO (2,866.0 G/T) of stern trawler conducted in the convention area during 9 days (Jul. 31 ~ Aug. 8. 2006). The main purpose of the trial fishing was to determine the geographical distribution of walleye pollock in the convention area and to collect biological data of walleye pollock. But walleye pollock was caught 1 fish (0.7kg) only during Korean trial fishing in 2006. Fig. 1 ~ 3 were presented the hydroacoustic tracklines and haul positions during the Korean trial fishing.

NAMBUK HO conducted 3 hauls using the midwater trawl net (codend mesh size 120㎜). The depth of trawl gear was 130m to 350m, the hauling time was 7 hour to 12 hour. In haul no. 1, some squid and fish caught; squid 58 fish (19.7 kg), Rockfish 1 fish (2.7 kg) and smooth lumpsucker 1 fish (0.3 kg). Haul no. 2 were caught 20 fish (5.5 kg) of squid and 1 fish (0.5 kg) of smooth lumpsucker. Haul no. 3 were caught 1 fish (0.5 kg) of squid and 7 fish (5.5 kg) of smooth lumpsucker. (Table 1, 4).

ORIENTAL ANGEL conducted 3 hauls using the midwater trawl net (codend mesh size 130㎜). The depth of trawl gear was 250m, the hauling time was 4 hour to 8 hour. In haul no. 1 and 3, could not caught anything. Haul no. 2 were caught 6 fish (1.10 kg) of lanternfish and 2 fish (0.4 kg) of unidentified sp.. (Table 2, 4).

JOONSUNG HO conducted 5 hauls using the midwater trawl net (codend mesh size 120㎜). The depth of trawl gear was 150m to 250m, the hauling time was 2 hour to 12 hour. In haul no. 1 and 2, could not caught anything. Haul no. 3 were caught 1 fish (0.7 kg) of pollock and 2 fish (0.6 kg) of squid. Haul no. 4 was caught 8 fish (2.6 kg) of squid. Haul no. 5 was caught 2 fish (0.5 kg) of squid. (Table 3, 4).

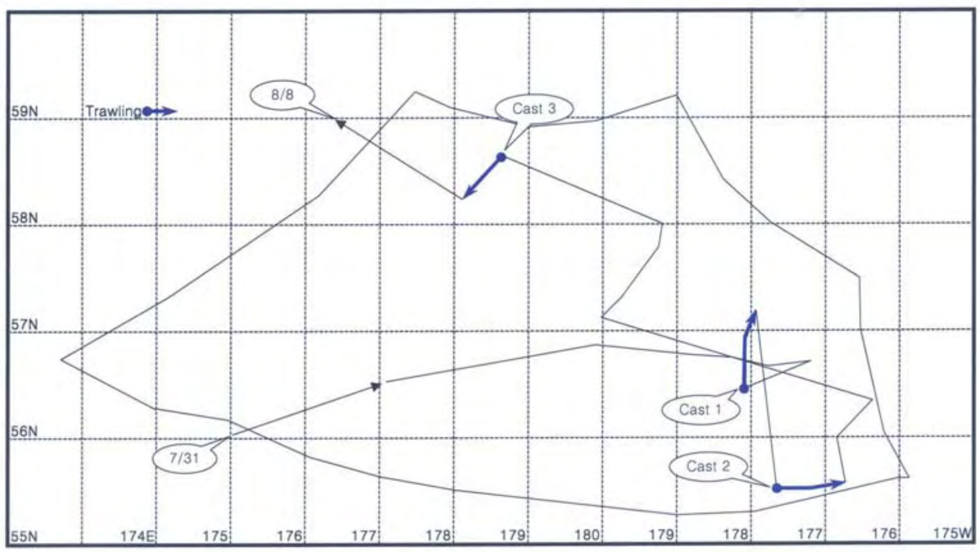


Fig. 1. Hydroacoustic trackline and haul positions (Bold line) of NAMBUK HO in convention area during Jul. 31 ~ Aug. 8. 2006.

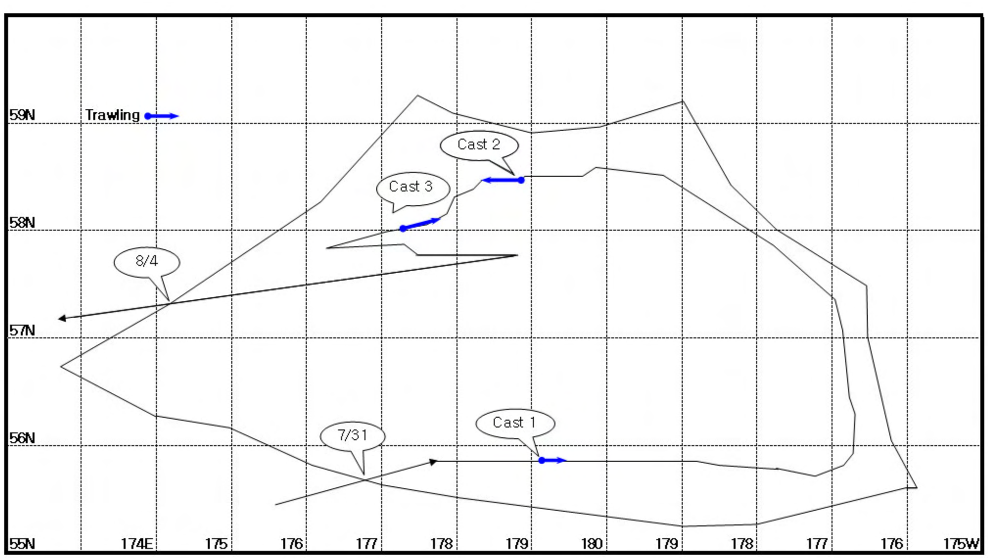


Fig. 2. Hydroacoustic trackline and haul positions (Bold line) of ORIENTAL

ANGEL in convention area Jul. 31 ~ Aug. 5. 2006.

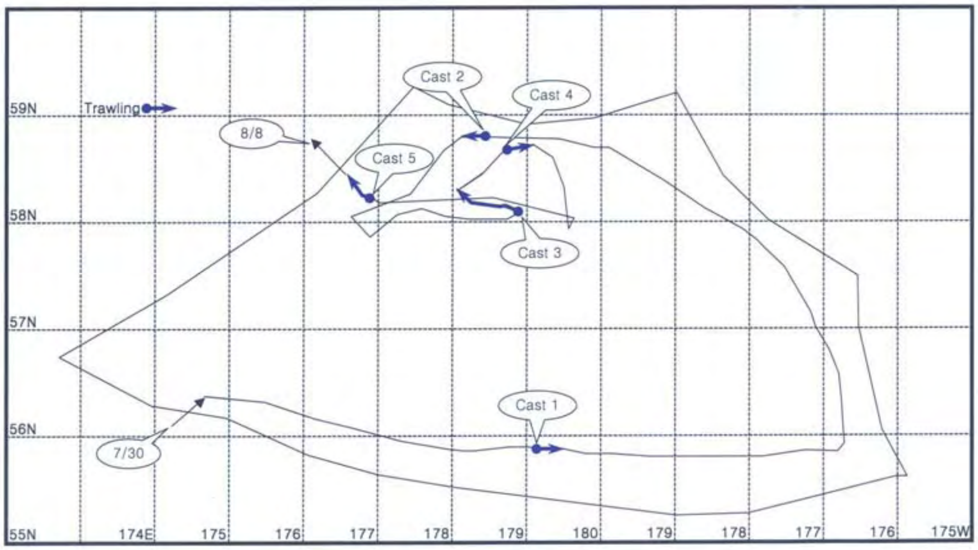


Fig. 3. Hydroacoustic trackline and haul positions (Bold line) of JOONSUNG HO in convention area during Jul. 31 ~ Aug. 8. 2006.

Table 1. Information of hauls conducted by NAMBUK HO during the Korean trial fishing in the convention area in 2006

Haul No.	Date	Set time	Set Position	Hauling position	Towing time	Depth of gear(m)
1	2 Aug.	06:40	56° 28'N 178° 05'W	57° 07'N 178° 01'W	11:00	350
2	3 Aug.	06:00	55° 29'N 177° 44'W	55° 37'N 176° 25'W	12:10	130
3	8 Aug.	06:00	58° 46'N 178° 45'E	58° 38'N 178° 02E	07:00	160

Table 2. Information of hauls conducted by ORIENTAL ANGEL during the Korean trial fishing in the convention area in 2006

Haul No.	Date	Set time	Set Position	Hauling position	Towing time	Depth of gear(m)
1	31 Jul.	18:50	55° 55'N 179° 12'E	55° 51'N 179° 28'E	07:20	250
2	2 Aug.	19:10	58° 36'N 178° 39'E	58° 35'N 178° 19'E	07:00	250
3	3 Aug.	05:25	58° 01'N 177° 38'E	58° 12'N 177° 40E	04:05	250

Table 3. Information of hauls conducted by JOONSUNG HO during the Korean trial fishing in the convention area in 2006

Haul No.	Date	Set time	Set Position	Hauling position	Towing time	Depth of gear(m)
1	31 Jul.	20:05	55° 51'N 179° 16'E	55° 51'N 179° 27'E	05:40	200
2	2 Aug.	19:30	58° 42'N 178° 20'E	58° 42'N 178° 06E	08:00	250
3	4 Aug.	18:40	58° 01'N 178° 46'E	58° 22'N 178° 03E	11:20	200
4	5 Aug.	13:15	58° 43'N 178° 37'E	58° 46'N 179° 03'E	02:00	150
5	8 Aug.	10:20	58° 27'N 177° 44'E	58° 35N 177° 34'E	03:00	200

Table 4. Catch information of Korean trial fishing in the Convention area in 2006

Vessel	Period of trial fishing	Haul	Catch	
			Pollock	Others
NAMBUK HO	Jul. 31 ~ Aug. 8. 2006	3	None	3 species (89 fish, 34.2kg)
ORIENTAL ANGEL	Jul. 31 ~ Aug. 5. 2006	3	None	2 species (8 fish, 1.5 kg)
JOONSUNG HO	Jul. 31 ~ Aug. 8. 2006	5	1 fish (0.7 kg)	1 species (12 fish, 3.7 kg)
Total		11	1 fish (0.7 kg)	5 species (109 fish, 39.4 kg)

※ Others are squid, smooth lumpsucker, rockfish, lanternfish and unidentified sp..

Photo 1. Squid.

Photo 2. Smooth lumpsucker.

Photo 3. Rockfish.

Photo 4. Lanternfish.

Photo 5. Unidentified sp.

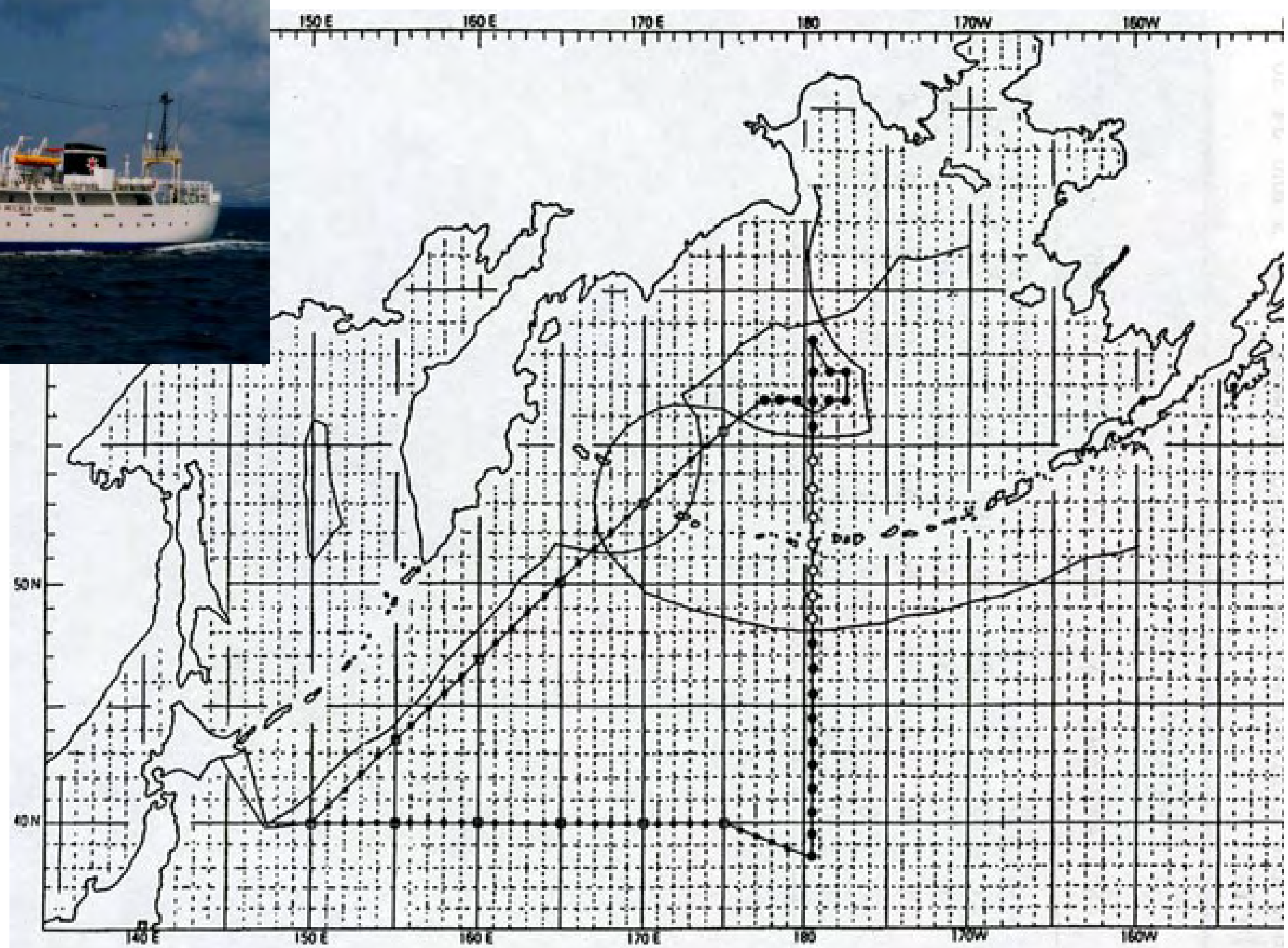
2007 survey information : Walleye pollock bycatch in Japanese salmon surveys

A. Nishimura, K. Morita,
M. Fukuwaka, and T. Nagasawa

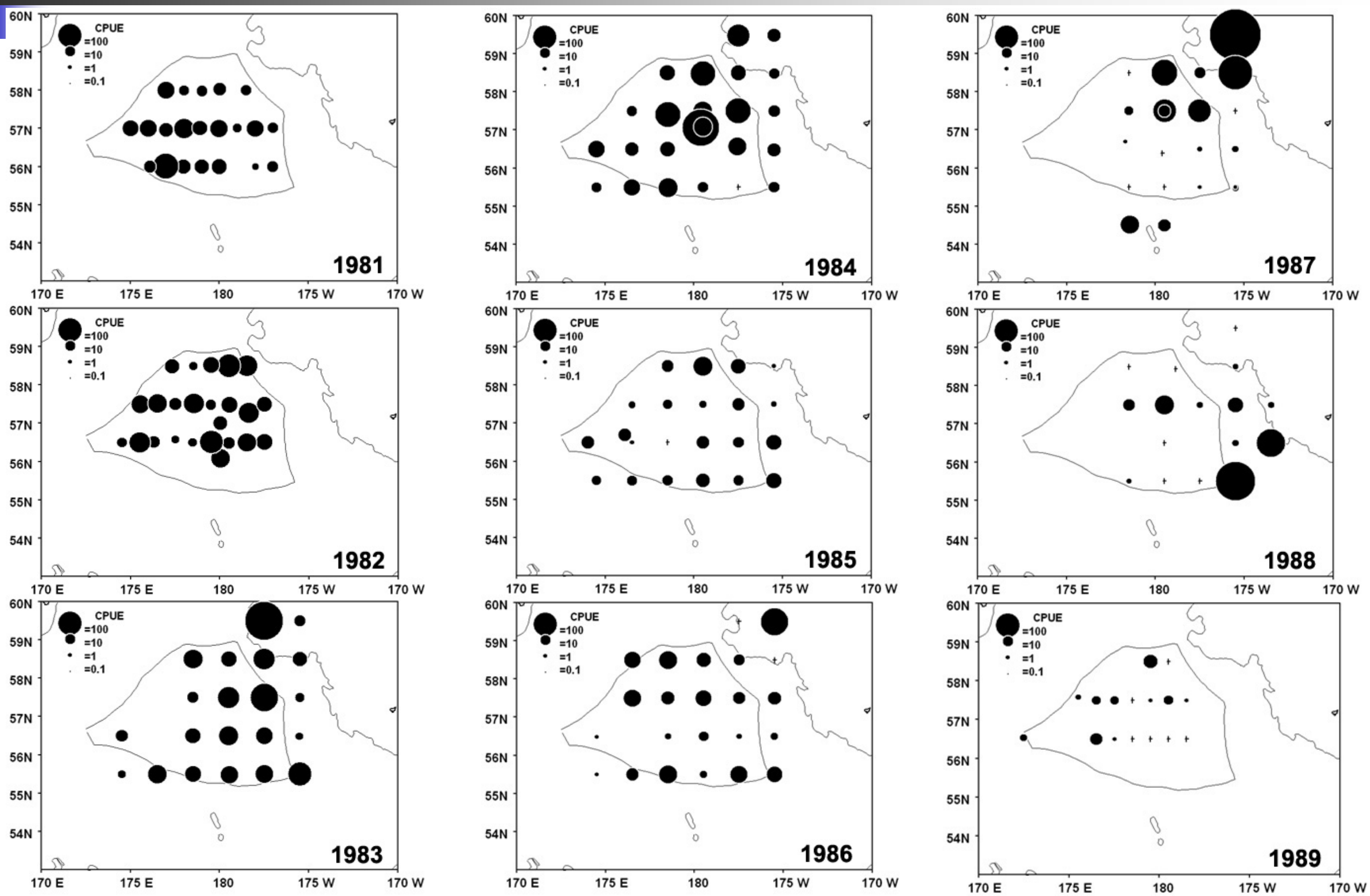
Hokkaido Nat. Fish. Res. Inst.

Wakatake Maru salmon survey

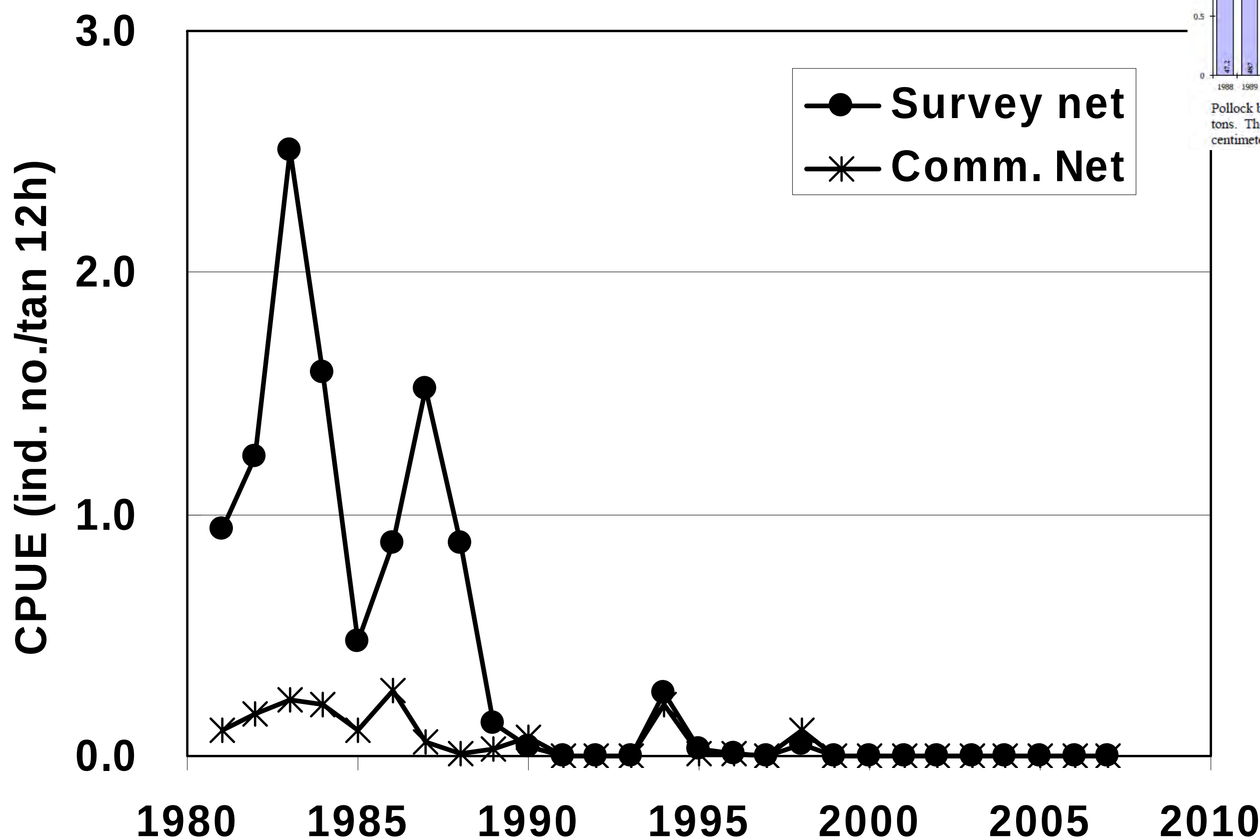
http://www.dokyoi.pref.hokkaido.jp

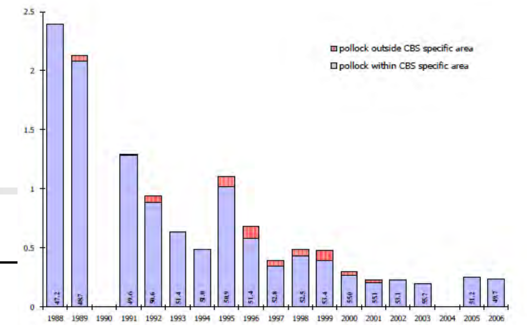


Walleye pollock bycatch (in 1980s) Horizontal distribution of CPUE



Walleye pollock bycatch from salmon gillnet



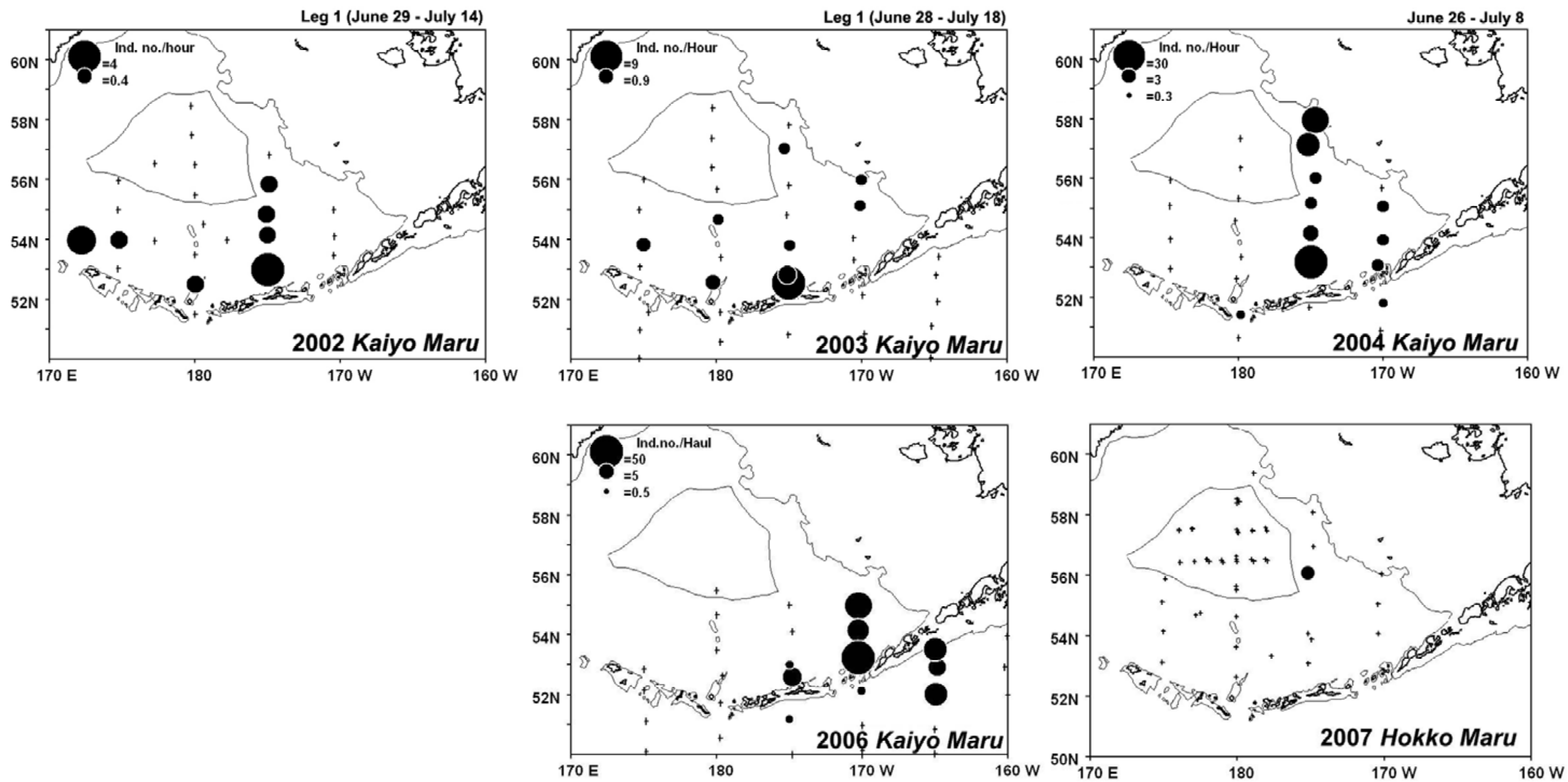


Pollock biomass estimates from the 1988-2005 Bogoslof Area EIT surveys in millions of tons. There were no surveys in 1990 and in 2004. Numbers are mean fork length in centimeters.

BASIS salmon surveys

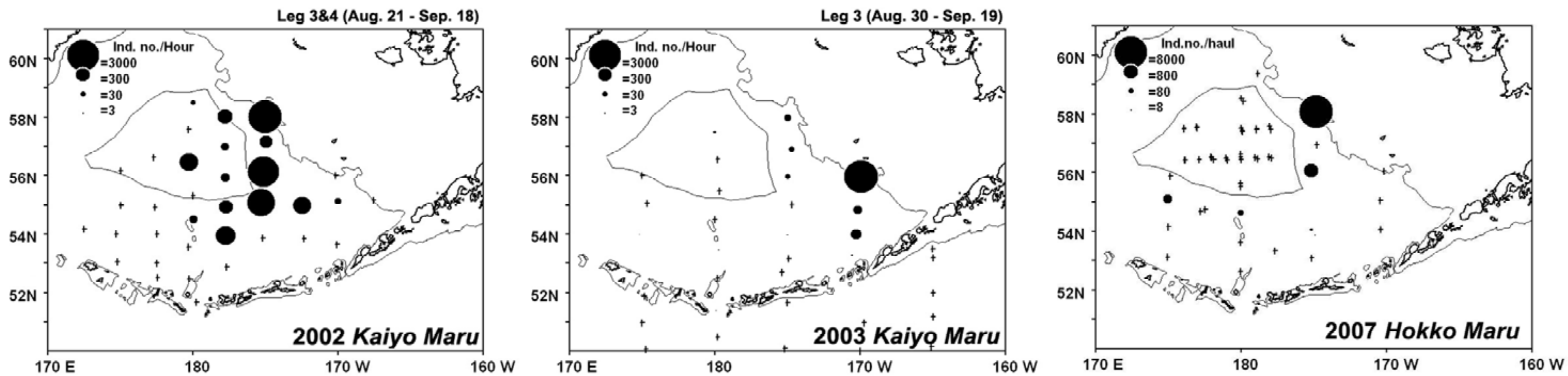
Adult walleye pollock bycatch: Recent Basis surveys

HNF BASIS by catch: Adult walleye pollock

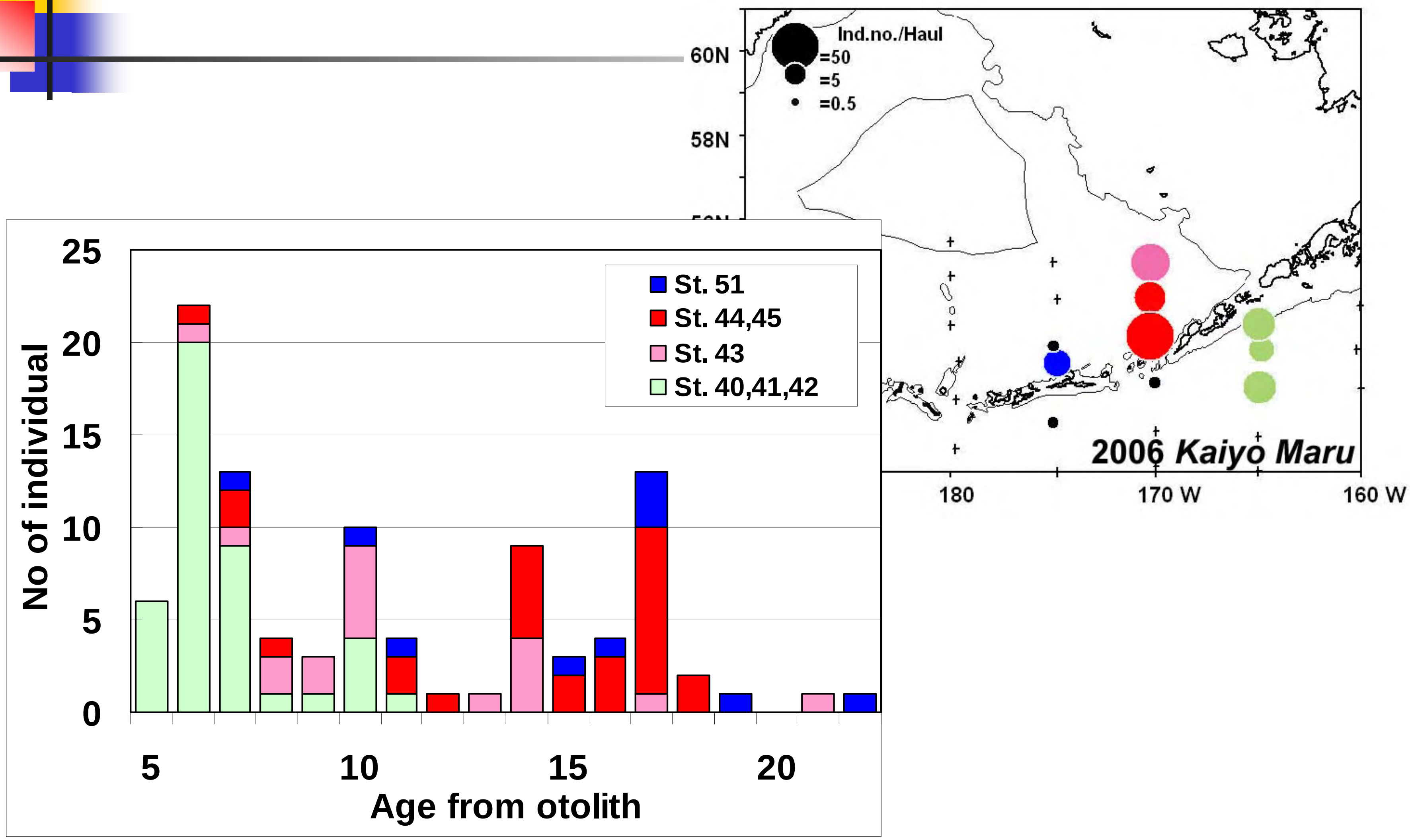


Preliminary

Junenile walleye pollock bycatch: Recent Basis surveys



Age composition of pollock from 2006 Basis Bycatch



Review results of Russian research cruises in 2007

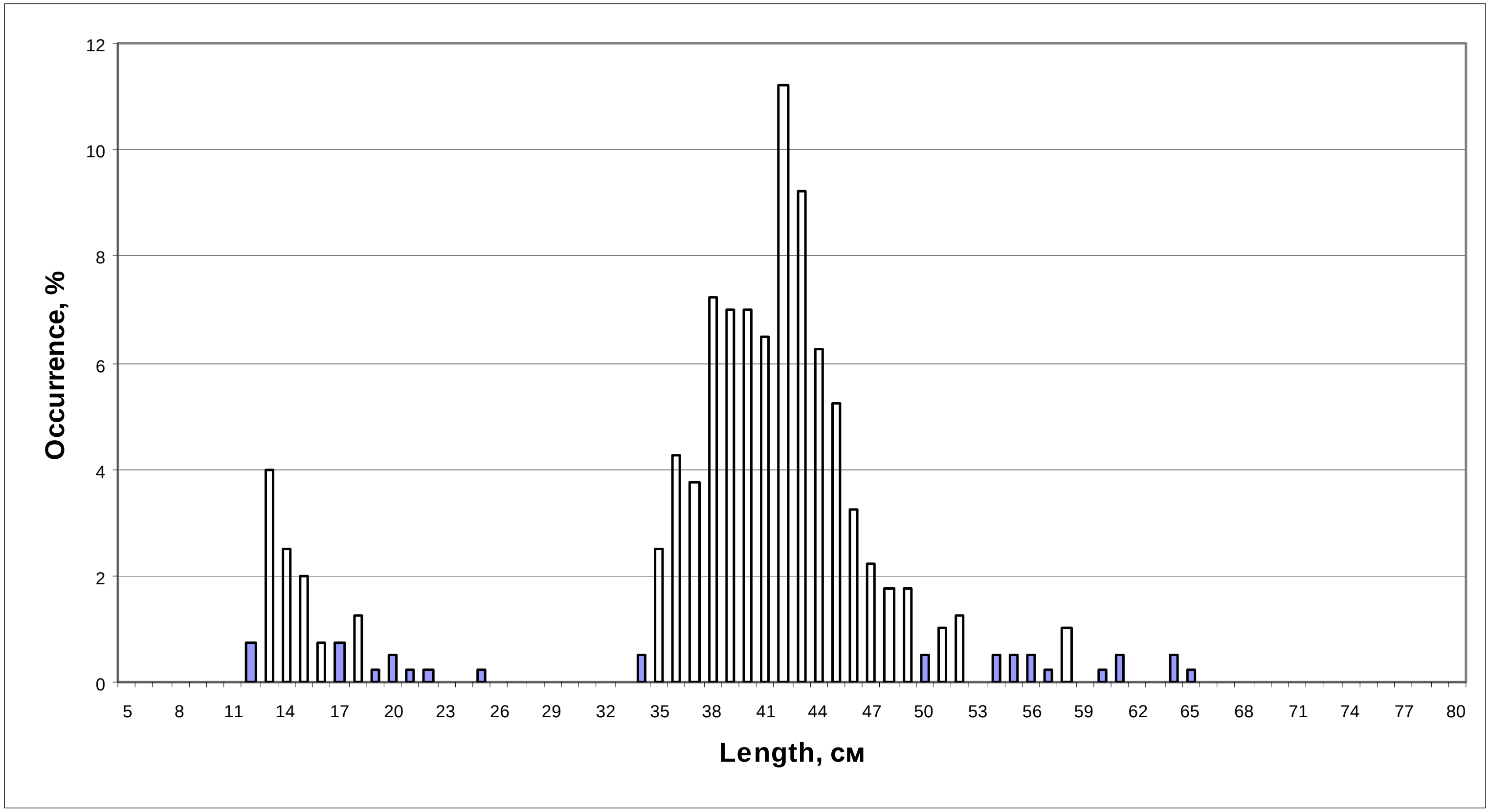


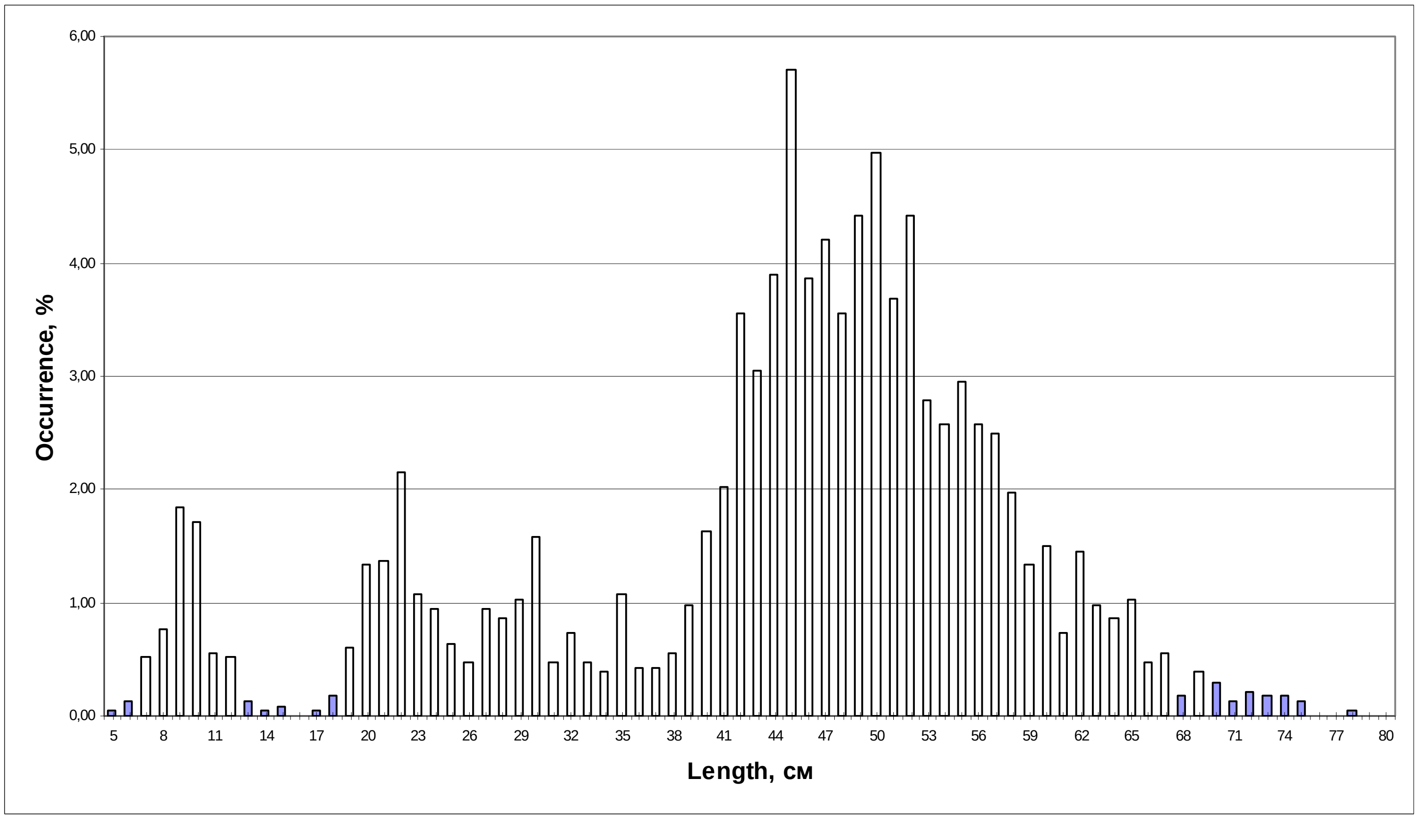
Fig. 2. Length composition of West Koryak pollock based on trawl survey.

Table 1. Biological characteristic of West Bering pollock

Average length, cm/numbers		41,2/849
Min.-max. length		12-68
Mode		42
Average weight, g	females	547,6
	males	422,5
Min.-max. weight	females	320-1510
	males	275-610
Male portion,%		22,2
Prevailing maturity stage of gonads,%	females	VI - 44,4; III - 13,3; IV - 8,9
	males	IV – 70,0; VI – 20,0; II-III – 10,0
Stomach filling, units		0,56
Portion of empty stomach, %		80,0
Prevailed food objects,%		euphausiidae - 88,9, small crustaceans – 11,1
Cubic condition index		0,54
Numbers		45

Note: average length is indicated from the results of mass measurements, average weight – from the results of biological analyses.

Karagin sub-zone



- Fig. 3. Length composition of Karagin pollock based on trawl survey.

Fig. 4. Share of prespawing (IV, IV-V and V) and postspawing pollock in Karagin area during the period from 22 to 29 of April.

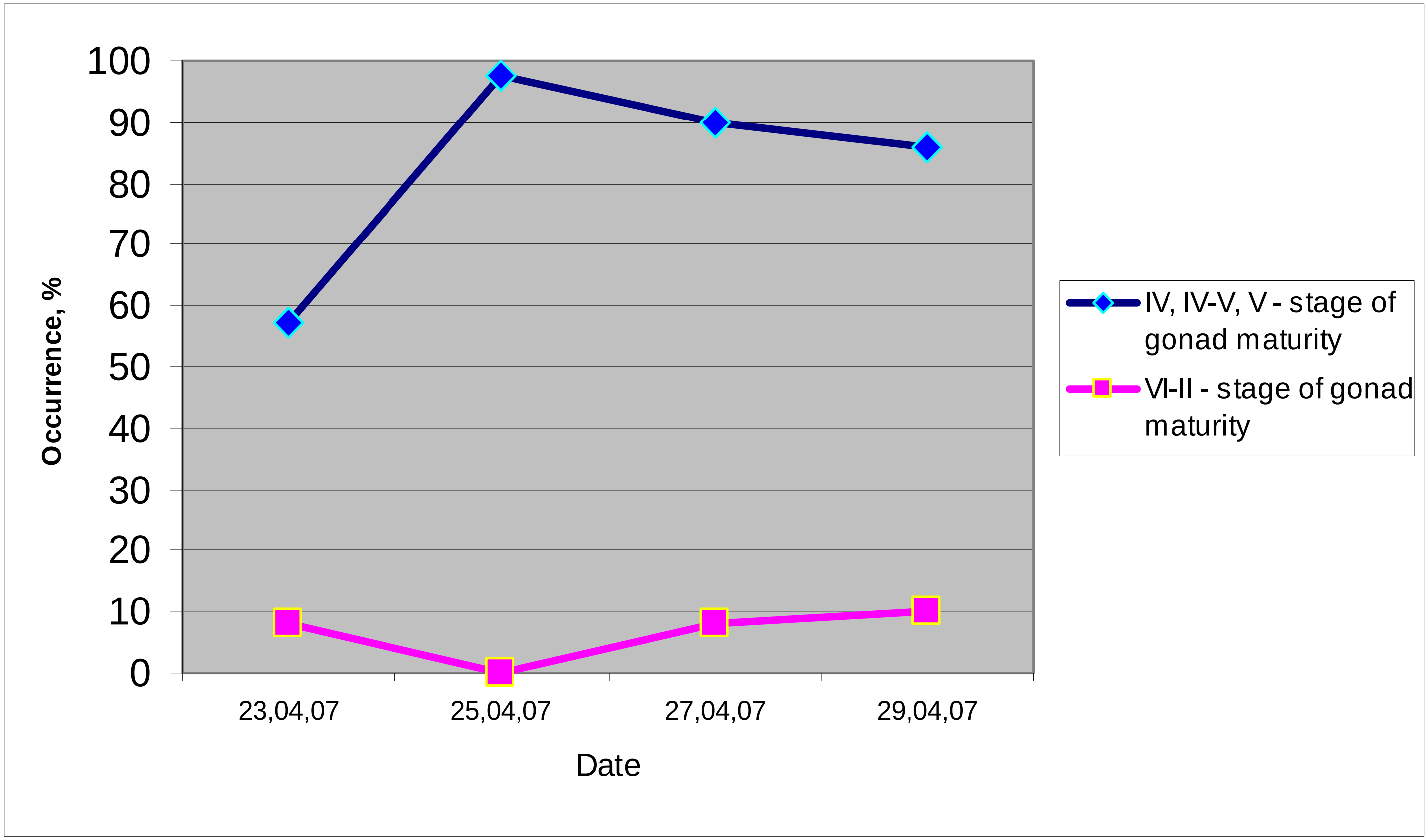


Fig. 5. Pollock distribution in the Karagin subzone based on the trawl survey data, 22.04-02.05.2007

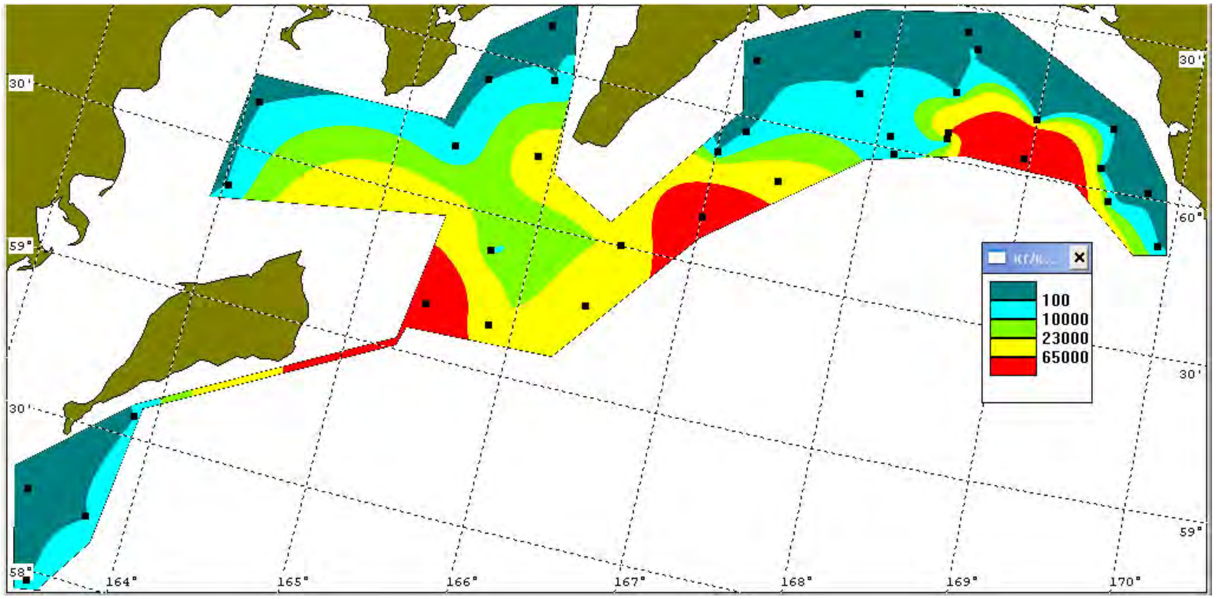
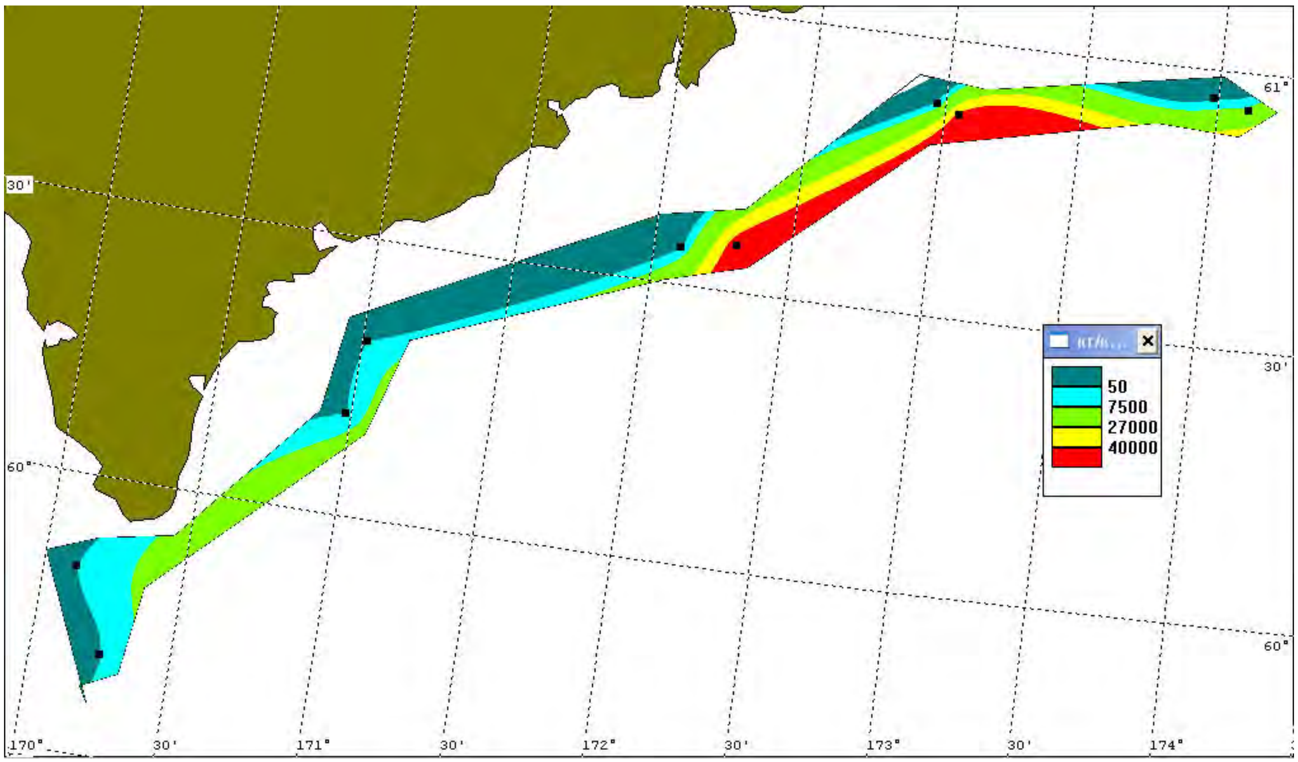
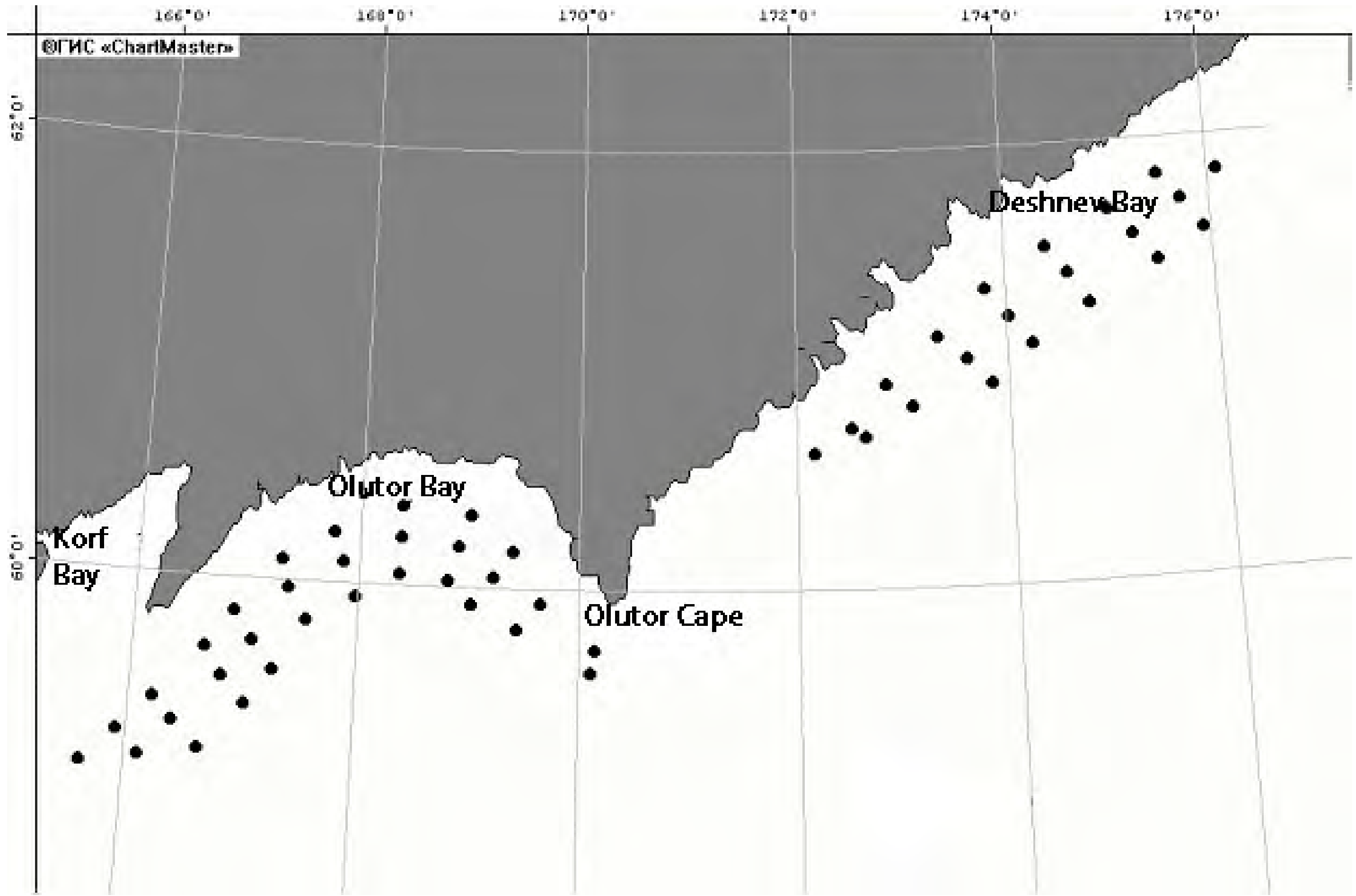


Fig. 6. Pollock distribution in the West Bering sea zone based on the trawl survey data, 22.04-02.05.2007.



Survey aboard RTMS “Bagration” to the North-West Bering Sea in May-June 2007



- Fig. 13. Position of ichthyoplankton stations of “Bagration” from 7 to 14 of May.

Fig. 22. Length composition of West Berimg Sea pollock in Olutor and Koryak area in May-June, based on trawl survey in May-June 2007.

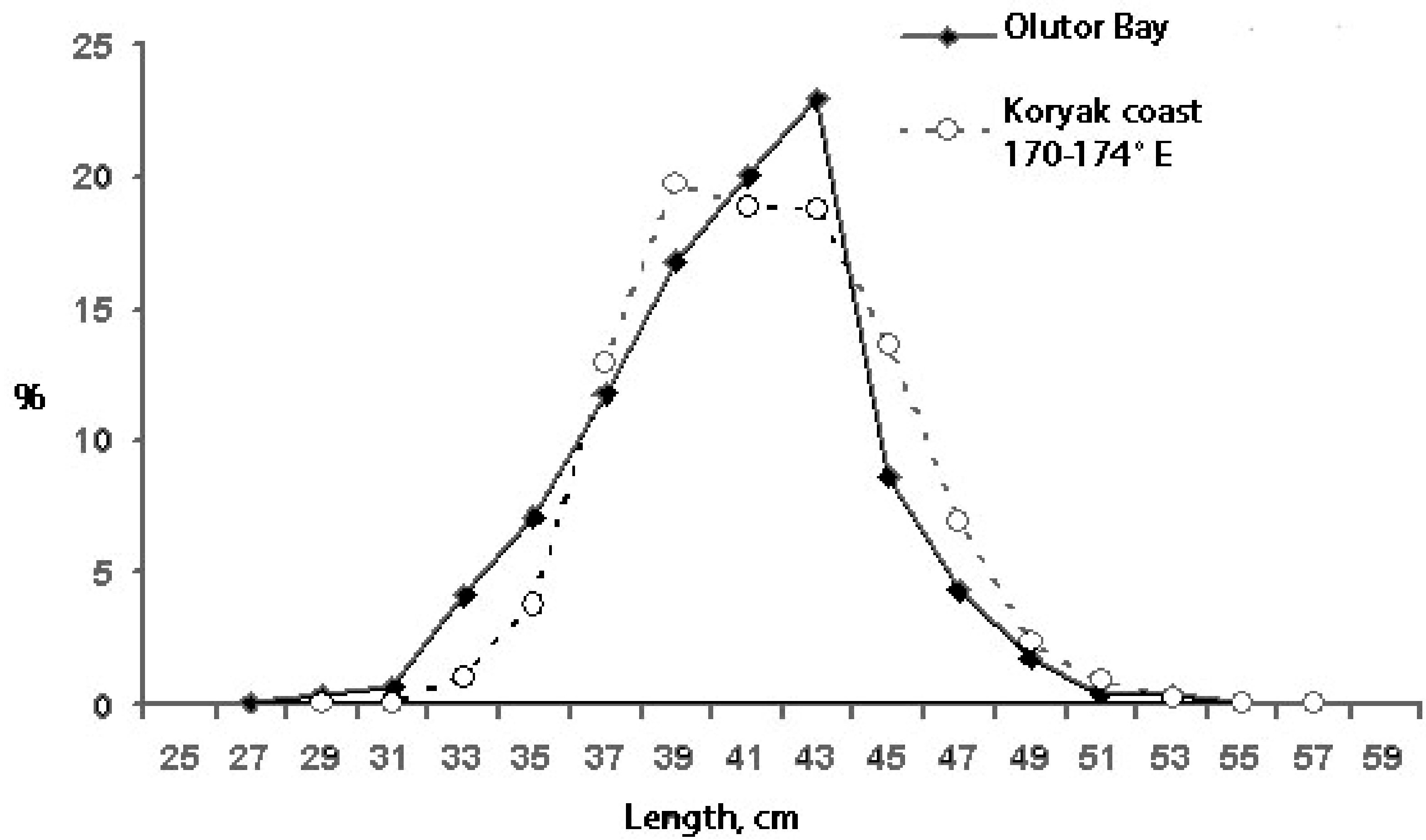


Fig. 24. Size-age composition of the West Bering Sea pollock in catches of "Bagration" in Olutor and Koryak area between 170º and 174º E in May-June 2007.

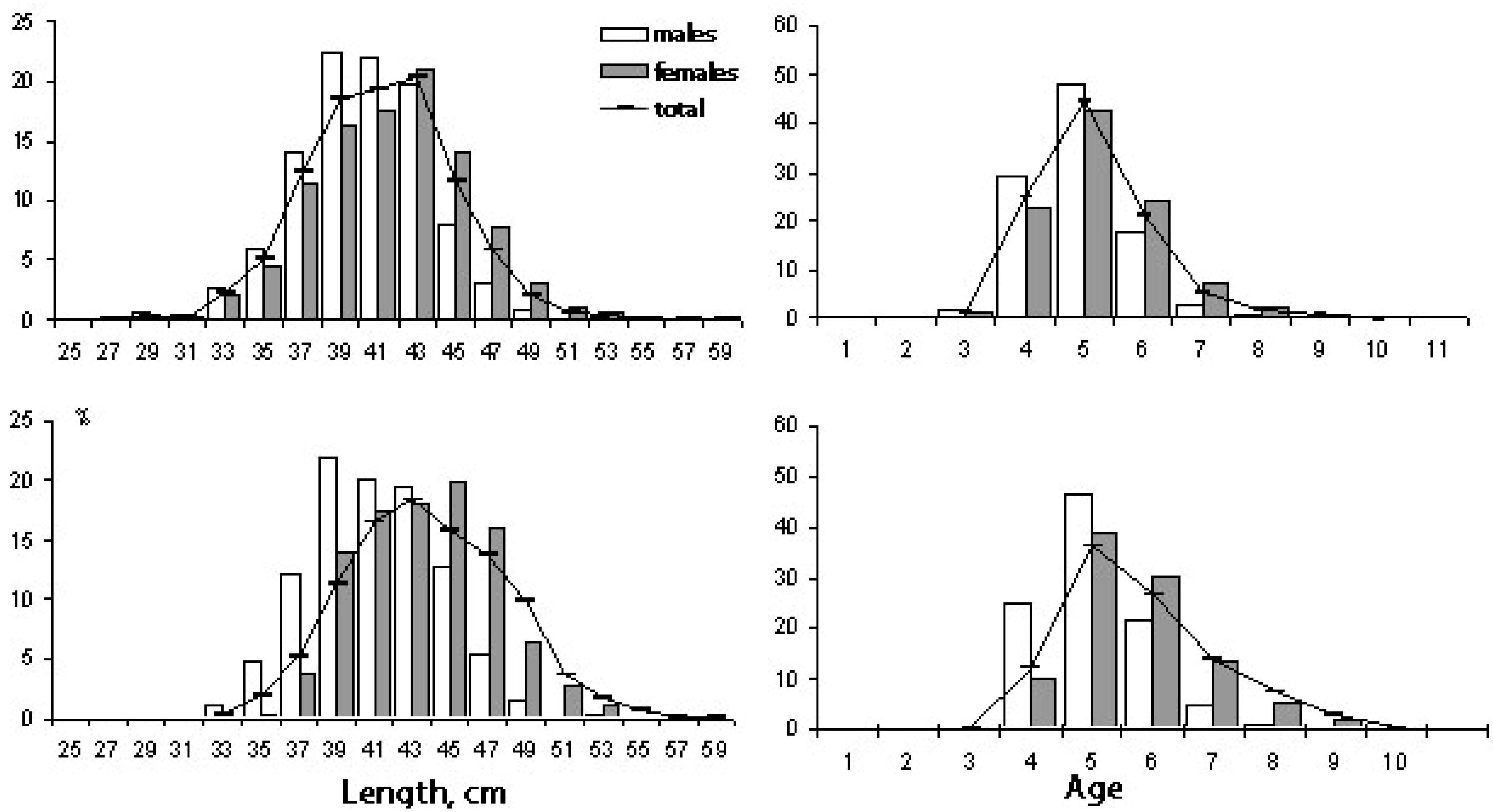


Fig. 27. Fishing activities of fleet in Bering Sea from May 16 to June 11.

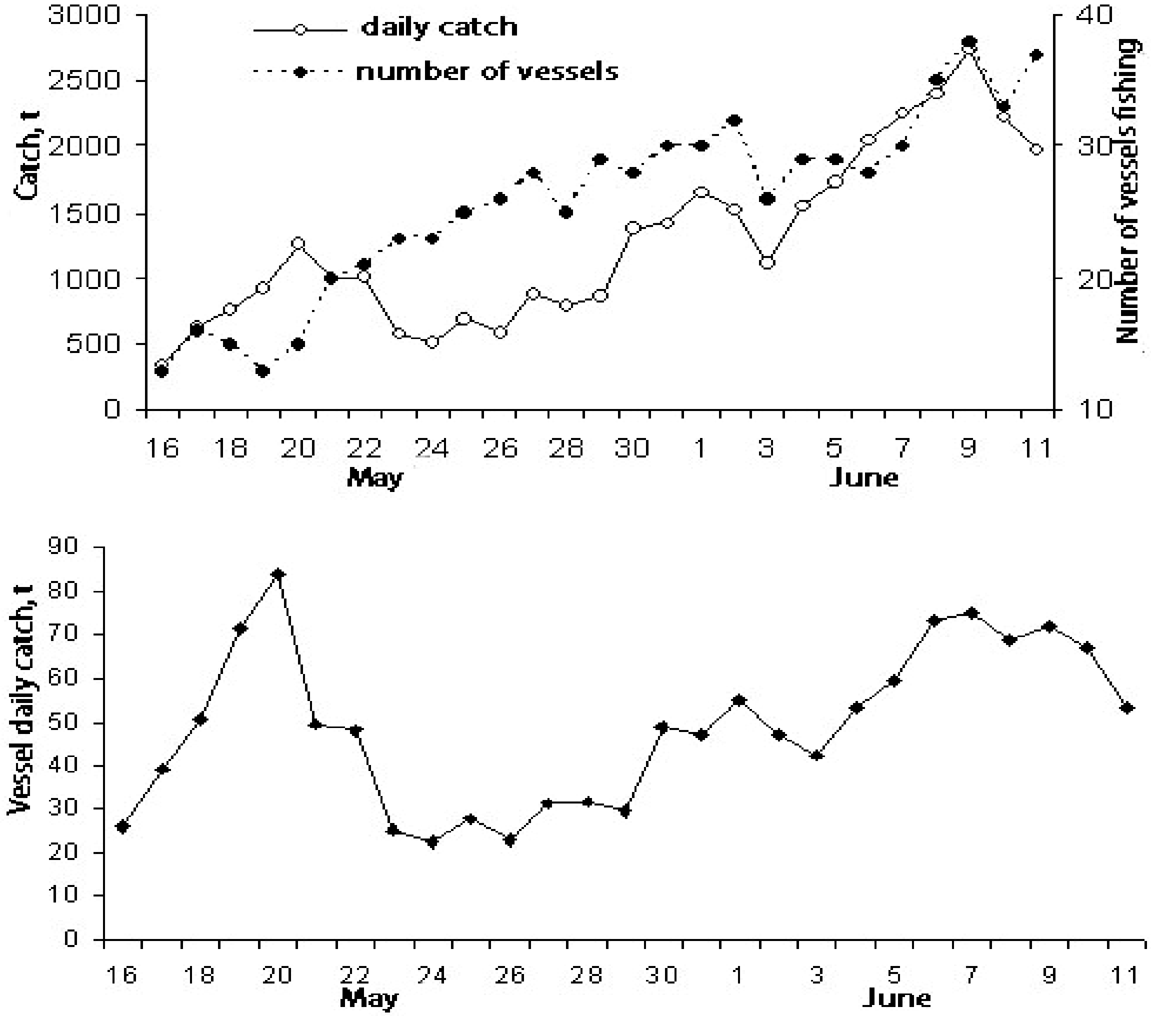


Fig. 28. Distribution of fisheries fleet in Bering Sea from May 16 to June 11

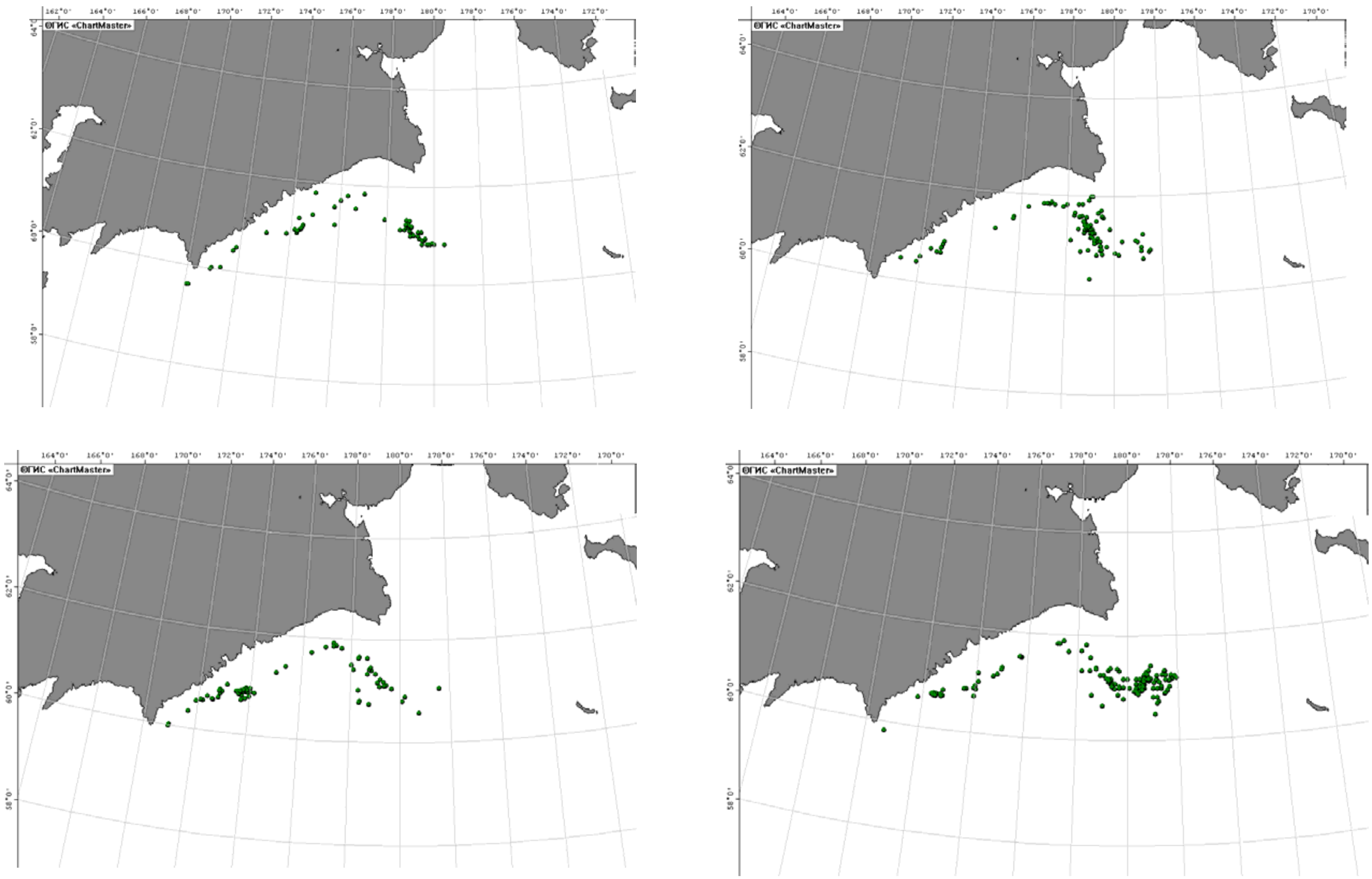
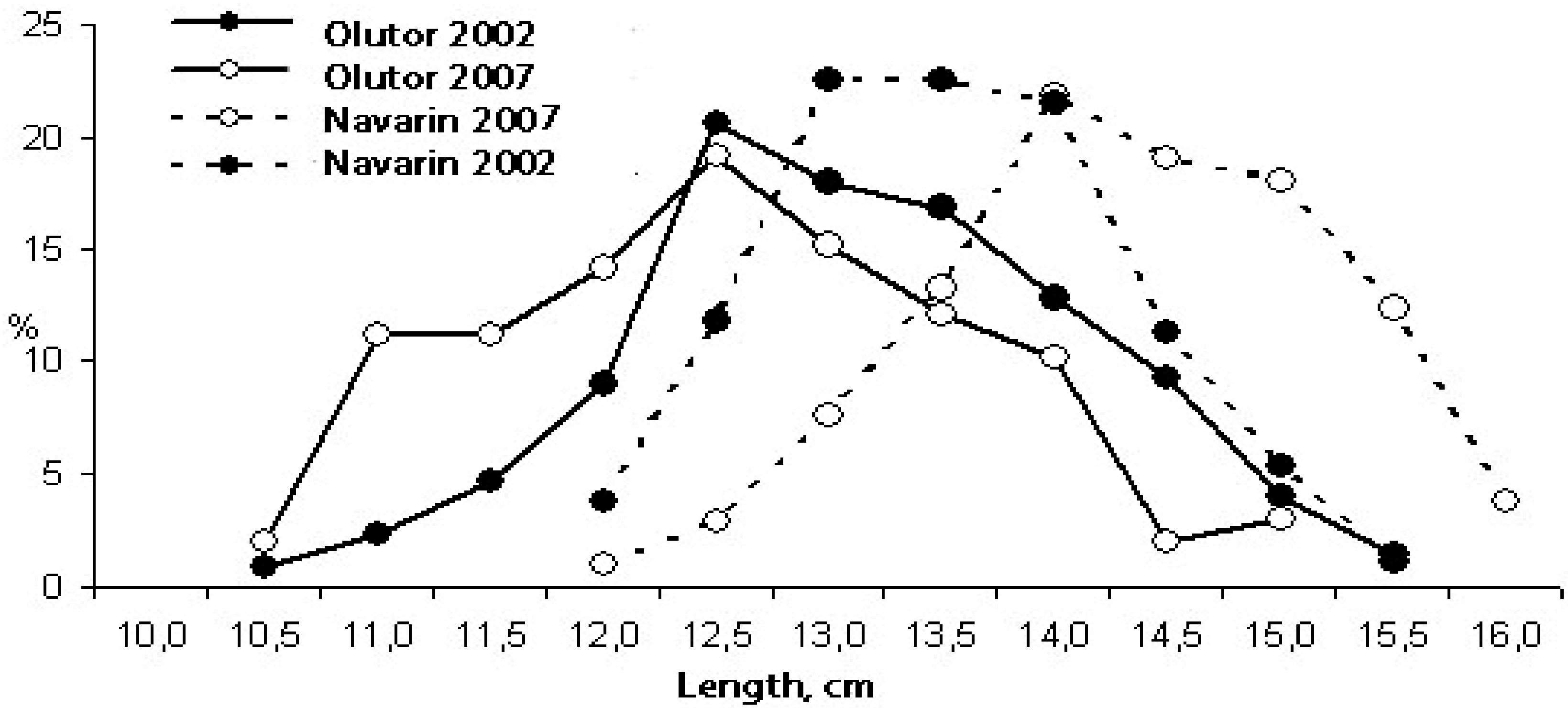


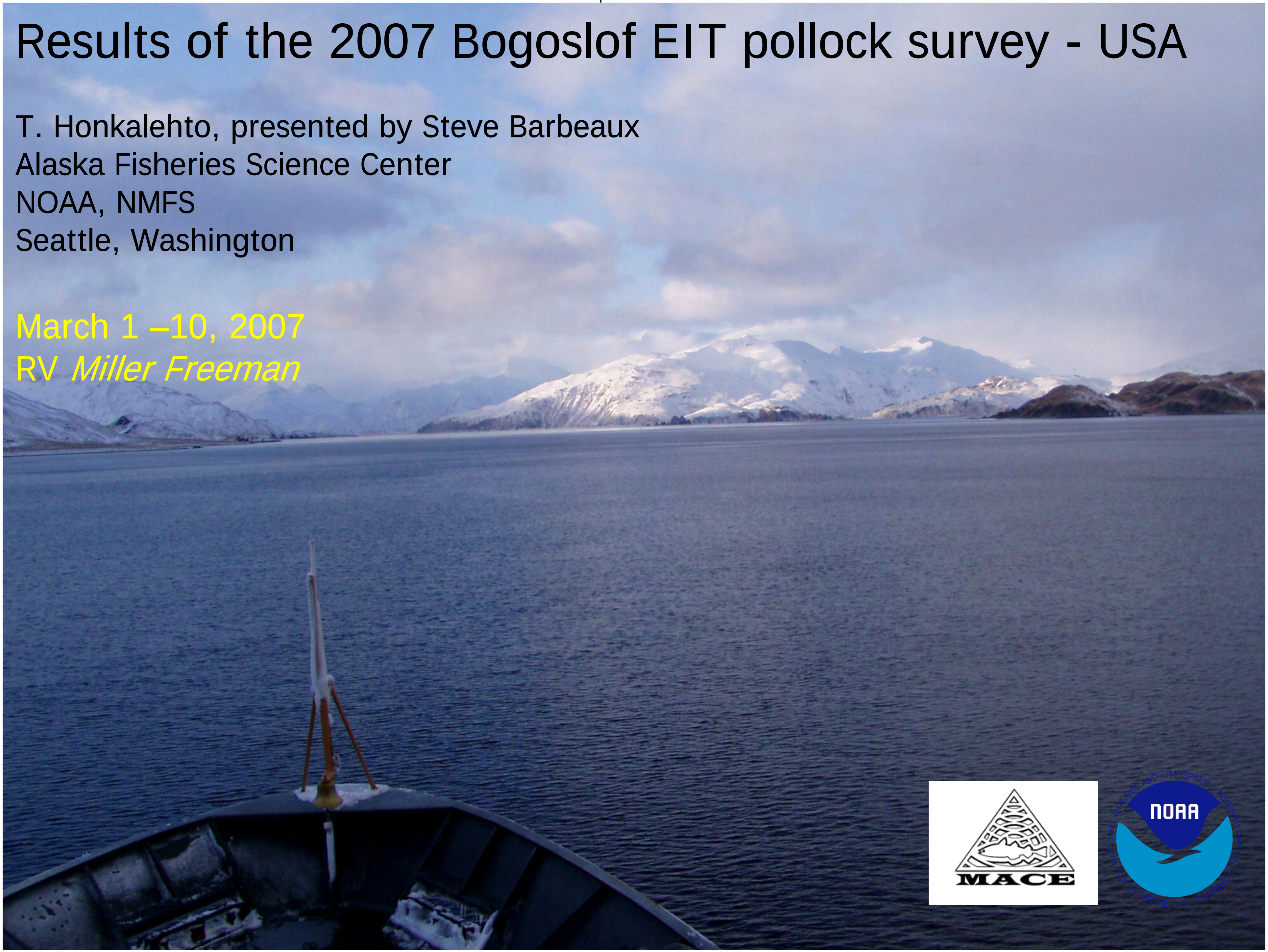
Fig. 32. Size composition of one year old pollock in Bering Sea in May of 2002 and 2007.

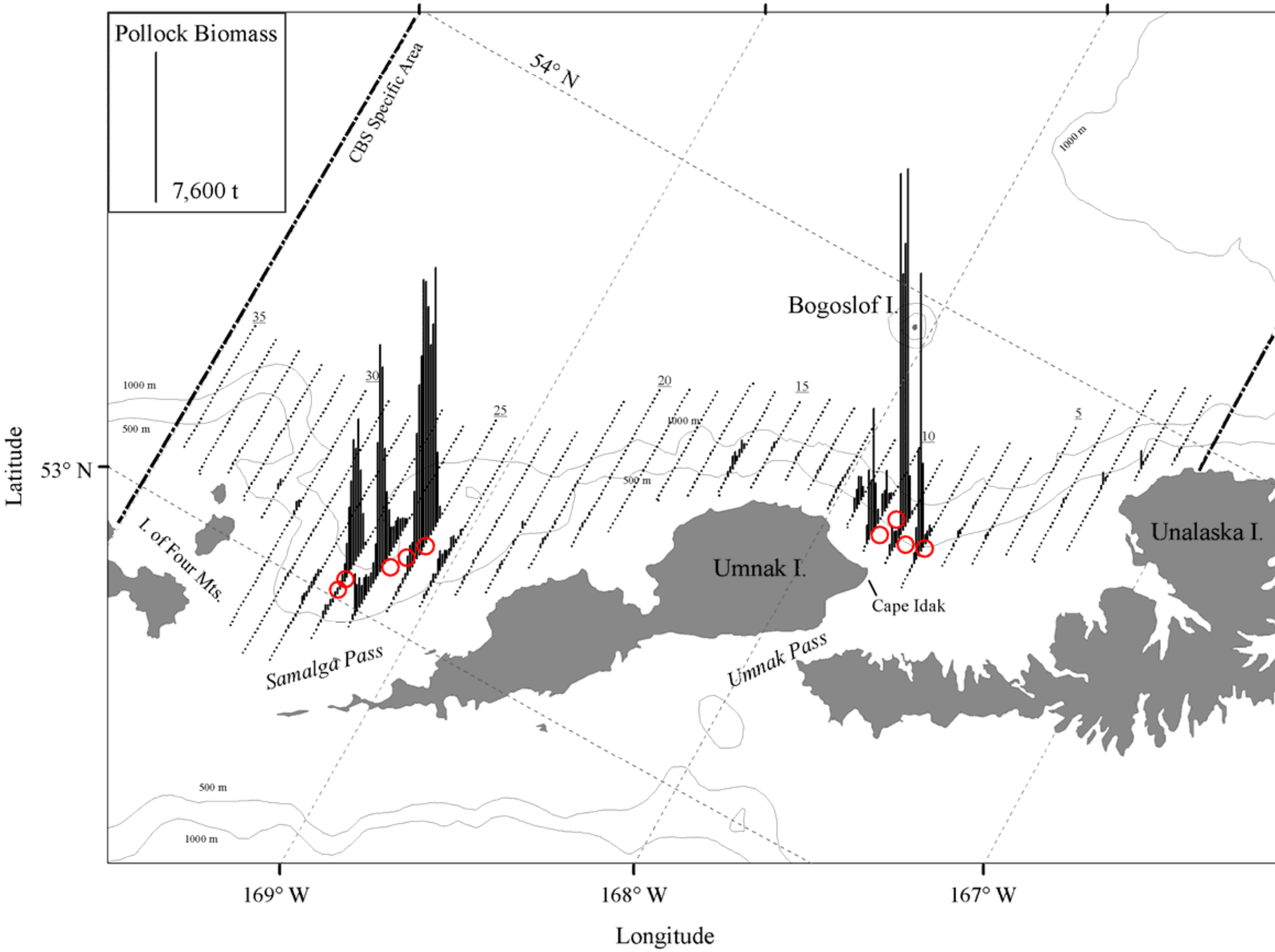


Results of the 2007 Bogoslof EIT pollock survey - USA

T. Honkalehto, presented by Steve Barbeaux
Alaska Fisheries Science Center
NOAA, NMFS
Seattle, Washington

March 1 –10, 2007
RV *Miller Freeman*





(t) attributed to pollock observed during the winter 2007 EIT survey in the Bogoslof Island area.

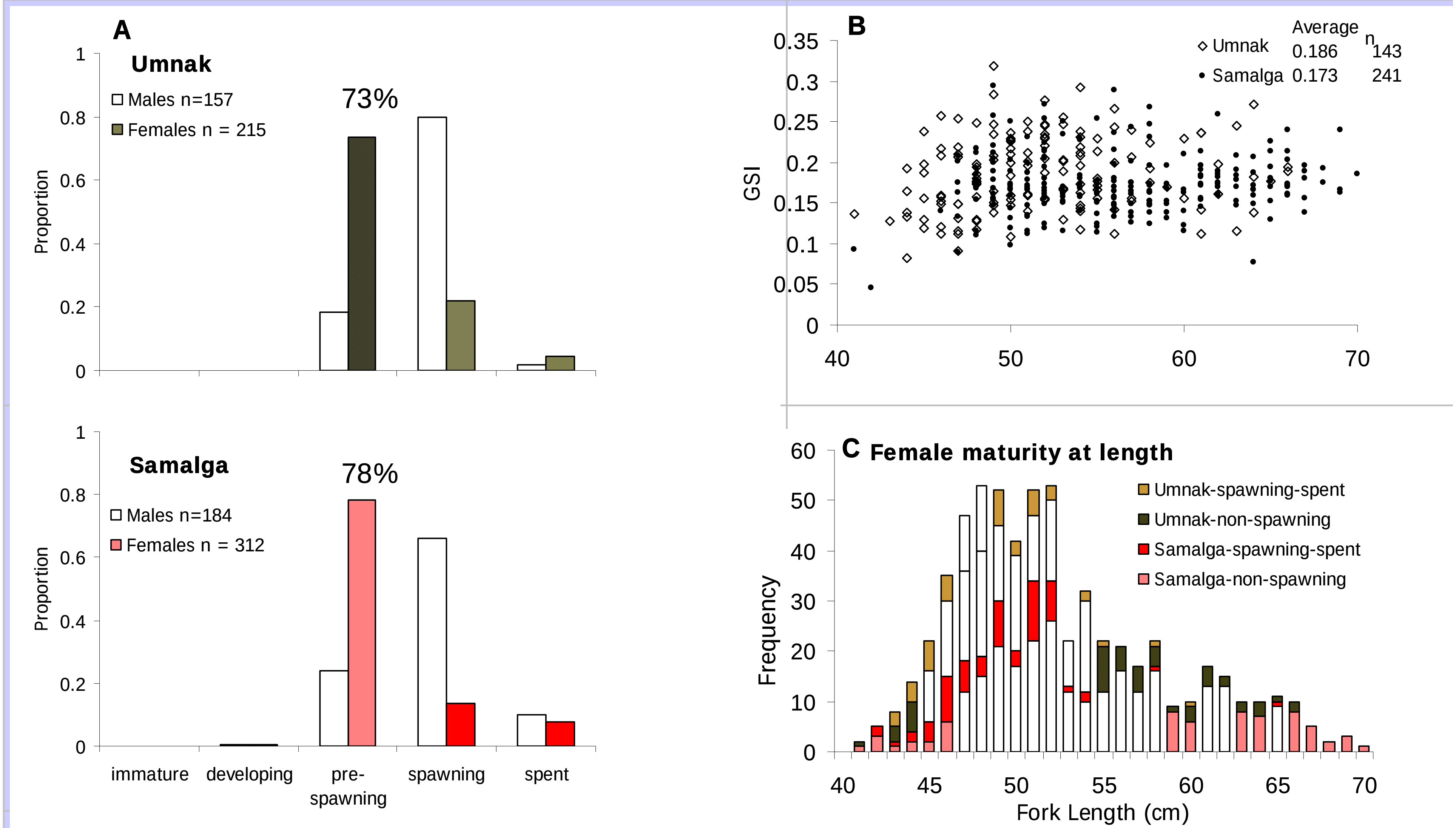
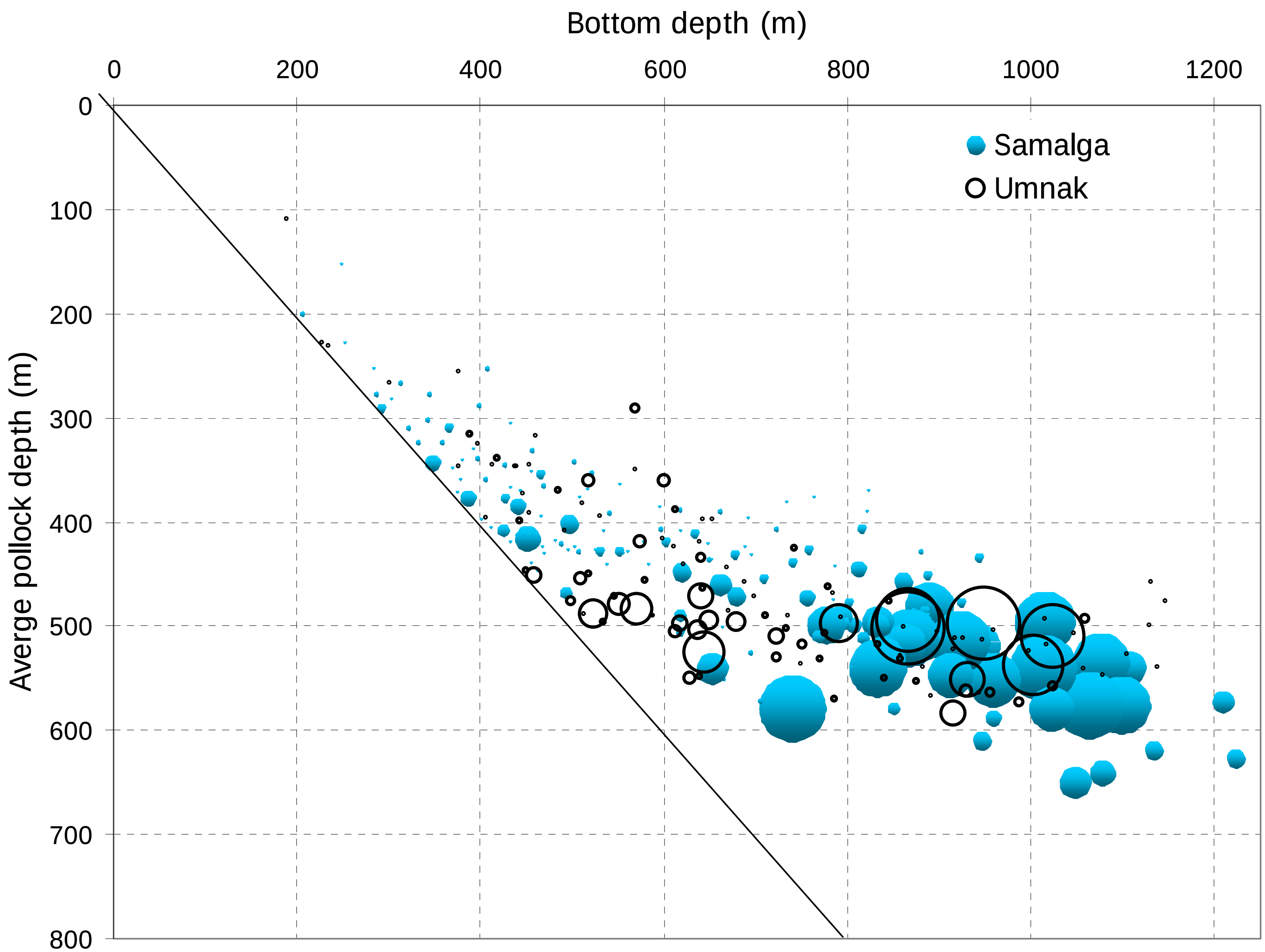


Figure 2.--Pollock maturity stages for Umnak and Samalga areas (A), gonado-somatic index (GSI) for pre-spawning females as a function of fork length (cm) (B), and female maturity at length (C) observed during the winter 2007 echo integration-trawl survey of the Bogoslof Island area.



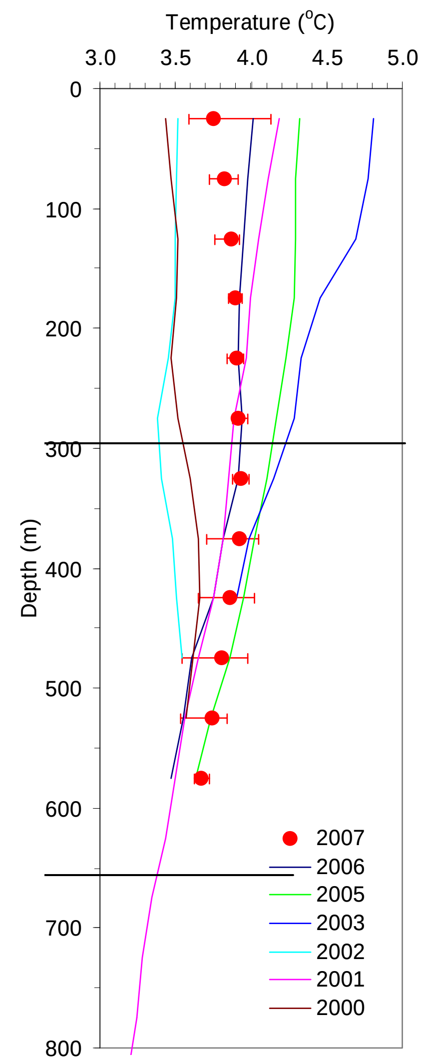


Figure 3. Average pollock depth (weighted by biomass) versus bottom depth, per 0.5 nmi sailed distance (left). Bubble size scaled to maximum biomass/0.5 nmi interval (13,710 t).

Average temperature (°C) by 50-m depth interval, 2000-2007 (right). Red bars are 2007 temperature range.

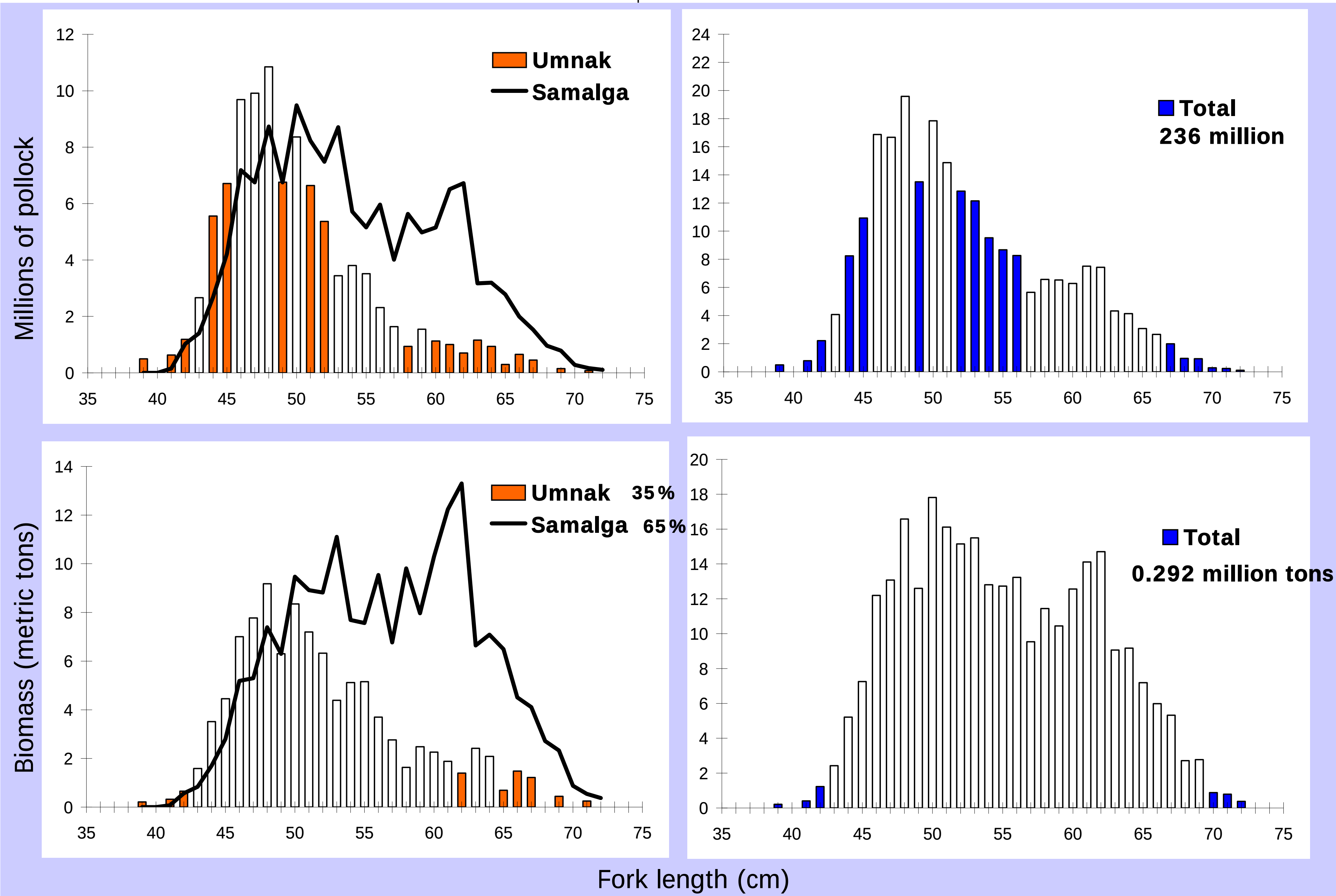


Figure 4. Population-at-length (top) and biomass-at-length (bottom) estimates from the winter 2007 EIT survey of walleye pollock in the Bogoslof Island area.

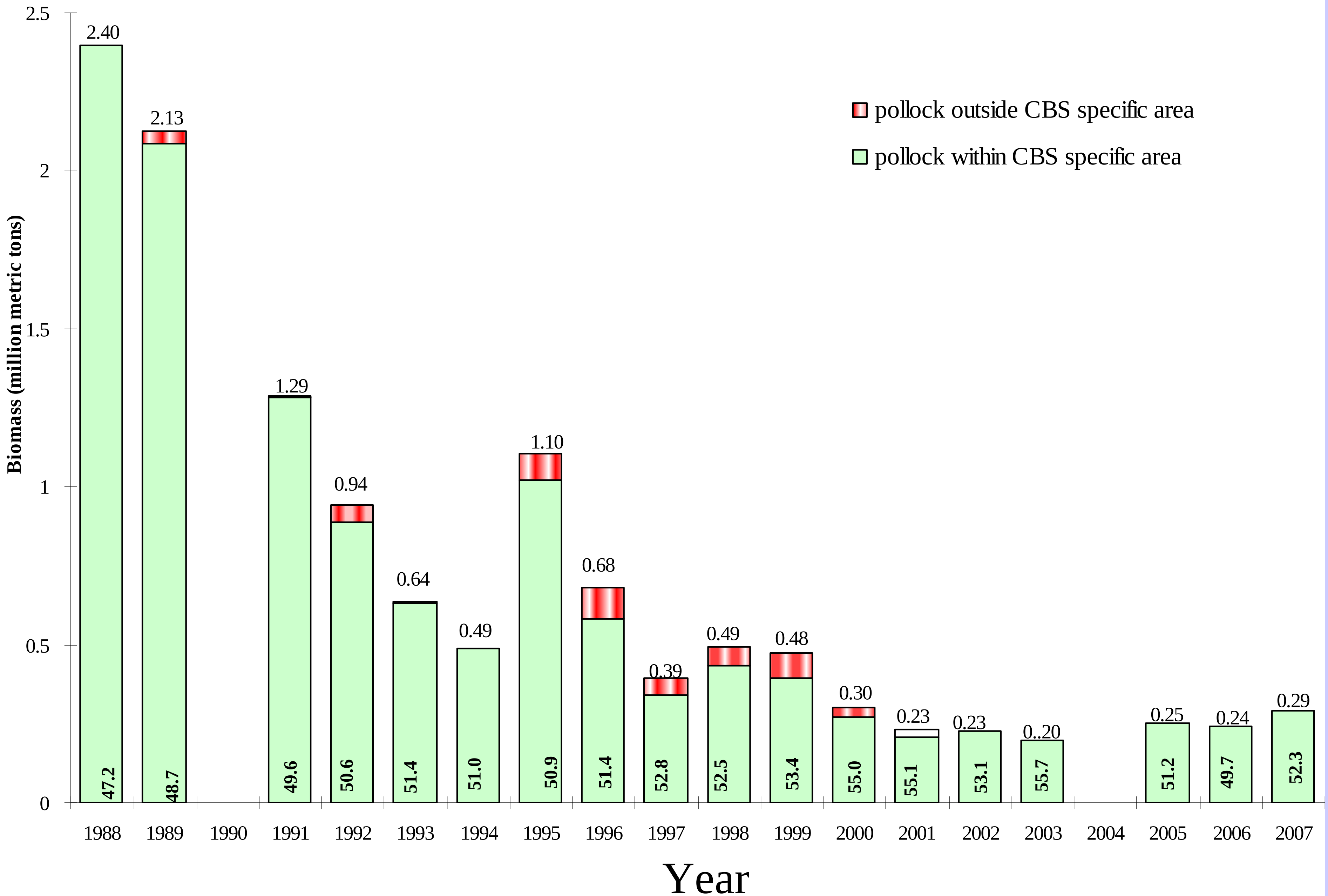
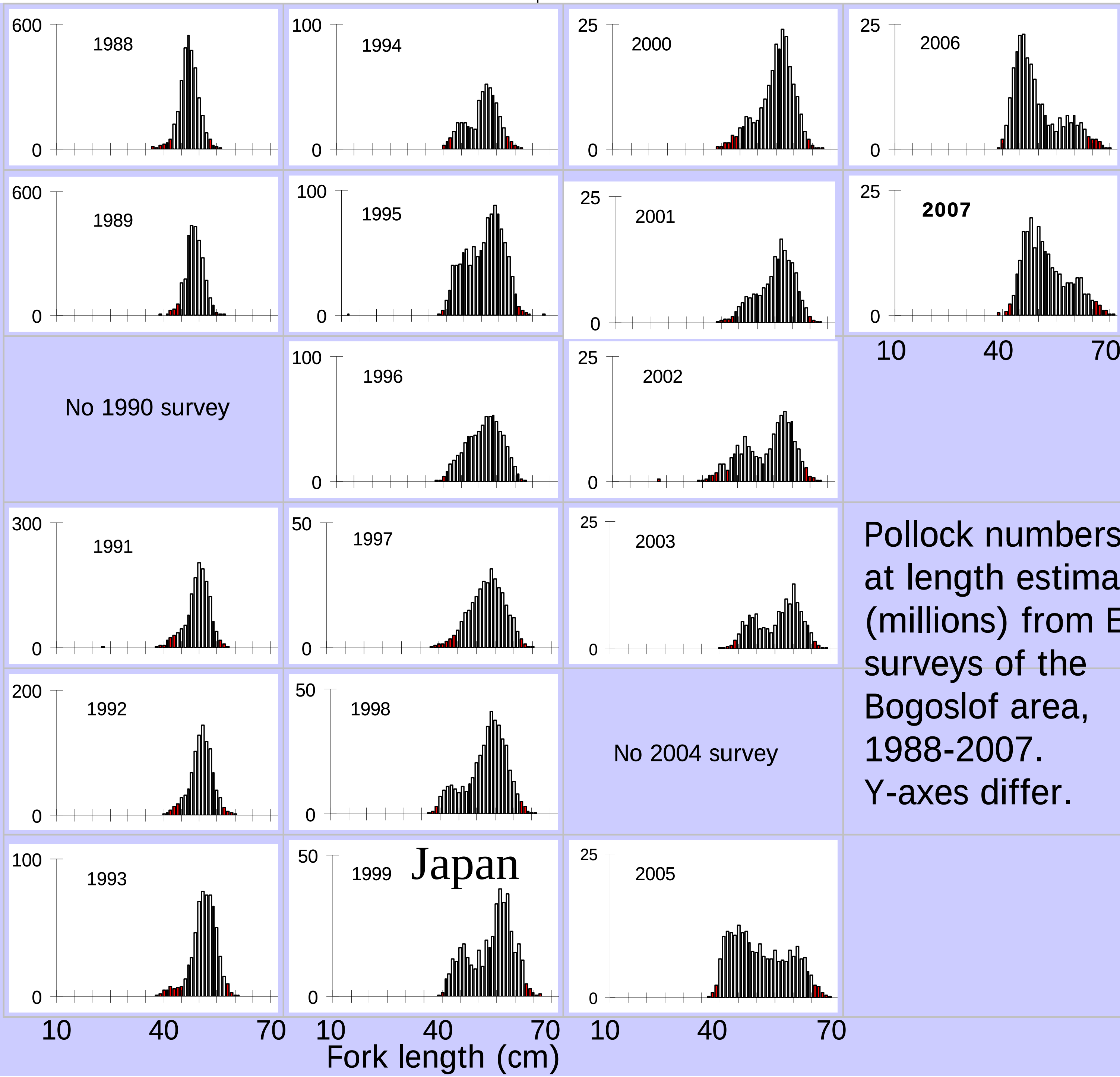
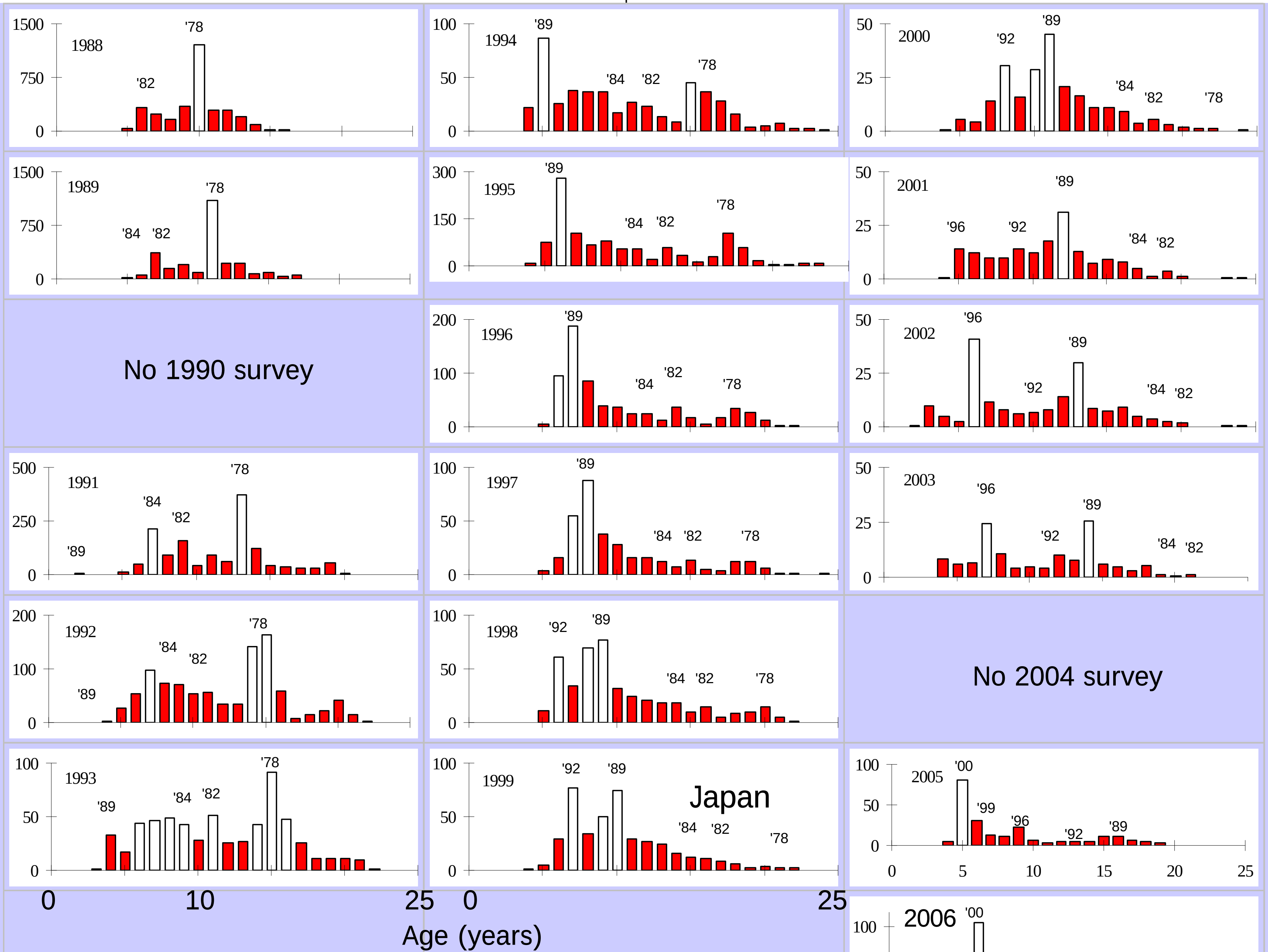


Figure 6. Biomass estimates (top of each bar) and average fork lengths (cm, inside bar) from Bogoslof area pollock EIT surveys, 1988-2007.



Pollock numbers at length estimates (millions) from EIT surveys of the Bogoslof area, 1988-2007. Y-axes differ.



Numbers-at-age estimates (millions) of pollock from EIT Bogoslof surveys 1988-2006. Major year classes on the EBS shelf are indicated.

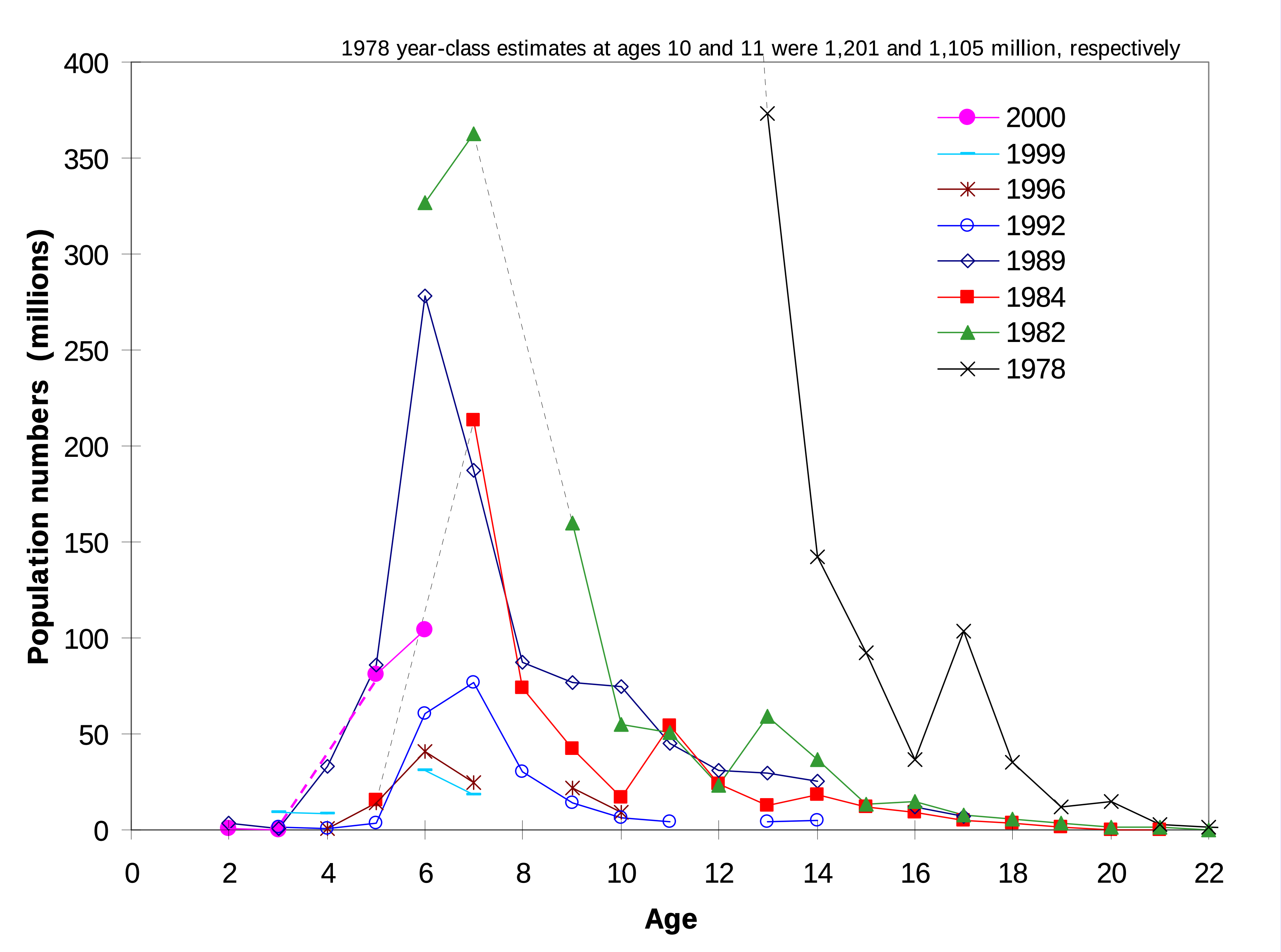


Figure x. Estimated population numbers at age for dominant year classes observed in winter EIT surveys of Bogoslof Island area spawning pollock. Data are from surveys conducted between 1988 and 2006. No surveys in 1990 or 2004.


March 2008 – no Bogoslof survey is planned
March 2009 – next Bogoslof survey – *R/V Oscar Dyson*

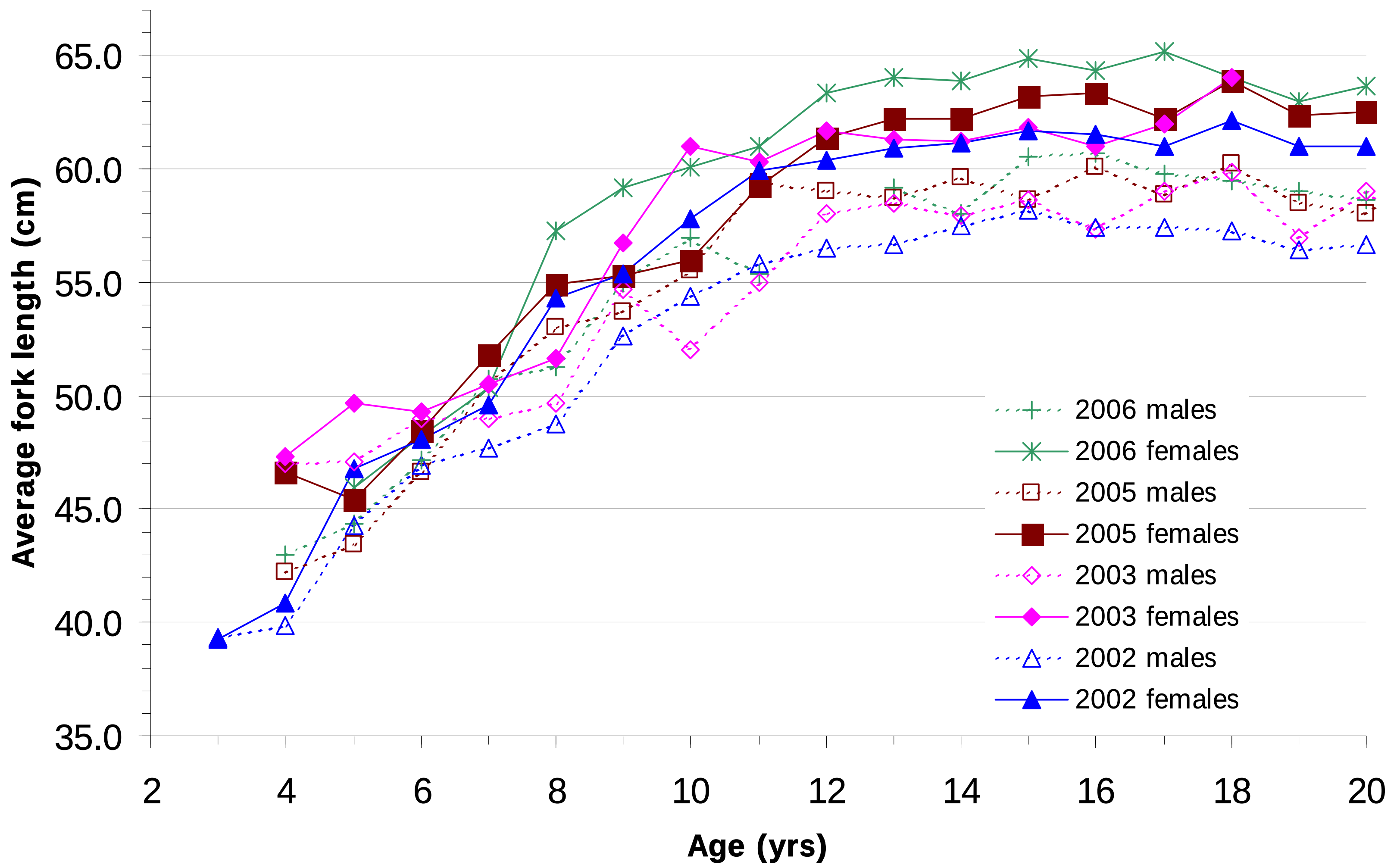
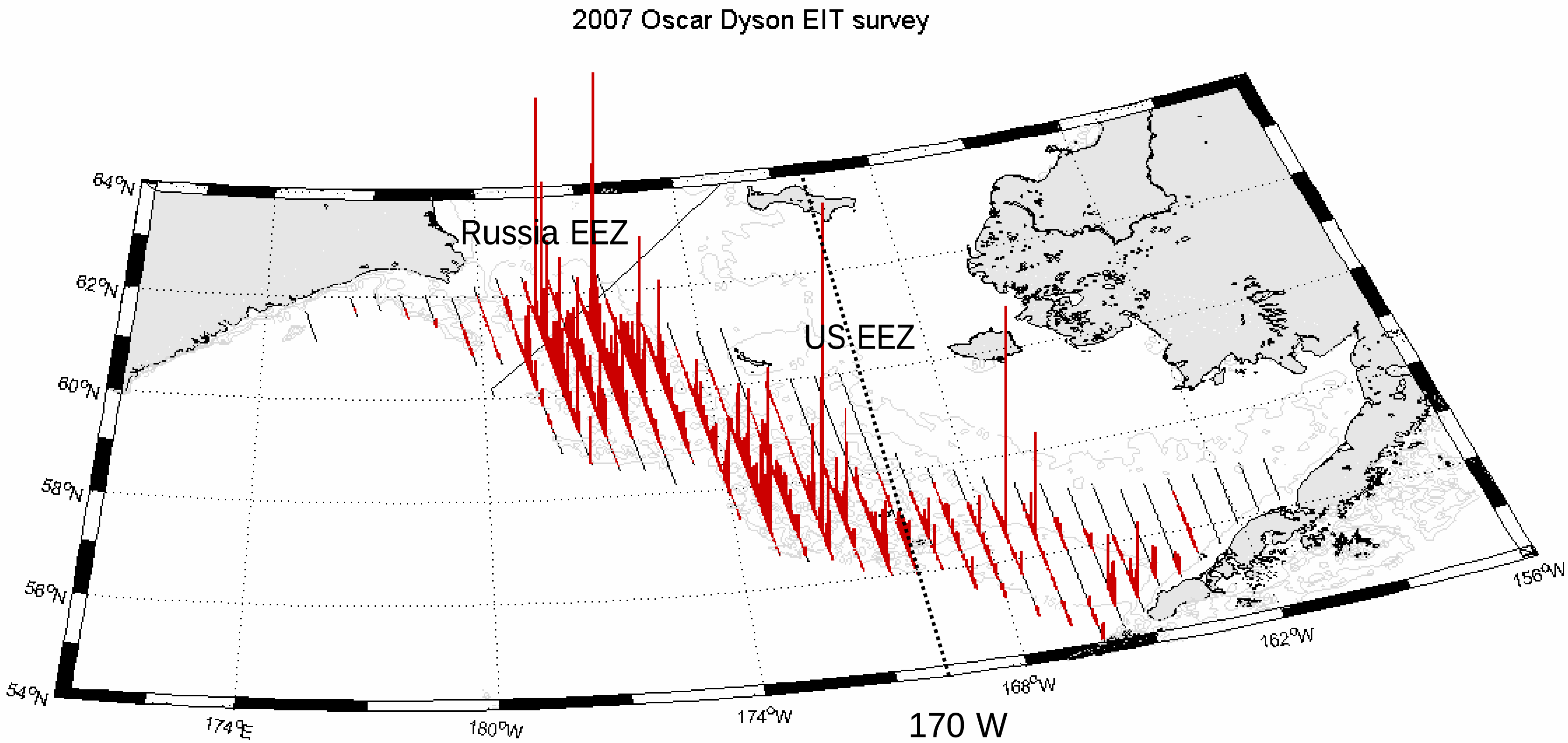


Figure x.--Average length at age for pollock from the winter 2002, 2003, 2005 and 2006 echo integration-trawl surveys of the Bogoslof Island area.

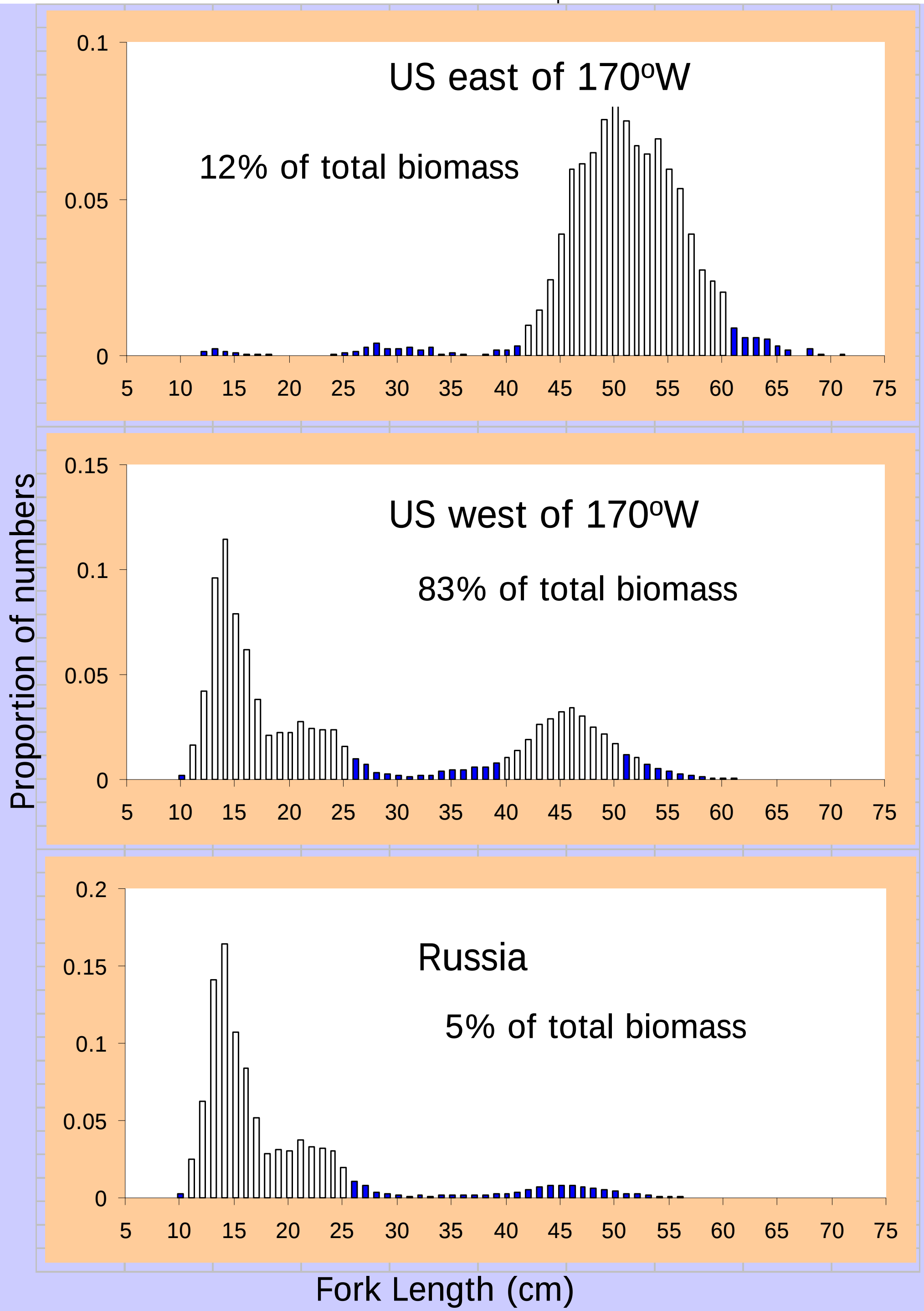
2007 Eastern Bering Sea shelf EIT survey of midwater walleye pollock -- Preliminary results

NOAA Ship *Oscar Dyson*

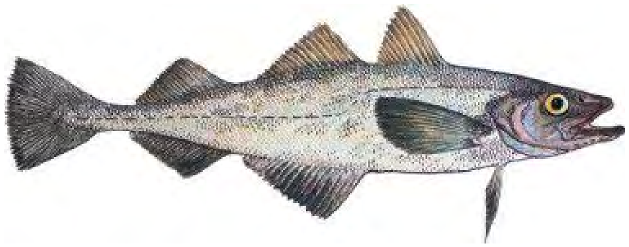
June 1-July 30 2007



The preliminary distribution of midwater walleye pollock biomass (14 m below the surface and 3 m off the bottom), as surveyed by NOAA Ship *Oscar Dyson* in the eastern Bering Sea during June and July 2007.



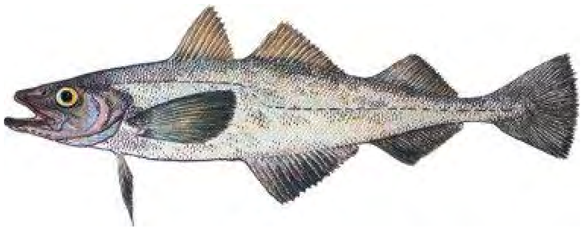
Preliminary results:
Proportion of estimated
total numbers of eastern Bering
Sea midwater walleye pollock
(between 14 m from the surface
and 3 m off bottom) from the
summer 2007 EIT survey,
by length composition,
scaled to numbers within
each area. Y-axes differ.



Eastern Bering Sea Pollock Stock Assessment

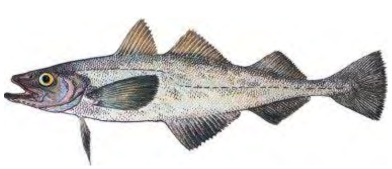
Jim Ianelli, Taina Honkalehto, Neal Williamson, and Steve Barbeaux

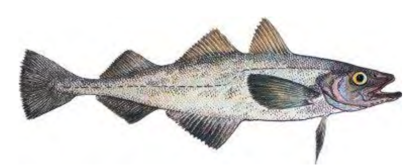
Alaska Fisheries Science Center
NOAA Fisheries



Eastern Bering Sea Catch

- 2007 TAC at 1.39 million t
- 1.4 million t average ABC for 2000-2006
- ABC projected ↓ to < 1.0 million t in 2008

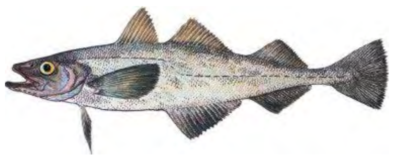


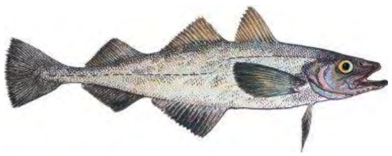


Eastern Bering Sea Survey Results

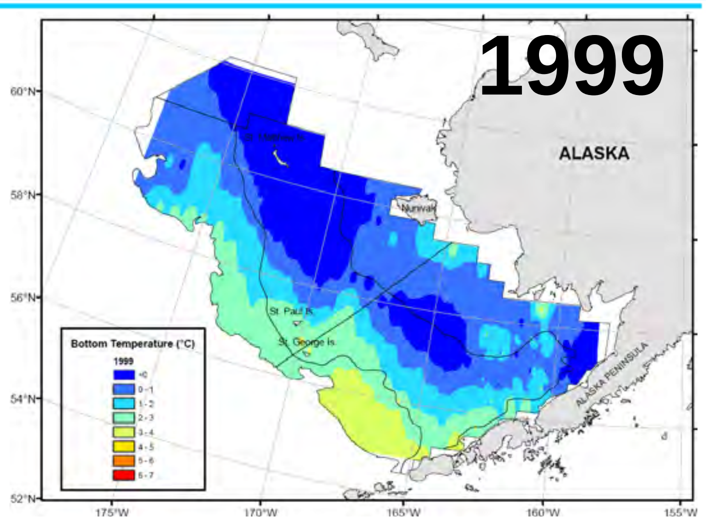
- 2005 BT Survey 5.1 million t
- 2006 BT Survey 2.85 million t
- 2007 BT Survey not yet available

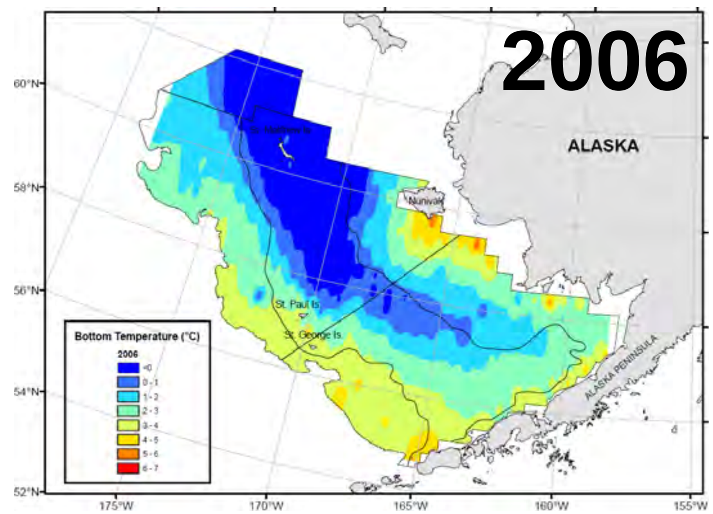
- 2005 EIT Survey 3.3 million t
- 2006 EIT Survey 1.56 million t
- 2007 EIT Survey ~ 2.15 million t

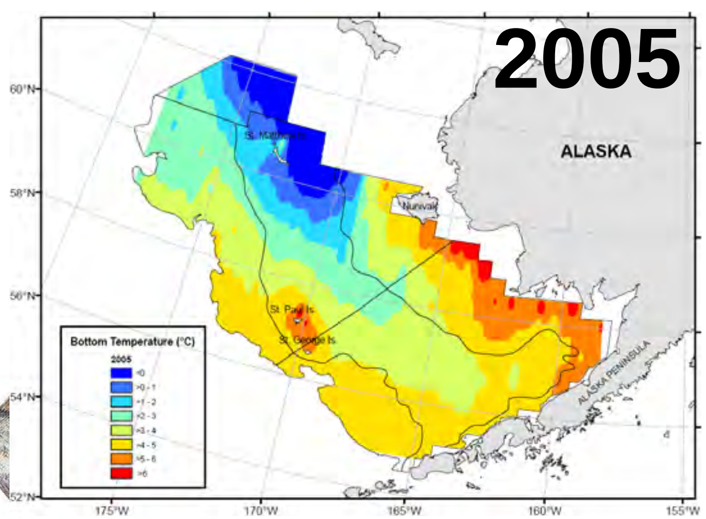


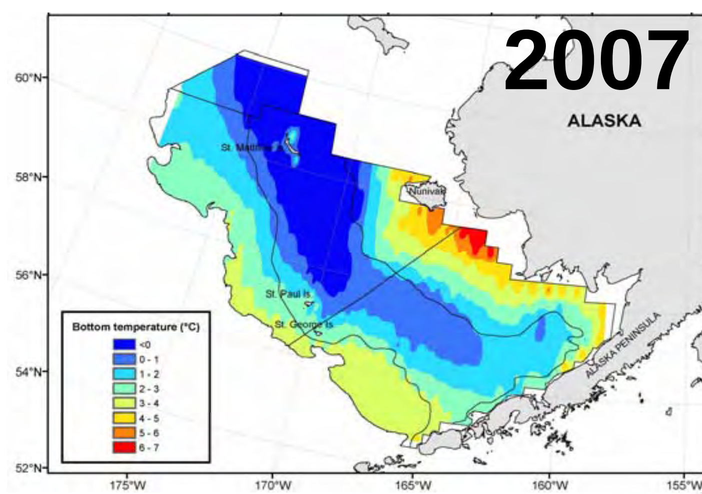


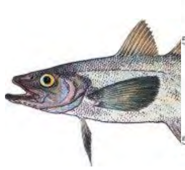
Bottom Temperatures

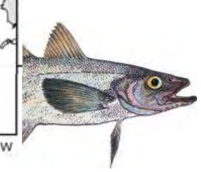




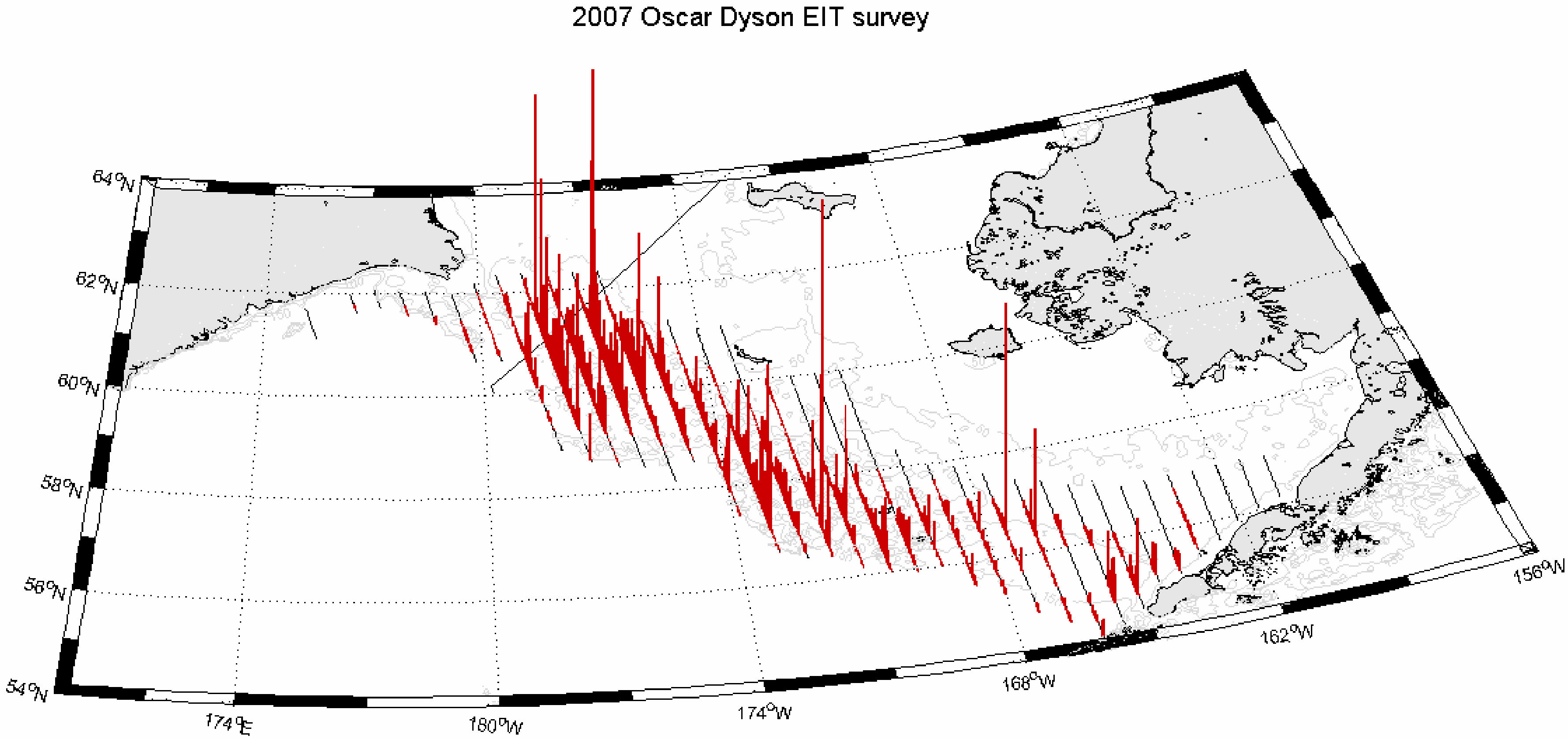




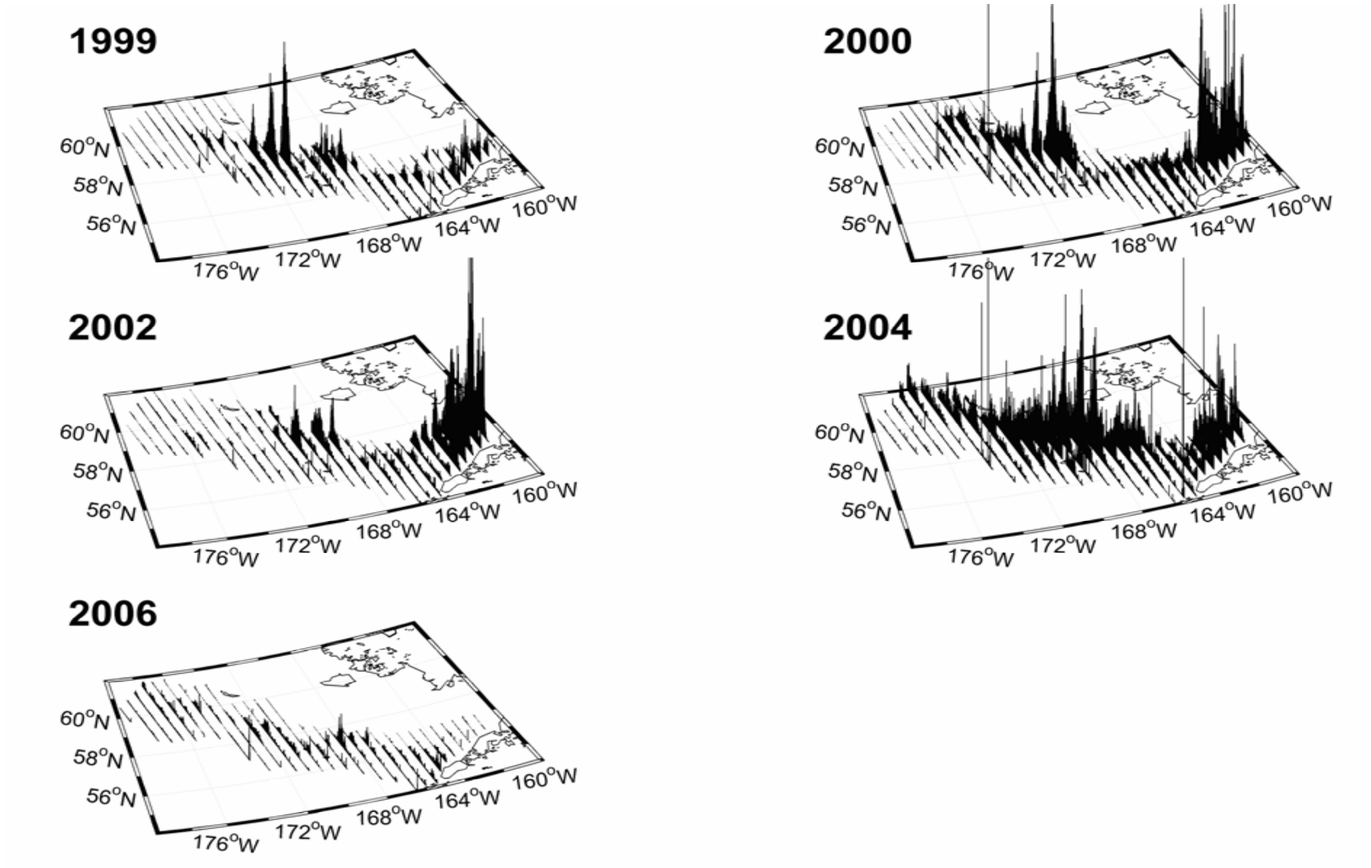


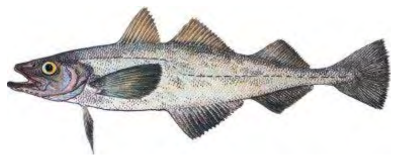


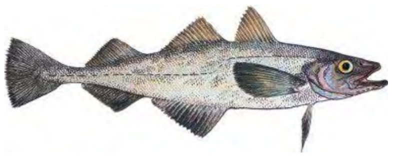
2007 EIT Survey



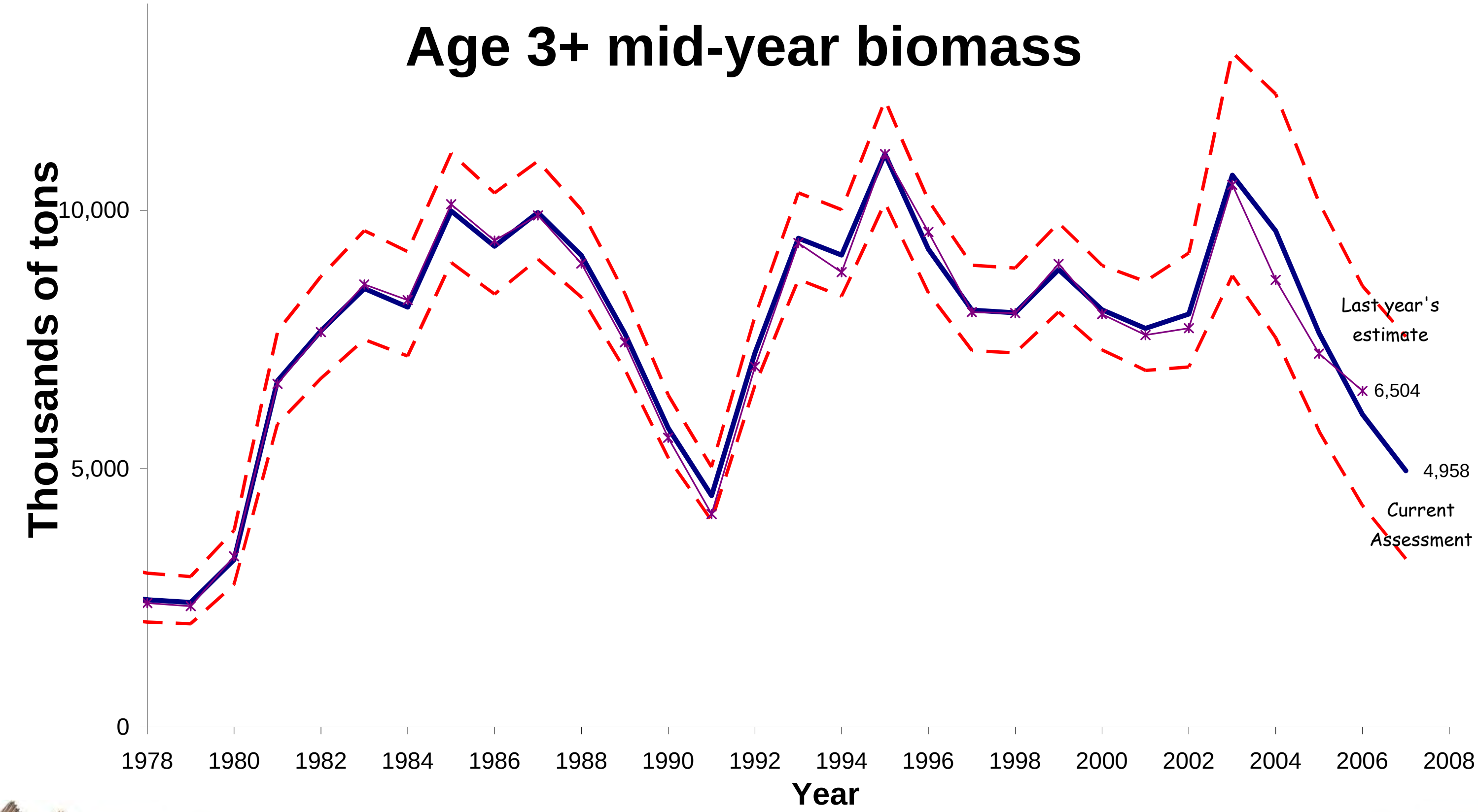
Ecosystem Considerations

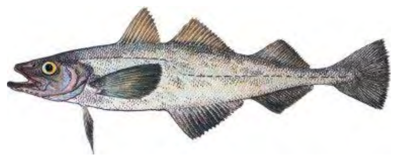


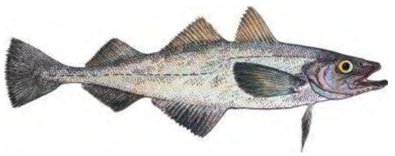




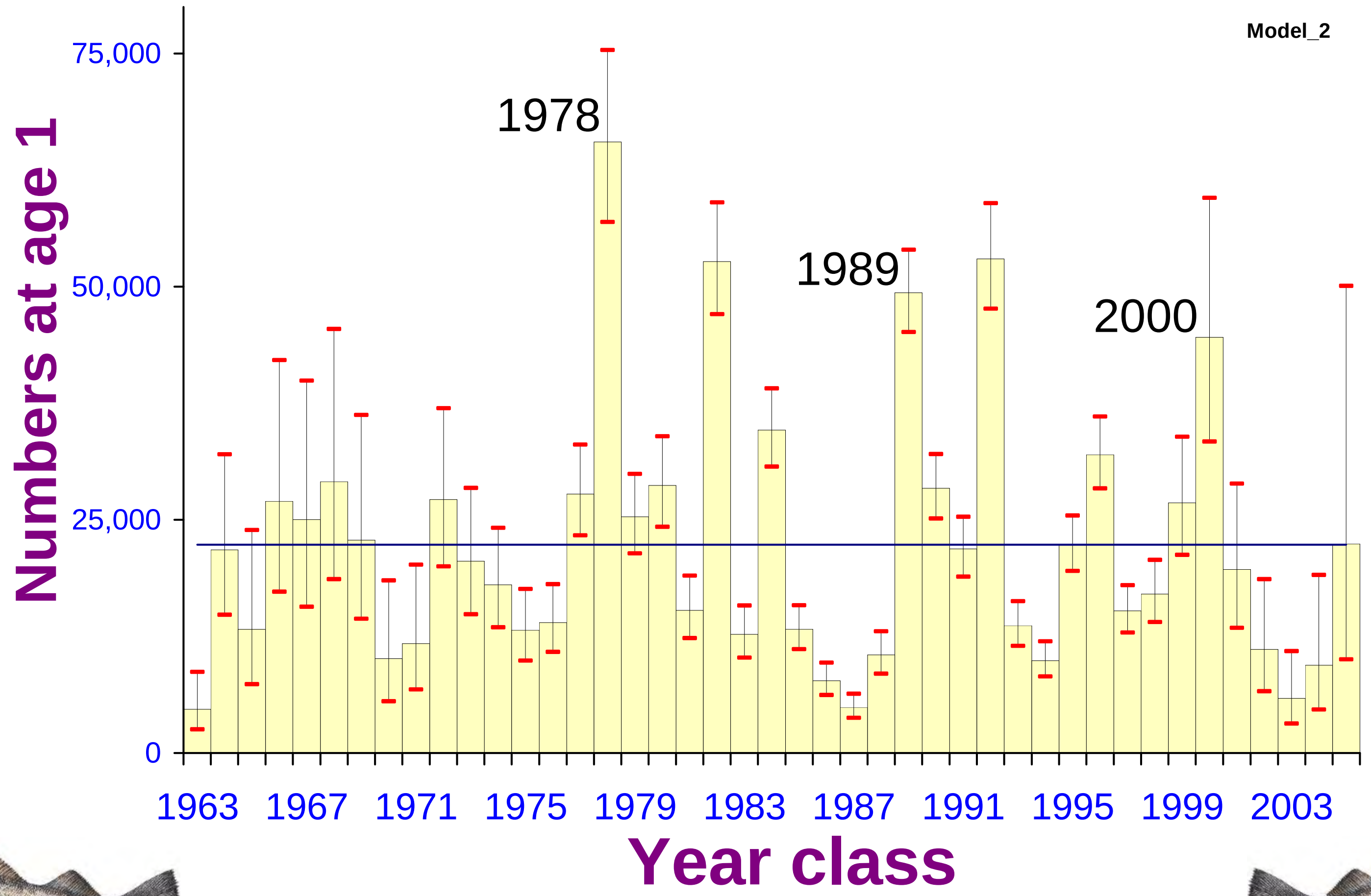
Eastern Bering Sea Pollock Biomass Trends

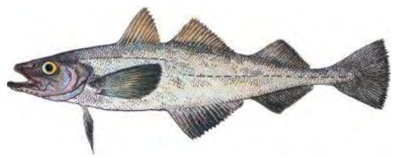


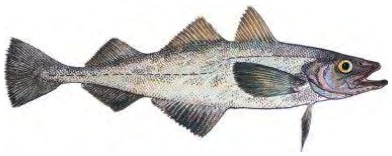




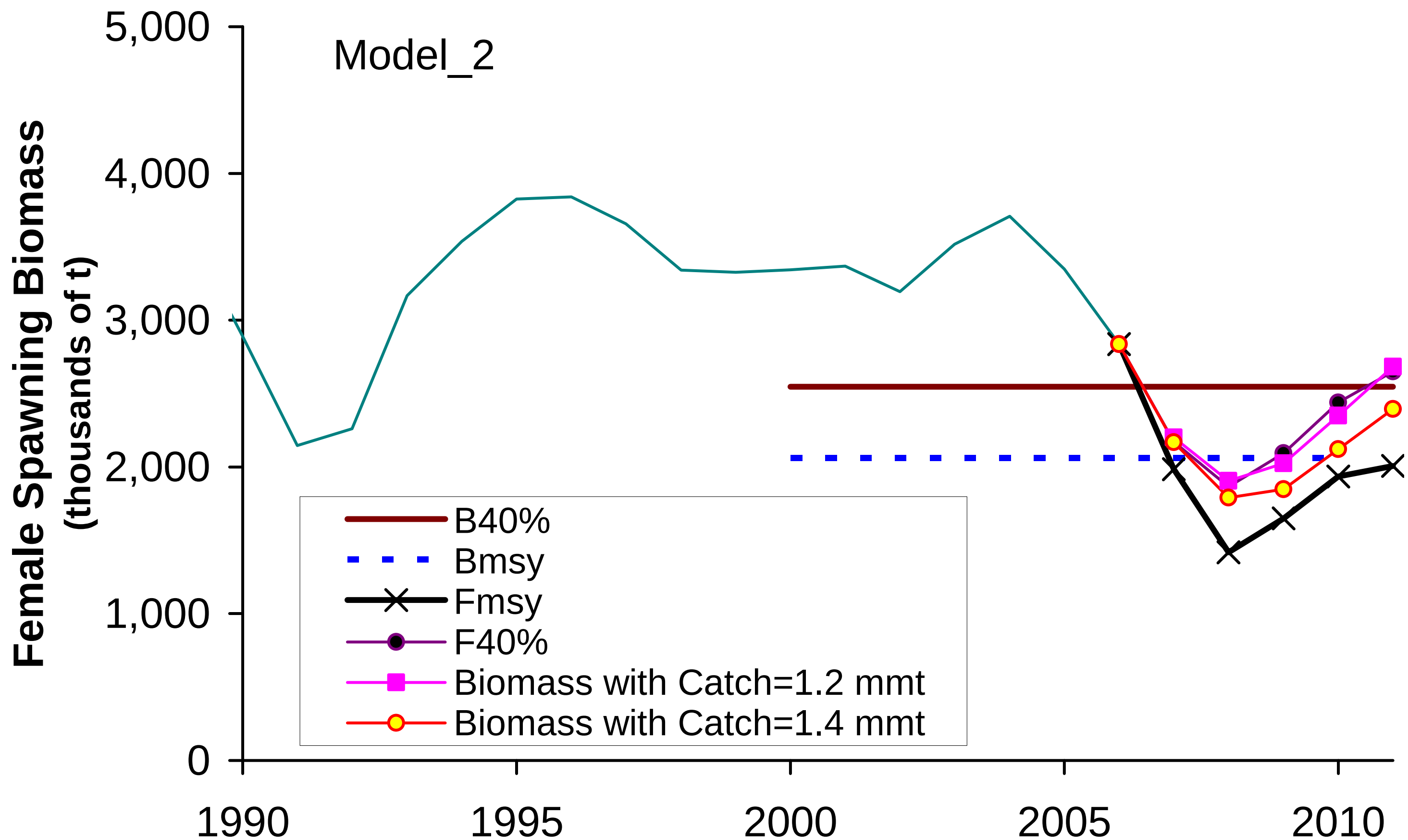
Eastern Bering Sea Pollock Recruitment Trends

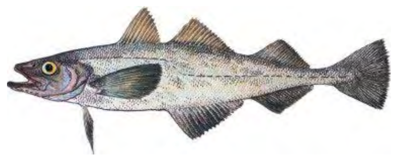


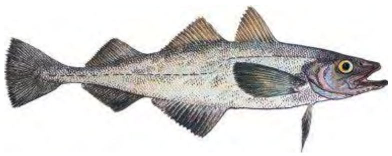




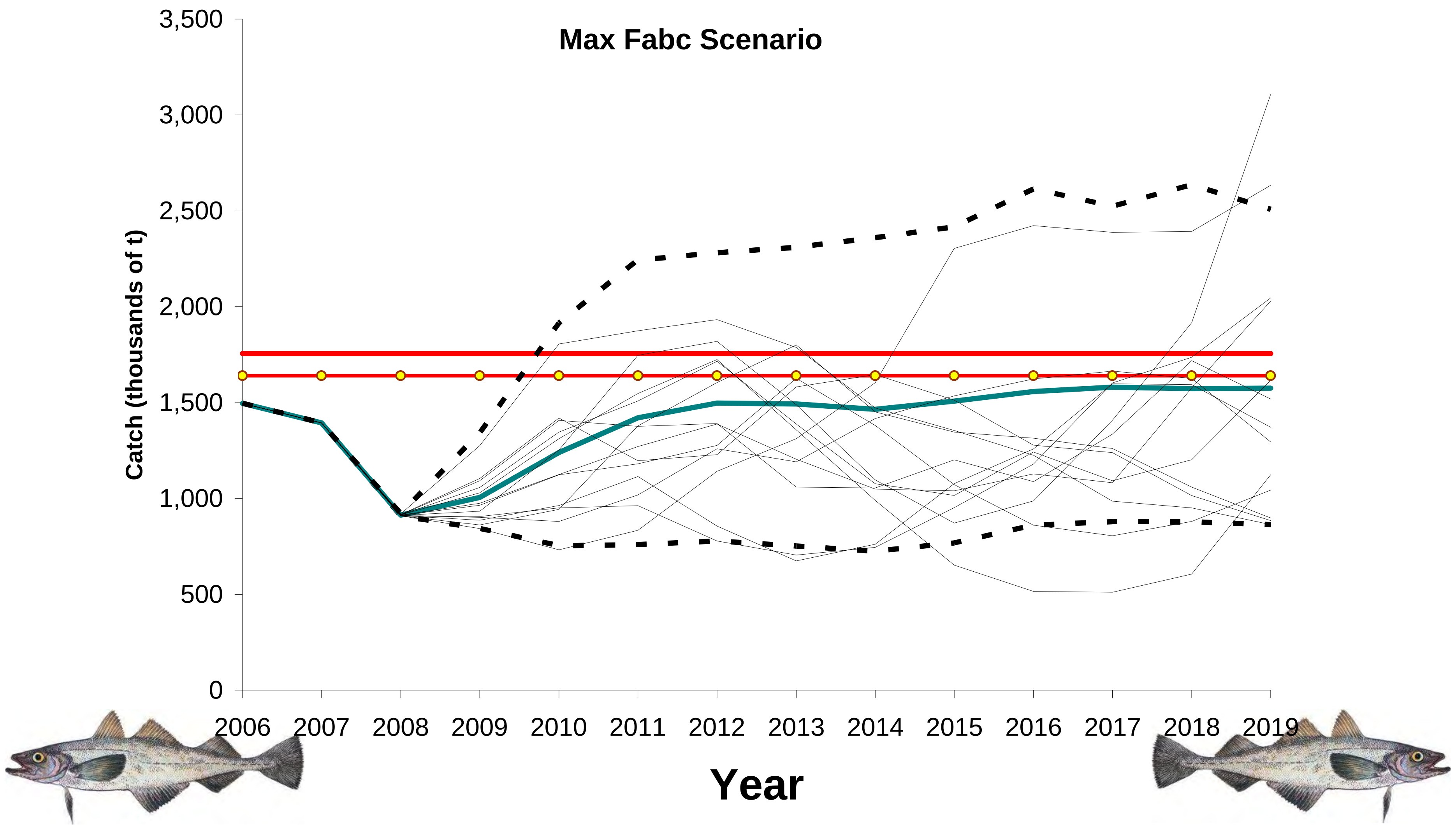
Eastern Bering Sea Pollock Biomass Trends



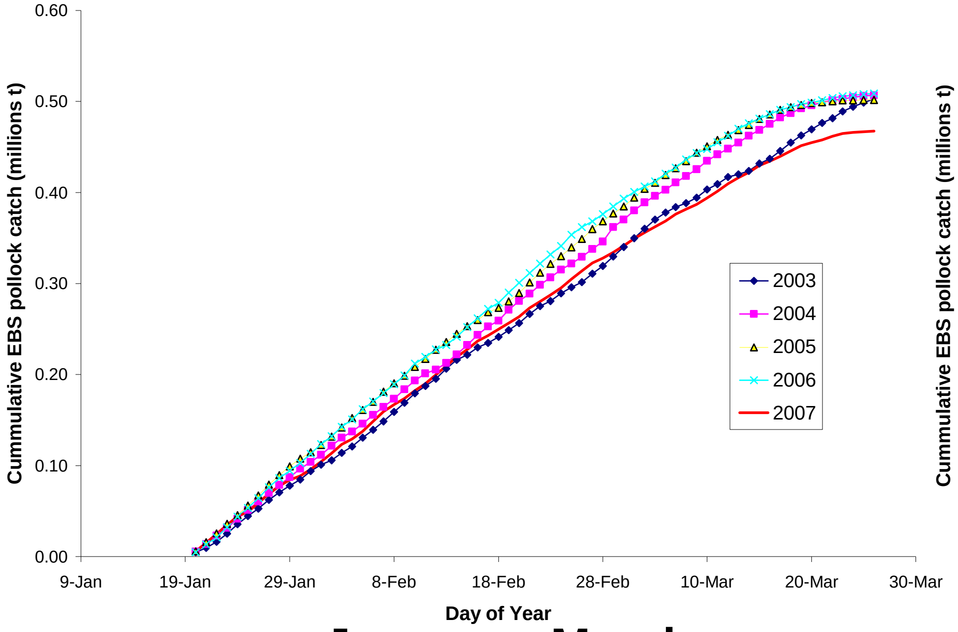




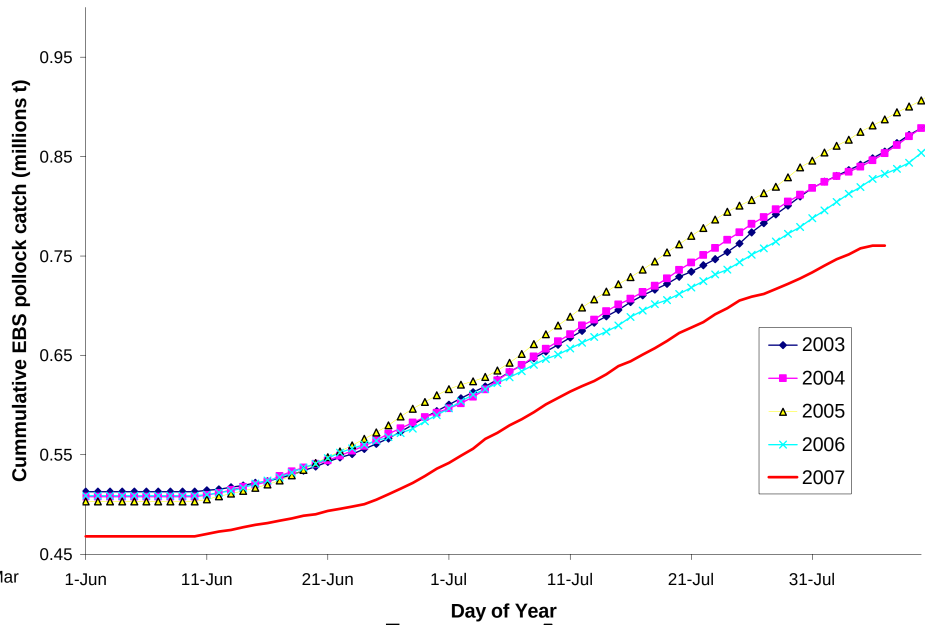
Projected Yield



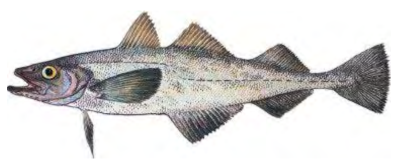
Cumulative Catch Levels

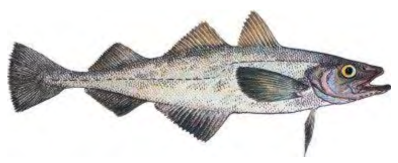


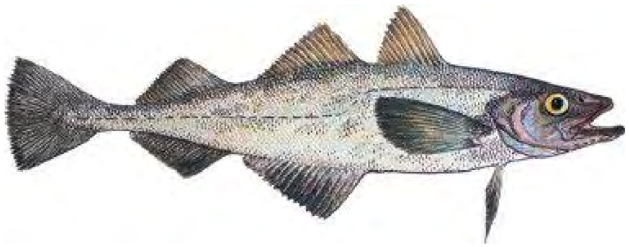
January - March



June - August



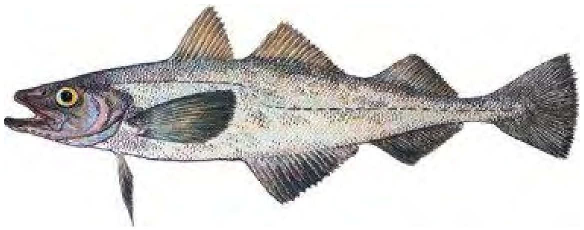




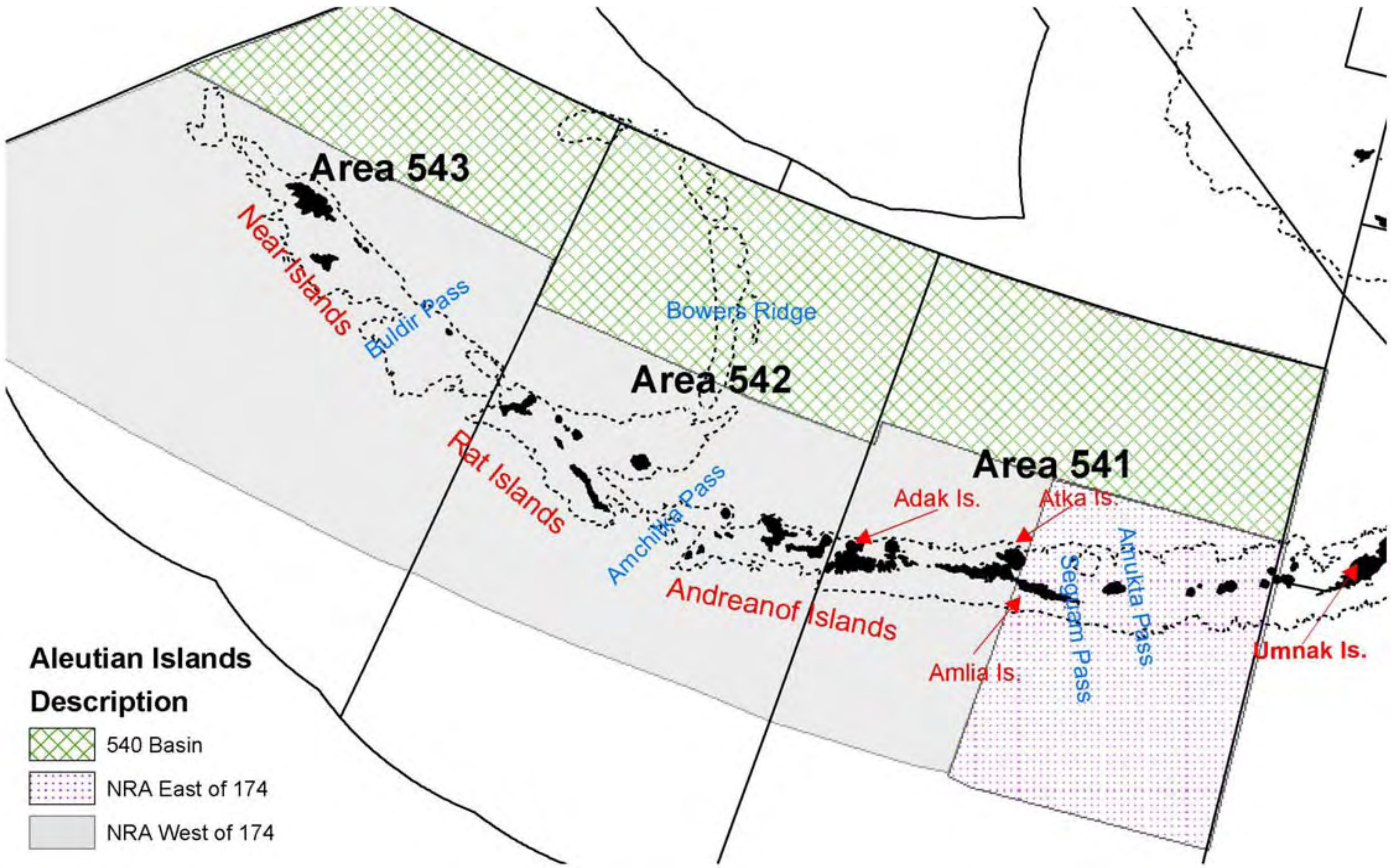
Aleutian Islands Pollock Stock Assessment

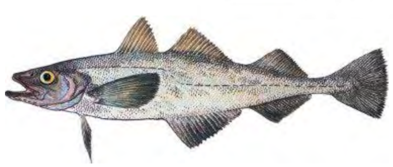
Jim Ianelli, Taina Honkalehto, Neal Williamson, and Steve Barbeaux

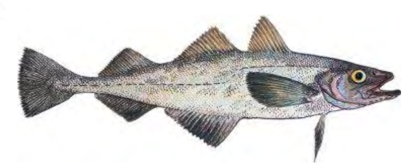
Alaska Fisheries Science Center
NOAA Fisheries



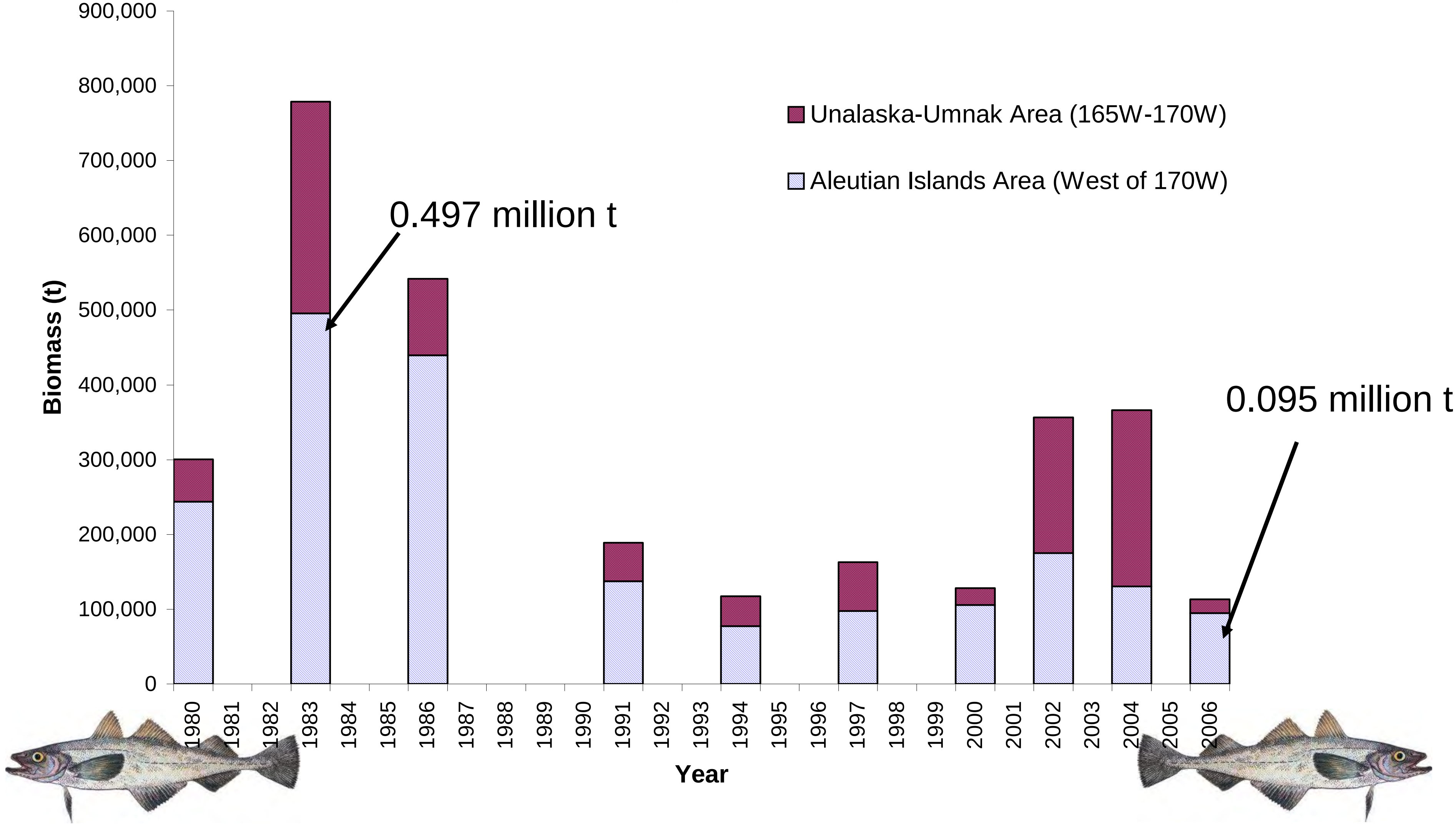
Aleutian Islands Management Areas





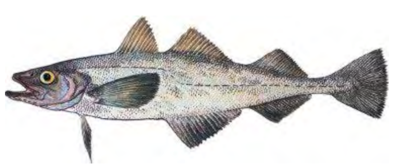


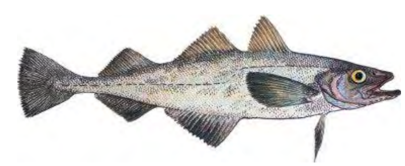
Aleutian Islands Bottom Trawl Surveys



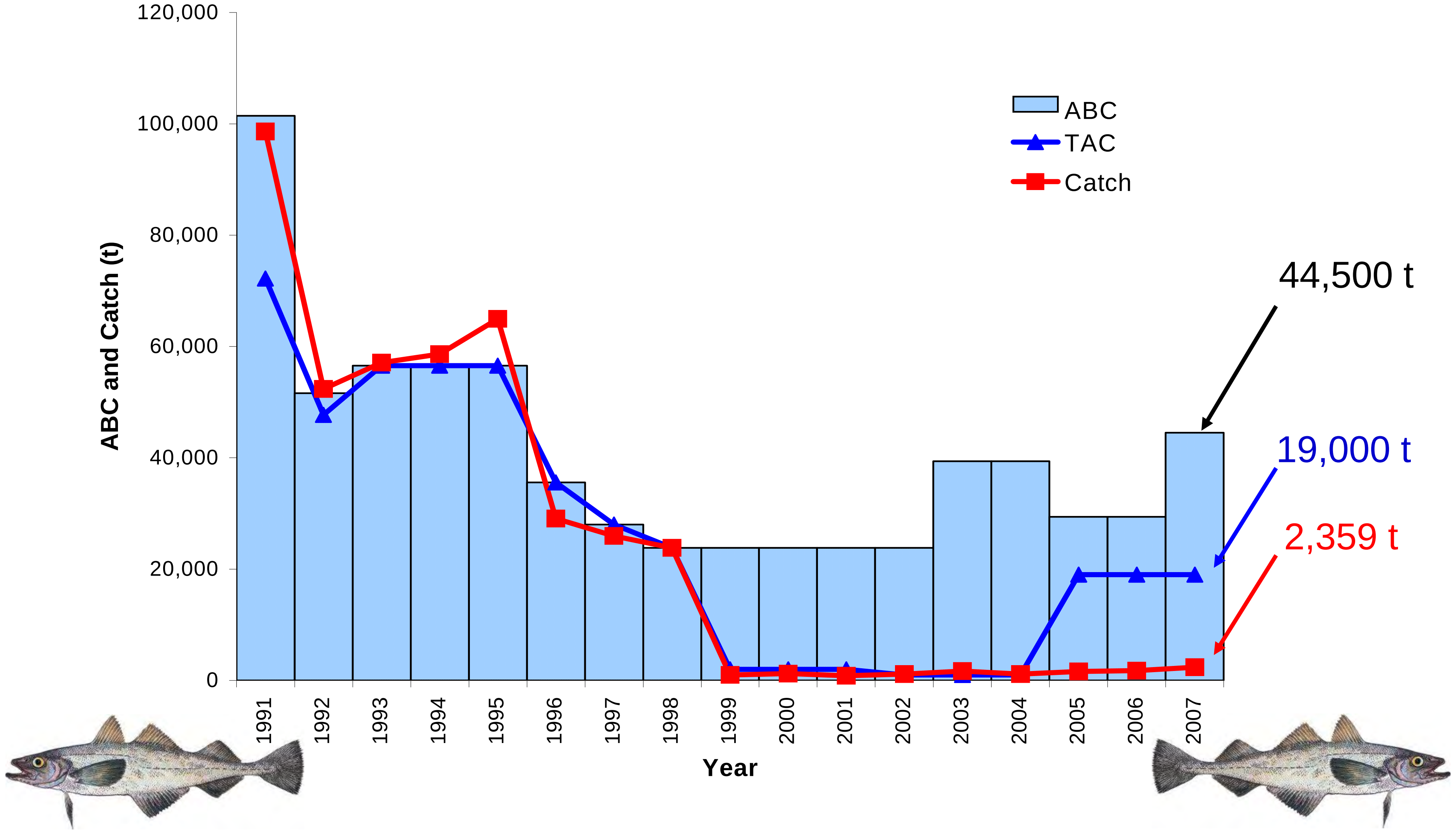
Aleutian Islands Area ABC and TAC

- The 2006 Age-structured stock assessment model (AMAK) accepted for management by the
- ABC_{07} 44,500 t
- OFL_{07} 54,500 t
- Since 2005 by rule the TAC is set at the lower of 19,000 t or ABC



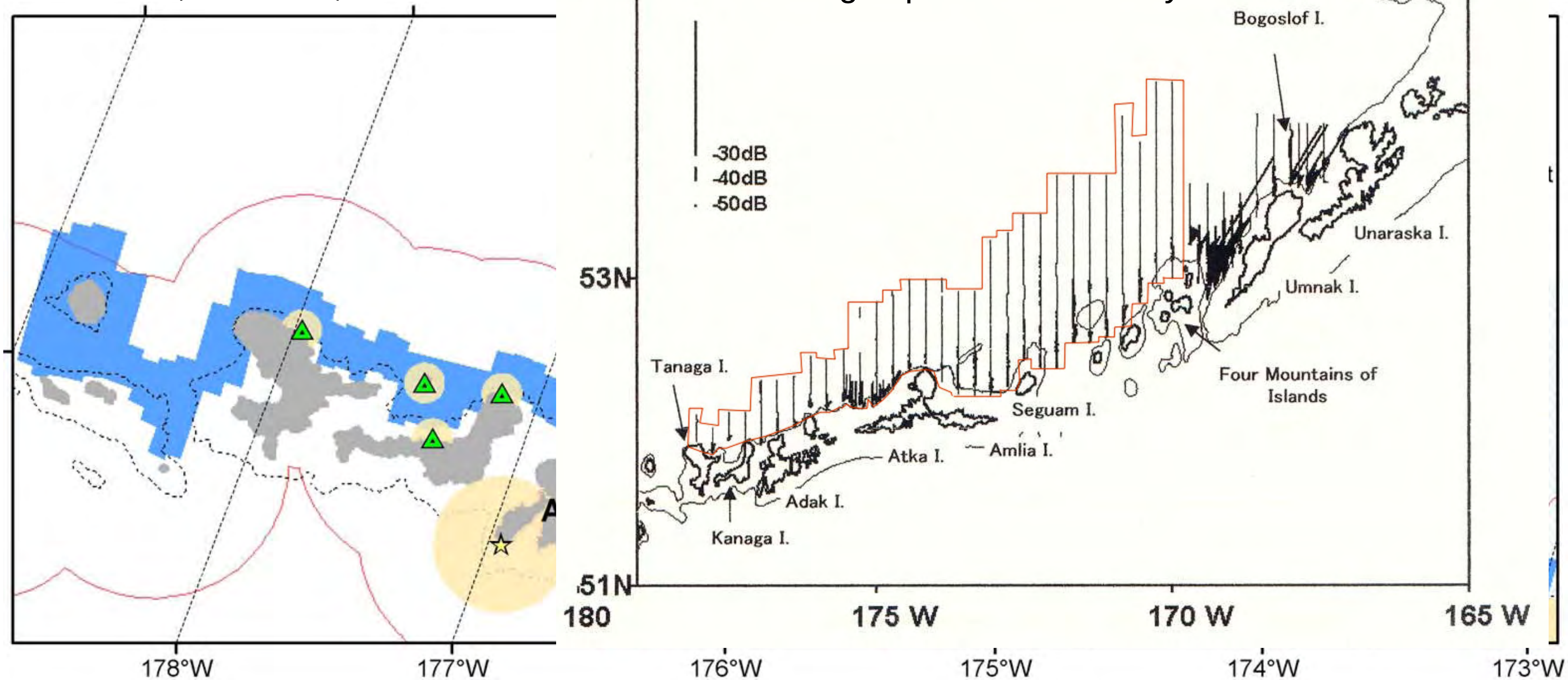


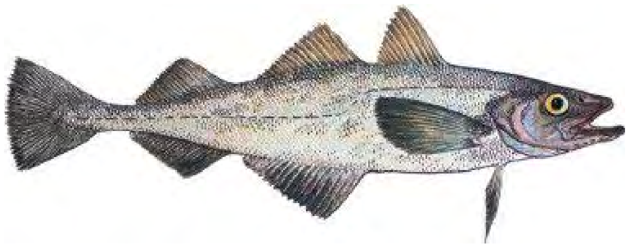
Aleutian Islands Pollock Catch



2007 Aleutian Islands Cooperative Acoustic Survey Study

- Expanded Area
- Quantitative results not yet available
- Qualitative results indicate low pollock biomass
- Pollock locations consistent with the 2002 R/V Kaiyo Maru Survey
- 1,300 t of 3,000 t allowance harvested during experimental fishery

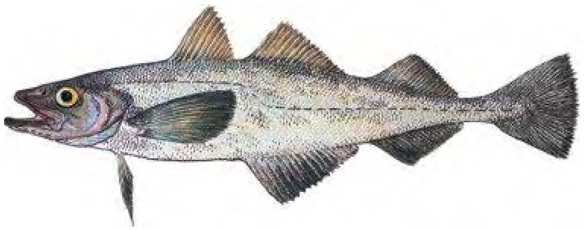




ABC in the Bogoslof Region under US fishery management practices

Jim Ianelli and Steve Barbeaux

Alaska Fisheries Science Center
NOAA Fisheries

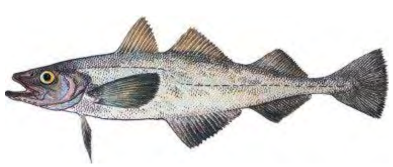


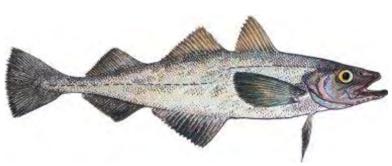
Biomass Adjusted Harvest Rate Rule

$$F_{abc} \le F_{40\%} \bullet \left(\frac{B_{2007}}{B_{Target}} - 0.05 \right) \Big/ (1 - 0.05)$$

- $M = 0.2$
- $F_{40\%} = 0.27$
- B_{Target} = 2.0 million t
- B_{2007} = 0.29 million t
- $F_{abc} = 0.0273$

ABC_{08} = 7,967 t



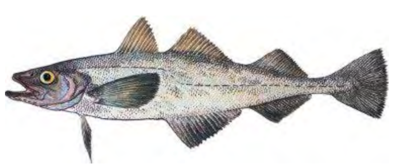


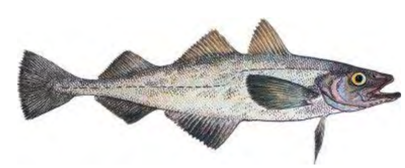
Biomass Adjusted Harvest Rate Rule

- The NPFMC Science and Statistical Committee has set the ABC using the biomass adjusted harvest rate rule since 1997.

- Directed pollock fishing has been closed in the Bogoslof Region since 1992

- Total Allowable Catch (TAC) set at 1,000 t solely for bycatch in other fisheries

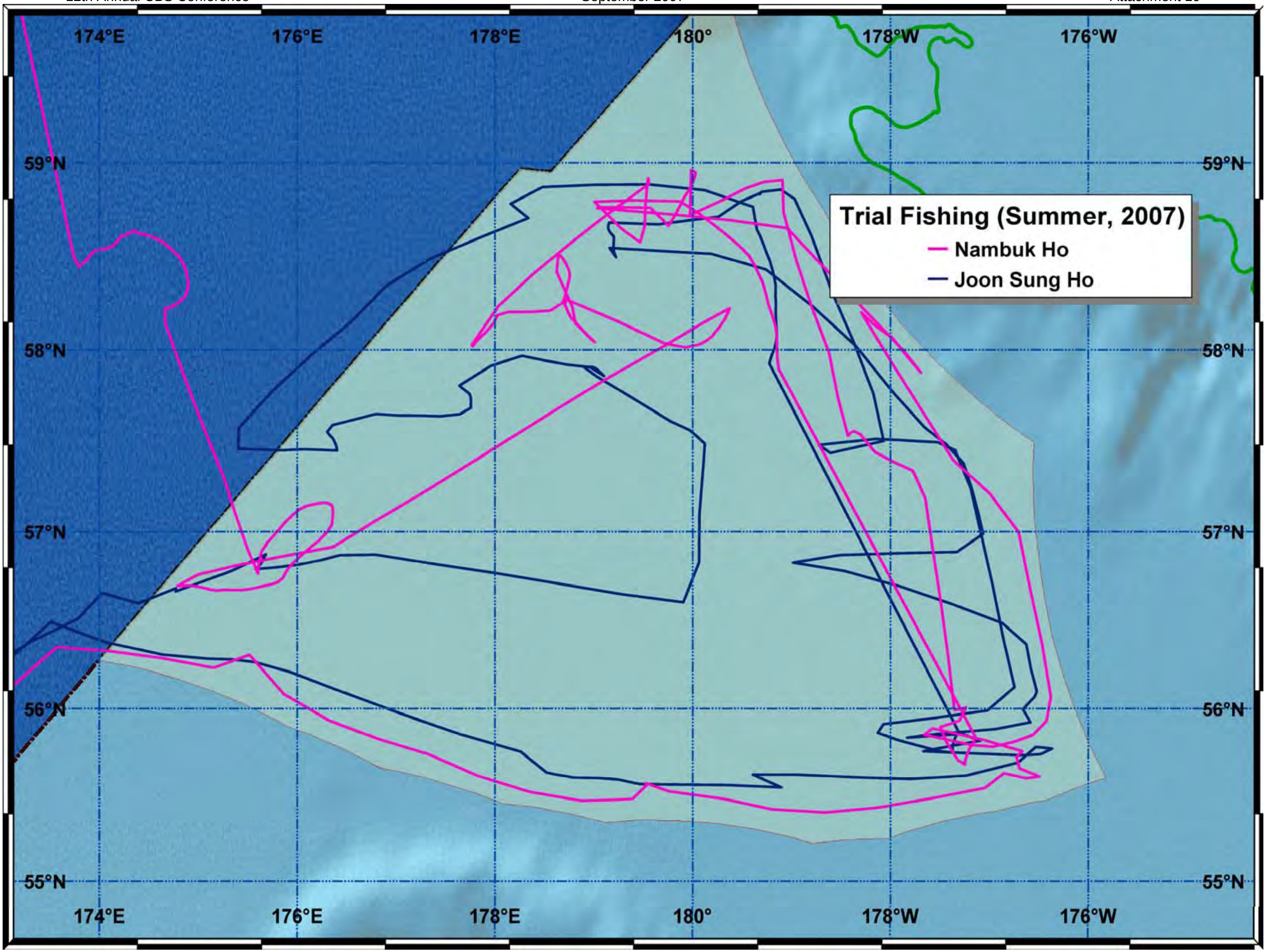


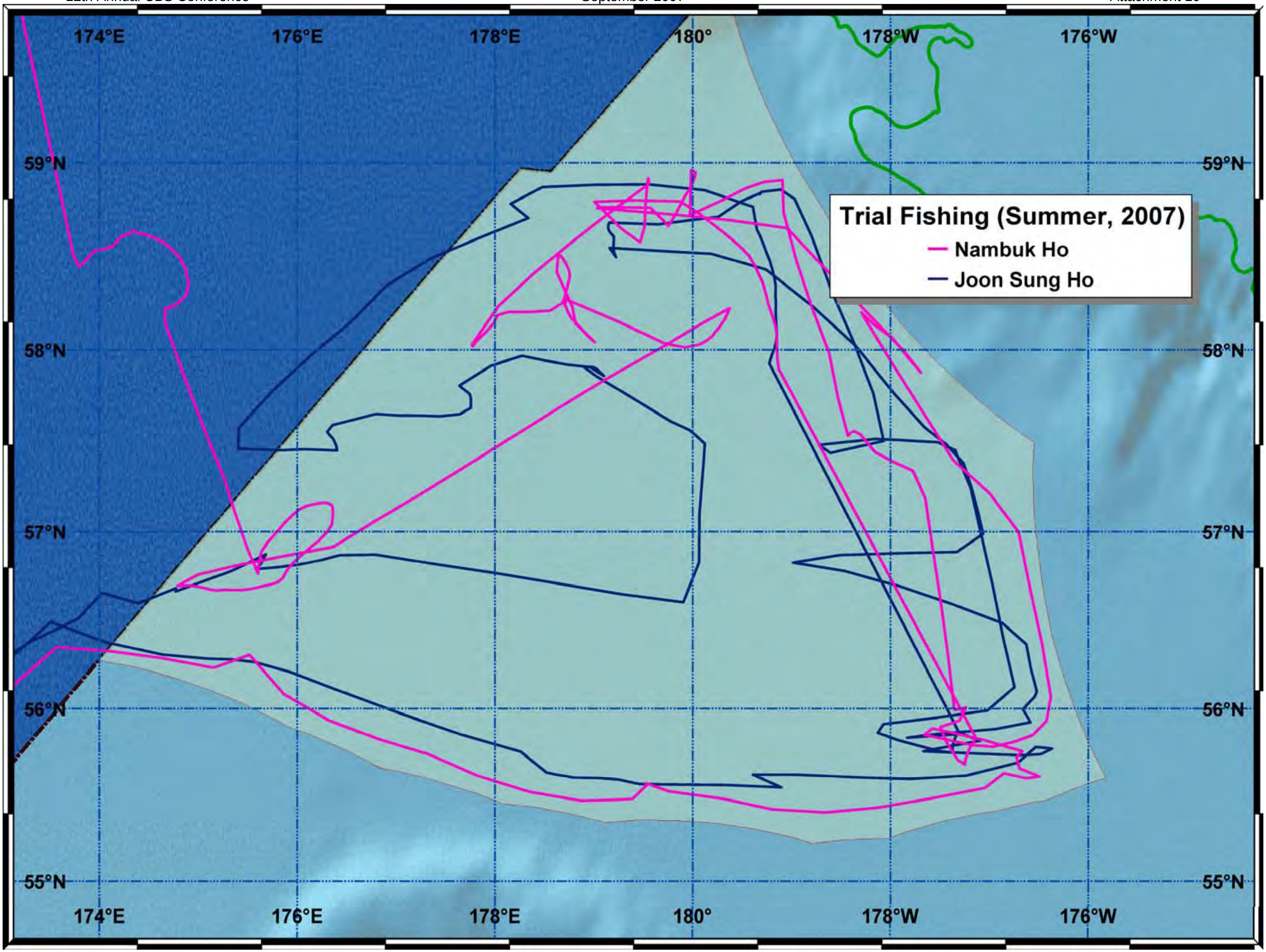


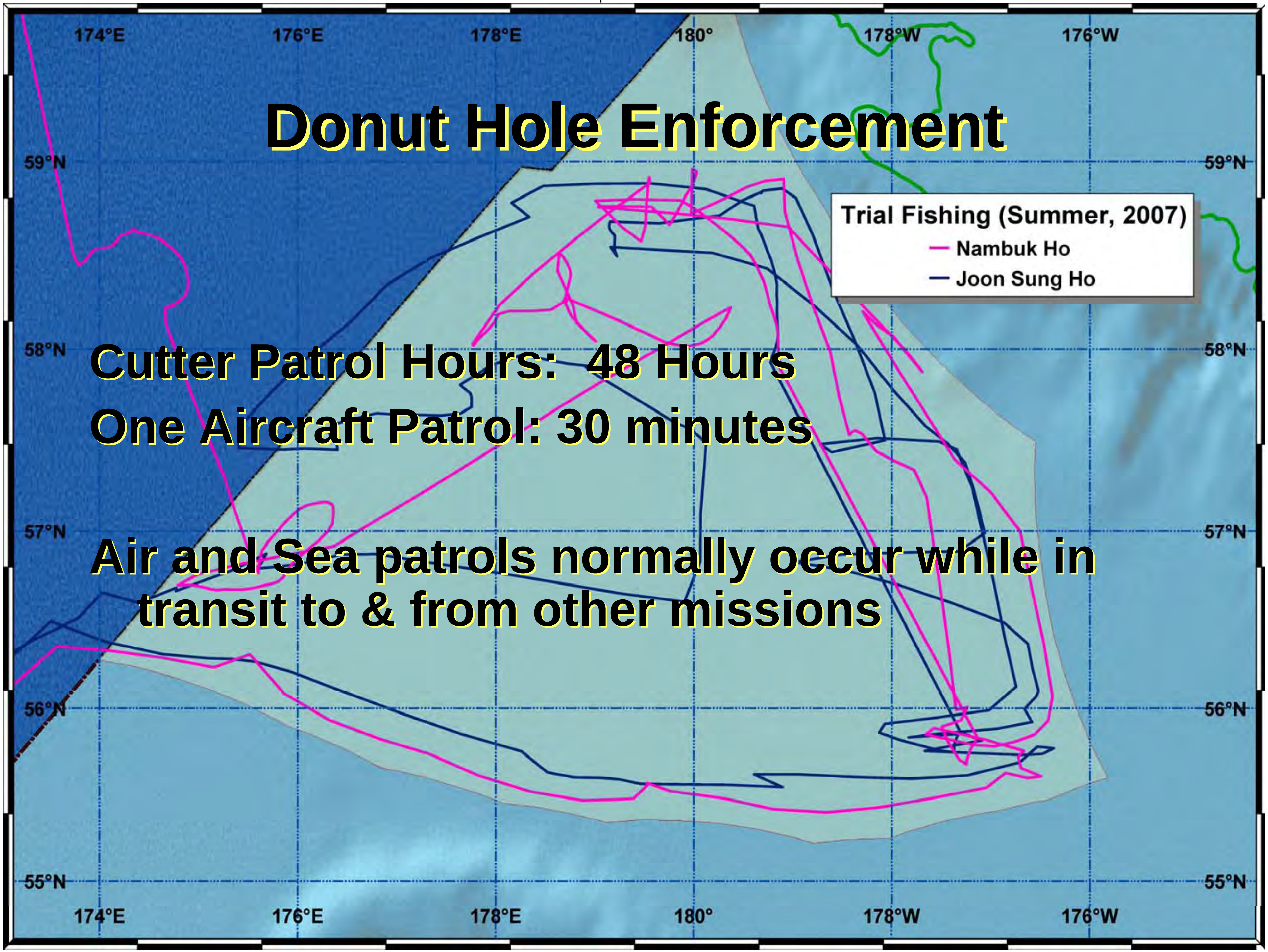
12th Annual Convention on the Conservation & Management of Pollock Resources in the Central Bering Sea

Coast Guard Fisheries Law Enforcement

LCDR Carl Hinshaw


Trial Fishing (Summer, 2007)
Nambuk Ho
Joon Sung Ho
174°E
176°E
178°E
180°
178°W
176°W
59°N
58°N
57°N
56°N
55°N


Trial Fishing (Summer, 2007)
Nambuk Ho
Joon Sung Ho
174°E
176°E
178°E
180°
178°W
176°W
59°N
58°N
57°N
56°N
55°N


Donut Hole Enforcement
Cutter Patrol Hours: 48 Hours
One Aircraft Patrol: 30 minutes
Air and Sea patrols normally occur while in transit to & from other missions
Trial Fishing (Summer, 2007)
Nambuk Ho
Joon Sung Ho
174°E
176°E
178°E
180°
178°W
176°W
59°N
58°N
57°N
56°N
55°N


QUESTIONS?
717
U.S. COAST GUARD
1707
723
U. S. COAST GUARD
160

Trial Fishing Plan for 2008

S. Korea

1. The Purposes of Trial Fishing

a) To analyze the geographical distribution of Pollock in the Central Bering Sea
b) To estimate total weight and number of fish of Pollock and other fishes
c) To collect biological data of Pollock and other fishes (length, sex, body, weight, maturity)

2. Number of Vessels: 2 vessels

3. Research Area and Cruise Plan

Research area covers a part of the Convention Area. Vessels engaged in trial fishing should observe conservation measures adopted by the Convention. Trial fishing will be conducted for two months in autumn with exception of movement of vessel between port and fishing ground.

Vessels engaged in trial fishing will assess fish stocks at average speed of 7~8kt, in a 5-mile in width. Fishing method is to keep track of fish stocks with scientific echo-sounder such as sonar, taking into account water temperature and the divergence of planktons, and the net will be thrown when fish stocks are detected.

4. Observer

One observer from Korea will be on board each vessel. One observer from other parties will be welcome on board in accordance with the terms and conditions on trial fishing on pollock. Cost for observer should be paid by the requesting party.

5. Report

The results of trial fishing will be submitted to the next Scientific and Technical Committee, and Annual Conference and informed to other Parties, including the type of catch and distribution data as specified in the Central Bering Sea Observer Program Manual.