

Scallop Plan Team Meeting Minutes

February 22, 2017

Fishermen's Hall

Kodiak, AK

Administrative: The Scallop Plan Team held their annual meeting at Fishermen's Hall in Kodiak, AK on February 22, 2017. Quinn Smith chaired the meeting.

Plan Team members present: Quinn Smith (Chair, ADF&G Douglas), Jim Armstrong (Vice Chair, NPFMC), Ryan Burt (ADF&G Kodiak), Sarah Webster (APU), Mike Byerly (subbing for Ken Goldman (ADF&G Homer), Ben Williams (ADF&G Juneau), Jie Zheng (ADF&G Juneau).

Public and agency personnel present (for some or all of meeting): Trent Hartill (ADF&G Juneau), Mark Stichert (ADF&G Kodiak), Nathaniel Nichols (ADF&G Kodiak), Gordon Kruse (UAF Juneau), Bob Foy (NMFS Kodiak), Tom Minio (F/V Provider), and Bobbie Minio (F/V Provider).

Present via phone connection: Scott Miller (NMFS Juneau), Elisa Russ (ADF&G Homer).

Agenda: The agenda for the meeting is attached at the end of this document.

Status of Statewide Scallop Stocks and SAFE report-Catch specifications by Area

Southeast Region (Smith)

Southeast Region fishery management biologist and Scallop Plan Team member Quinn Smith presented an update on the Southeast Region weathervane scallop fishery. Southeast Region scallop stocks occur in management Area D (Yakutat and District 16). There is no scallop fishery in Area A (Southeast). Separate guideline harvest levels (GHL) are set for the Yakutat and District 16 portions of Area D.

Weathervane scallops in the Southeast Region have historically not been assessed but will be in May 2017. Management of scallops in Area D relies on fishery dependent data and information collected by scallop observers. The GHL is adjusted based on changes in catch per unit effort (CPUE) by bed, the size and age of the scallop catch, and changes in spatial distribution of effort over time. In 2013/14, managers began evaluating fishery performance in-season using a minimum performance standard (MPS) to determine possible time and area of a fishery closure. The MPS in Area D is defined as the lowest, cumulative CPUE observed since 1997. The MPS is evaluated at the point in the fishing season when 50% of the GHL has been harvested. At that point, if cumulative CPUE falls below the MPS, then managers may take action to close the fishery. To date, the cumulative CPUEs of scallops in the Area D fisheries have not fallen below the MPS.

The District 16 GHL was lowered to 5,000 pounds of meats for the 2016/17 season. Scallop harvests from District 16 are unpredictable from year to year. CPUE, meat yield, and meat quality are highly variable. For example, during the 2016/17 season, CPUE remained low (like the 2014/15 and 2015/16 seasons) due mainly to small meat sizes. Graphs of raw and standardized CPUE do not show a definite trend due to low and highly variable fishing effort. Meat quality was variable but due to the small sizes of the scallops, limited effort was put in and only 240 pounds were harvested in 2016/17.

The Yakutat GHL has remained at 120,000 pounds of meats since 2012/13 and harvests have been comparable. The long term CPUE trend is decreasing but has been increasing over the past four fishing seasons. Graphs of raw and standardized CPUE show the same increasing trend. Estimated shell height distributions from Yakutat show an increased range of sizes since 2013/14.

Tanner crab bycatch remained relatively low in Area D with an estimated 1,200 crab caught during the 2016/17 season. The majority of Tanner crab measured by observers ranged from 20 mm to 50 mm carapace width. No crab bycatch cap has been established in Area D.

Central Region (Byerly)

Central Region research biologist Mike Byerly presented an update on the Prince William Sound (PWS) and Cook Inlet management areas scallop surveys and commercial fisheries. He began by giving a brief overview of the PWS and Cook Inlet registration areas, fishing districts and general scallop fishery regulations. Kayak Island and Kamishak Bay scallop beds are assessed in alternating years.

In Cook Inlet, two scallop beds are located in Kamishak Bay, the north and south beds. The most recent scallop assessment in the Kamishak Bay district was completed in 2015. Survey results showed a small increase in scallop abundance in the northern portion of the district and an age structure that included both older and younger scallops. Results also showed a concentration of smaller scallops in the southern portion of the north bed. Therefore, the southern portion of the north bed was closed to conserve younger scallops while a GHL of 10,000 pounds was established for the northern portion of the north bed for the 2015 and 2016 seasons. The entire southern bed has been closed since 2009.

In PWS, scallop beds occur near Kayak Island and are identified as the West Kayak Subsection (WKS) and East Kayak Subsection (EKS). The most recent scallop assessment near Kayak Island was completed in April 2016 and results showed increased abundance and biomass in the WKS, a continued trend since 2014. The survey also showed a continued decline of abundance and biomass in the EKS with historic low levels. The WKS opened to commercial fishing for scallops in 2016 with a GHL of 6,300 pounds for the first time since 2010; the EKS has been closed since 2012. Members of the fishing industry inquired about details of the Kayak Island survey and if there are any options for the fleet to help survey the area and/or do a little fishing there to compare catch rates to the ADF&G survey.

Westward Region (Nichols)

Westward Region fishery management biologist Nat Nichols presented an update on the Westward Region scallop fisheries. Westward Region includes four registration areas: Kodiak, Alaska Peninsula, Bering Sea, and Dutch Harbor. Managers use fishery dependent data, MPSs, and information from the scallop observer program to establish GHLs and manage harvests in-season. Crab bycatch in Westward Region scallop fisheries is limited by crab bycatch caps. Scallops in the Westward Region have historically not been assessed but, in 2016, the main Shelikof scallop bed was surveyed and it is planned to survey this bed again in 2017 along a portion of the Northeast District scallop beds.

In 2013/14, managers established a district wide GHL for the Kodiak Northeast District and discontinued use of bed and statistical area GHLs. However, if in-season observer data indicate poor scallop CPUE or localized depletion, then managers may use MPSs to close individual areas before the total district GHL is harvested. The Westward Region began setting MPSs in the Northeast District in 2003/2004. The Kodiak Northeast District GHL of 55,000 pounds of meats was not reached in 2016/17. CPUE has declined since the 2014/15 season and is partly due to fishing effort being more spread out around the district in 2015/16 and low catch rates in 2016/17. The distributions of scallop shell heights from 2015/16 season observer data showed a wider size range of scallops harvested compared to the 2014/15 season - this is mainly due to fishing effort being more spread out across the district in 2015/16.

Despite lowering the Kodiak Shelikof District GHL four times since the 2010/11 season, the 2016/17 cumulative CPUE is the 2nd lowest since the district was managed for a GHL. The district opened with a GHL of 25,000 pounds and the preliminary harvest for 2016/17 is 25,126 pounds. The 2016/17 CPUE of 31 lb/hr was comparable to the 2015/16 CPUE of 30 lb/hr and are the lowest seen since 1994/95. CPUE was low from the outset of the 2016/17 season but the entire GHL was harvested. The reason for the decline in CPUE of the main Shelikof bed is unknown but the survey conducted in April of 2016 and the survey planned for May 2017 will hopefully provide insight. Estimated Tanner crab bycatch for 2016/17 was approximately 3,800 crab out of 43,477.

The Kodiak Southwest District opened in 2009/10 with a GHL of 25,000 pounds. The fishery is allowed by ADF&G Commissioner's permit and managers are debating whether to continue exploratory fishing or implement management regulations. The GHL was reached in four out of the last six years. The district was closed early during the 2015/16 season due to high Tanner crab bycatch rates when the bycatch cap was reached after approximately 44% of the scallop GHL was harvested. The 2016/17 Tanner crab bycatch was much lower than the 2015/16 season bycatch. The area is very exposed to weather and dominated by large, old scallops but there are signs of younger year classes.

There was no exploratory effort to harvest scallops in the Kodiak Semidi Islands District in 2016/17.

The Alaska Peninsula Registration Area supported a scallop fishery in the mid- to late-1990s near the Shumagin Islands between 160° and 161° west longitude. In 2014/15, the area between 160° and 161° west longitude was open with a GHL of 7,500 pounds but effort in the area was deterred because of the presence of Pacific cod pot gear. This area was opened again for the 2016/17 season but no scallops were harvested and limited effort was put forth.

In 2012/13, the Alaska Board of Fisheries authorized exploratory fishing in Unimak Bight under the authority of an ADF&G Commissioner's permit to harvest a GHL of 15,000 pounds. The GHL has been achieved each season since 2012/13. Shell height and age distribution data for these years indicate the population has a broad range of age classes most represented by ages 7 to 12.

The Bering Sea Registration Area opened with a GHL of 50,000 pounds for the 2014/15 season. Two vessels participated in the fishery and harvested 12,445 pounds with an overall fishery

CPUE of 24 lb/hr. The two participating vessels quit fishing voluntarily due to low CPUE and signs of high natural mortality throughout the scallop bed. Fishermen and observers both reported high numbers of scallops in which the meat slid off the shell or ripped in half when shucked. In January 2015, samples of scallops were collected and sent to the ADF&G Anchorage Pathology Lab for analysis of any evidence of diseases and/or parasites. The results showed that the scallops were infected with an apicomplexan-like parasitic organism. In 2015/16, the area opened with a GHM of just 7,500 pounds to allow the fleet to look around the bed to better gauge the extent of the problem. In 2016/17, the area opened again with a GHM of 7,500 pounds to allow the fleet to further look around the bed to gauge the extent of the problem. One vessel harvested the 7,500 pound GHM's both seasons but the parasite event has not seemed to subside yet. Estimated crab bycatch during the 2016/17 season was 12,300 Tanner crab (bycatch capped at 260,000 Tanner crab), 63,849 snow crab (bycatch capped at 300,000 snow crab), and 36 king crab (bycatch capped at 500 king crab).

The Dutch Harbor Registration Area reopened to fishing in 2008/09 with a GHM of 10,000 pounds of meats, which was split between the Bering Sea and Pacific Ocean. Due to poor fishery performance on the Pacific side, the GHM was reduced to 5,000 pounds on the Bering Sea side from 2012/13 through 2014/15. The 2015/16 and 2016/17 GHM was raised to 10,000 pounds, split between the Bering Sea and Pacific Ocean, to allow for exploration on the Pacific Ocean side. The 5,000 pound GHM on the Bering Sea side has been reached each year with the harvest coming from one bed outside Inanudak Bay. Effort was put in on the Pacific Ocean side in both 2015/16 and 2016/17 but no scallops were harvested either season.

Monitoring Ocean Acidification and its Potential Effect on the Scallop Stocks (Foy)

Bob gave an update of research on impacts of ocean acidification on crab stocks in Alaska since 2013 and a literature review of studies on the impacts of ocean acidification on scallop stocks outside of Alaska. About 25-30% of carbon source increases end up in the ocean sink and North Pacific Ocean pH values are decreasing 0.0024 per year. Studies have found that ocean acidification causes many calcifying organisms to change in respiration rate, aerobic metabolism and stress tolerance and require greater energy in shell maintenance and result in less energy in reproduction and growth. Ocean acidification is an Alaska problem because Alaska's water is close to equilibrium (about 1.0) in terms of aragonite saturation state, and any change will have an impact. Currently, monitoring ocean pH values occurs in several places in Alaska, including Port Conclusion, Chiniak, Gulf of Alaska, and Bering Sea. The pH values and CO₂ concentrations vary seasonally, spatially and temporally. Aragonite saturation states also change by depth, season and location.

The Alaska Fisheries Science Center in Kodiak has conducted many studies on impacts of ocean acidification on commercially important fish, shellfish, their prey (calcareous plankton), and shelter (corals) with objectives to understand species-specific physiological responses and forecast population impacts and economic consequences. Many lab studies have been focused on king and Tanner crab in Alaska during 2010-2016. Generally, for red king crab, decreased pH values are associated with smaller eggs and embryos, larger yolks, increased larval calcification, and decreased survival. For Tanner crab, a lower pH value also results in larger yolks and smaller embryos, and thus, slower development. There are also carryover effects of decreased pH: from embryo to larvae, year 1 has no significant difference in number of hatched larvae, but year 2, has 71% fewer viable larvae hatched. Juvenile Tanner crab have lower survival rates with pH values of 7.8 and 7.5 and growth rates are also lower with pH 7.5. Percentages of calcium contents in adult Tanner crab are lower with pH values of 7.8 and 7.5. For Tanner

crab, internal pH values are no different among treatments of control (pH 8.09), pH 7.8 and pH 7.5; however, there may be energetic costs to maintain pH values and defense mechanisms. A pH of 7.5 results in cells dying faster than can be removed, a high turnover rate. Overall, crab are sensitive to temperature, pH, and CaCO₃ saturation. A simulation study was used to model the population impacts of ocean acidification on Tanner crab. Predictably, with ocean acidification, the proportion of larvae hatching that survive to juvenile stage C8 could decline by 25% over 100 years. Catch and profit could decline by more than 50% within 20 years, and there could be \$500 million - \$1 billion loss to Alaskan households.

Bob mentioned that there has not been research on the impacts of ocean acidification on scallops in Alaska, but he reviewed the literature on this topic for scallops in other areas. Scallop shells are made of both aragonite and calcite, and aragonite is a much more reactive mineral to lower pH values. We would expect that with ocean acidification, there would be increased upwelling of corrosive water into scallop habitat and shell building stress would increase. We still don't know the exact mineral composition of the scallop shell and how it will change. We also don't know the resilience of scallop shells, energetics, and capacity for acclimation and adaptation. For Atlantic great scallop (*Pecten maximus*) (Ireland, Norway), under ocean acidification, the calcification is constant and internal pH values are not changed; however, the thermal tolerance is narrow and there are negative impacts on larval survival and growth. For Zhikong scallop (*Chlamys farreri*) (Asia), a study shows that calcification decreased 33% at pH 7.9 and respiration decreased 14%. For *Argopecten purpuratus* (Chile), shell thickness was reduced at pH 7.7, and there was shell dissolution and low growth rates. Overall, ocean acidification would decrease calcification rates and impair growth and survival. For larvae, ocean acidification would result in increased mortality, reduced growth, impaired development and shell deformities.

Update on Scallop Parasite Studies (Burt)

Ryan Burt presented on the results of a parasite study conducted by the ADF&G Pathology laboratory on apicomplexan parasites in Alaskan scallops. Samples of scallops were first sent to the ADF&G pathology lab from the Bering sea district in the 2014/15 fishery due to the observer poor meat condition. The study was then expanded statewide in the 2015/16 season when observers collected scallop meats from all areas fished.

In examination the ADF&G Pathology lab found that there was an overall prevalence of 82.2% of an apicomplexan protozoan parasite in the scallop meats with a range among fishing districts from 68.8% to 100% of individuals infected. Overall mean intensity of infection based on the number of parasite foci/section was 9.3, with mean intensities ranging from 5.4-29.2 by sample location. Samples from Bering Sea Side (Dutch Harbor) and Southwest Kodiak had the most severe infections; some sections contained more than 60 parasite foci.

A similar apicomplexan has been described from Iceland scallops, *Chlamys islandica*, queen scallops, *Aequipecten opercularis*, and king scallops, *Pecten maximus* from Iceland and the UK and Atlantic sea scallops from the Atlantic waters of Canada and the US. The parasite from those hosts and localities was confirmed to be the same species based on rDNA sequencing. Interestingly, Iceland scallops have been recorded in the North Pacific, so it is possible that the same parasite species or one that is closely related also infects Alaskan weathervane scallops.

Future direction with this work could include additional sampling of scallops from an area with high infection (e.g., Dutch Harbor or Southwest Kodiak) to examine for this parasite in tissues other than adductor muscle; obtain gross photographs and assessment of those samples to correlate with infection severity; evaluate additional organoleptic testing of normal and affected meats for grading of product

quality; collaborate with the researchers in the Atlantic to determine the relatedness of the Alaskan parasite by rDNA sequencing; and continue ongoing discussions regarding potential management strategies.

Progress on New Scallop Assessment Program (Williams & Smith)

Quinn Smith presented a progress update on the fishery independent scallop survey. Central Region has been conducting dredge surveys since 1996 and sets GHLs off of biomass estimates. The plan for the statewide assessment is to expand Central Region survey to other regions. The areas and beds planned for surveys in 2016 were the Central Region Kayak I east and west beds, the Southeast Region Yakutat 1 bed, and the Westward Region Shelikof 1 and 2 beds. The first step was to develop sampling grids for the regional scallop beds. Sampling grids the Southeast and Westward beds were developed based on the design of 1 Nmi square grids used in Central Region. The extents of the grids were based on historical tow paths using those grid cells which had a cumulative historical catch of >2000lbs. Ben Williams performed a minimum sample size simulation resulting in the expected CVs given the percentage of stations sampled. It was decided that 30% of the stations would be sampled with a target CV of 20%. The sampling design used was the same as in Central Region; systematic with a random starting point. The survey began at Kayak I with the plan of surveying there and proceeding on to the Yakutat bed. The R/V Solstice was used for this survey. There were lots of weather days so the vessel was only able to survey the east and west Kayak I beds.

A second survey of the Shelikof beds was conducted by the R/V Pandalus. The survey began in the Shelikof 1 bed and ended early after the Pandalus had a mechanical. The F/V Provider later finished the survey, completing Shelikof beds 1, 2, and 3. The survey plan for 2017 is to re-survey the Shelikof 1 bed, and survey the Yakutat 1 and a few of the Kodiak NE beds.

The CVs at for Shelikof 1 and east Kayak were acceptable but was higher for west Kayak (38%). The higher CV at west Kayak was likely due to the high spatial aggregation of the scallops and lower sampling density. There was not much variation in the meat wt/round wt ratio within beds. There was a big difference, however, between the May and June surveys at Shelikof. This was due the spawning taking place between the surveys. Therefore, need to pay attention to survey timing and ratios when setting GHLs.

No aging was done on the shells collected in 2016, but historically, the age structure for the Shelikof 1 bed looks good, the west Kayak bed looks ok, and the east Kayak bed shows little recruitment. When looking at the proportion of clappers observed in the 2016 surveys, there was little sign of high mortality. GHL projections based on 5% and 10% exploitation rates were presented. Using round weight for determining GHLs was recommended.

In a separate presentation, Quinn showed slides of the Dredgemaster manufactured by Notus Electronics. This instrument measures tilt and roll angles of the dredge along with depth, wire out, and temperature and provides a real time display. This package is being purchased and will be used in the 2017 surveys.

Ben Williams presented some updates to the observer sampling. There were a few changes to the protocols for this past season. In the past, there was a bias toward collecting larger shells. Subsampling protocols were adjusted to address this. The data is still being analyzed but results should be available in May. The goal is to have sampling procedures between the survey and observers similar so the results can be comparable. Historical fishery CPUE trends and shell height data for Shelikof were presented. There's been a decrease in CPUE while there hasn't been a large change in the size composition.

In the future, the recommendation was made to present both meat wt and round wt cpue estimates with a further recommendation to guide management toward using round weight. There were questions and discussion of how to measure harvest if the fishery was just landing meats. Ben has done a lot of work in attempting to standardize CPUE and mentioned that the methods are still preliminary but showed a lot a promise and should be pursued.

Alternative Data-Poor Methods for Scallop Management (Kruse)

Gordon Kruse gave a presentation on data-poor methods for assessing and managing the commercial scallop fishery in Tasmanian waters. He provided biological background on the three species of commercially harvested scallops in Tasmania. There were some similarities to weathervane scallops in that these species have variable growth rates by location and are genetically homogenous with some isolation by distance, they differ in that weathervane scallops have a much older max life expectancy.

The management structure of the Tasmanian fishery is characterized by three jurisdictions, with stocks (beds) straddling the jurisdictions. The fishery is mature, having started in early 1900, and is susceptible to a boom-bust cycle. Since 1988 the fishery has been closed 12 of the possible 28 years. Management has had the fishery rotate through open and closed areas that have lead to spikes in catches. The fishery now has few participants and most vessels are in the 18-24 m size –class. They utilize a single 'harvester' dredge 3-4 m wide with a toothed bar across the front to dig out scallops that are dumped into sorting/washing on deck with no at-sea processing. There are multiple products produced e.g., scallop on shell, w/roe, in a fresh market, no product is sold overseas.

The fishery has no size limits and there are no observers onboard, there was a significant change to management in the 1980s with a change to IFQ in 1986. The management structure is quite different from U.S. style management with detailed spatial management of 'paddock fishery' (beds) that are closed unless evidence shows it can support a fishery. The current FMP was implemented in 2010, the FMP defines a decision rule to open and close fisheries in particular areas. There are minimum size/age limits set, whereby at least 80% of scallops must be >90 mm or age-3+. These minimums were set to try to allow at least two chances for an individual scallop to spawn before harvest. Alternative size limits can be established for areas where scallops are small.

The management structure attempts to protect juveniles and allow rebuilding to occur as size structure is particularly important to the stock dynamics. Open areas are rotated to reduce pressure on any given paddock. A candidate area can be nominated for opening, this area will then be explored for whether size and density are commercially viable. Commercial viability is based upon anticipated economic return that is reviewed by a scallop advisory committee. The fleet is used to determine catch rates and size composition discard. There is a threshold - if too many scallops are less than minimum size (>20%) then vessel has to move at least 250 m away to explore for larger animals. Additionally there are meat recovery guidelines established - this assists with the economic return. There are also occasional inseason surveys - economic viability is recurring thread through the management structure.

There are a number of scientific issues that may arise with this management strategy. For instance should highly productive beds be opened for industry or is it better to keep as brood stock spawning areas? There is also the concern of whether the common scallops can be accurately aged, an aging program could be useful - growth rates, maturity, natural mortality. Age data can also be used for yield per recruit analyses to indicate appropriate harvest rates. Further area specific sizes need to be examined for their effects on stock demographics. There are substantial mortality events that need explored, along with estimates of discard mortality and examinations of whether current stock recruitment is overfished.

There are also a number of administrative tasks that would be helpful as there is no formal reporting of annual stock assessments and fishery evaluations and assessments of economic performance of the fishery are lacking.

Review/Respond to SSC comments

2016 SSC comments:

Comment 1: The SSC appreciates the reasoning for a moratorium on aging during the 2016/17 season while aging protocols are being worked out. However, **the SSC recommends collecting specimens for aging in 2016/17** for subsequent aging once the protocols are developed.

Response: Aging specimens are being collected during the moratorium from survey-caught scallops as well as fishery dependent sampling.

Comment 2: Development of an aging protocol should be a high priority. Ideally, this work should include an age validation study confirming that rings are formed annually and a study of precision of age estimates among readers. An outcome could be that an age determination is precise up to some age beyond which age estimates become imprecise. If so, the aging protocol might specify to stop counting once some maximum count is attained after which a plus group is formed. Such a stopping point for age determinations could speed up, and reduce the costs of, processing of specimens, yet still provide valuable data for development of age-structured assessment models.

Response: The aging protocol is currently being finalized. Methods for characterizing precision among readers are part of that protocol. Age validation, using O18 and a benthic temperature model, has been added to the Scallop Plan Team's suggested research priorities.

Comment 3: The SSC had been looking forward to development of an age-structured stock assessment for Kamishak Bay scallops for many years and was disappointed to hear that ADF&G staffing issues have prevented progress. In addition to direct application to fishery management, experience with age-structured scallop assessments will become even more important as the statewide scallop assessment program becomes operational. Given the lack of progress and ongoing agency staffing issues, a graduate student research project may be a practical approach to develop and implement such a model.

Response: The ADF&G is in the process of hiring a Biometrician II. Once on board, the new hire will be responsible for advancing the age-structured assessment model for scallops. Quite a bit of work needs to be done on the model, which will have to be robust to highly variable M, including major die-off events, as well as highly variable size-at-age..

Comment 4: With regard to the SSC's 2015 Comment 1, the SSC appreciates plans to collect new observer data on meat weight, shell height, and discards. However, the other part of the SSC's comment was for the Scallop Plan Team to consider the potential merits of estimating CPUE based on numbers of retained scallops in the catch rather than based on meat weight. Also along these lines, during the Scallop Plan Team meeting, Jim Stone asked about the potential to **manage scallops based on number of animals harvested rather than pounds of shucked meats**. The SSC encourages the Scallop Plan Team to explore this possibility in the future. The SSC looks forward to more complete responses to some of the SSC's other previous comments after results from the data-limited symposium become published.

Response: At the 2017 SPT meeting, Ben Williams presented on sampling round weight vs. meat weight and numbers. The relationship between meat weight and round weight varies within and across months, however, round weight is directly convertible to N. Additionally, measuring round weight is far more practical than counting each scallop that comes aboard, especially a commercial vessel. Catch per unit effort is now presented in both round-weight and meat-weight, as well as in both standardized and unstandardized forms in the 2017 SAFE. Alaska Department of Fish and Game staff intends to continue to collect whole weight vs meat weight data in both the preseason survey and observer program in order to build a robust data set for examining the best way to back calculate from meat weight to whole weight. As to the data-limited workshop, the event - a joint meeting of the crab and scallop plan teams - never took place, as it was awaiting the publication of the Lowell-Wakefield Proceedings.

Comment 5: The SSC appreciates short summaries of recent and ongoing research reported in the Appendices. These Appendices should be cited in the body of the SAFE document so that the reader is aware of them. The Appendices included an exploratory analysis of relationships between fishery CPUE and scallop abundance estimates from dredge surveys. In many cases, fishery CPUE tracked trends in survey abundances fairly well with some exceptions (e.g., negative correlation for Kayak Island east). **The SSC looks forward to more thorough analyses of these relationships including data from planned survey expansions in the future. Understanding such relationships could improve the use of survey and fishery data in fishery management. The SSC also looks forward to further development of the discard mortality rates introduced in the Appendices.**

Response: The SPT discussed the issue of plotting survey and fishery CPUE together for consideration of correspondence between the two. This can be done for the Central District, for which there are uninterrupted time series. A pilot study was conducted by ADF&G on discard mortality. The SPT will look into the results and prepare a summary. The existing assumed discard mortality is 20% and informal reports from the pilot study suggest much lower mortality.

Comment 6: The SSC appreciates revisions to **research recommendations** undertaken by the Scallop Plan Team. The SSC offers a few additions. First, development of a statewide survey program elevates the need to estimate survey catchability, which may vary among areas with bottom type and other factors. Second, as scallop fisheries in many areas suffer from declining CPUE, the SSC feels that research into metapopulation structure should be a priority to

understand the degree of connectedness among scallop beds. Next generation genetic tools should be brought to bear on this question.

Response: These research priorities were added to the Council’s research priorities during their June 2016 review. As a result of SPT discussion at their 2017 meeting, the first suggestion was retained, but the second and third suggestion were observed to overlap with an existing research priority (see below).

Comment 7: Future SAFE documents would be improved with the addition of the following: (1) a section that highlights new information since the last SAFE report, (2) expansion of the Executive Summary to include OFL and ABC recommendations, (3) a list of tables and figures in the SAFE, and (4) historical catches that show the derivation of MSY estimates.

Response: These recommendations have been incorporated into the current SAFE.

Comment 8: The SSC requests some clarifications in next year’s SAFE. On the top of p. 4, please clarify that no vessels have fished to date in the state waters open access fishery. On p. 16, please indicate the catchability coefficient that is used to calculate abundance from dredge surveys. On the bottom of p. 39, weights are given in round weights. Please equate these to meat weights for comparison. In particular, how does a round weight of 205,950 lb relate to the 15,000 lb GH (meat weight)?

Response: These recommendations have been incorporated into the current SAFE.

Comment 9: There are a number of typos in the SAFE. For example, Figure 1-1 appears twice on p. 5 and there are two versions of Figure 1-7 on p. 17 and p. 20. The paragraph in the middle of p. 5 begins with an incomplete sentence, the last sentence on p. 16 is incomplete, the figure caption on p. 17 is missing, and Table 2-2 and 1-1 cited in the middle of p. 51 should be Table 1-2 and 1-3. There are other typos.

Response: These recommendations have been incorporated into the current SAFE.

Research Priorities (Armstrong)

An overview of the Council’s revisions to its terminology associated with research priorities was reviewed, followed by a review of existing, including new SSC-suggested, research projects. The table on the following pages comprises the modified research priorities identified by the Plan Team.

Research ID	Title	Description	Council/SSC Priority	Plan Team	Research Status
166	Estimate scallop stock abundance	Estimate scallop stock abundance in unsurveyed areas using fishery independent methods including analysis of current camera sled data.	Urgent	Strategic	Partially underway
171	Acquire basic life history information (e.g., natural mortality, growth, size at maturity) for data-poor stocks	Basic life history information is needed for stock assessment and management of data-poor stocks, such as scallops, sharks, skates, sculpins, octopus, grenadiers, squid, and blue king crab (Bering Sea), golden king crabs (Aleutian Islands), and red king crab (Norton Sound). Specifically, information is needed on natural mortality, growth rates, size at maturity, and other basic indicators of stock production/productivity.	Urgent	Important	Partially underway
173	Expand studies to identify stock and management boundaries	To identify and refine stock boundaries and understand source/sink dynamics (e.g., scallop metapopulations). Conduct studies to evaluate all crab stock boundaries relative to management boundaries (e.g, Bristol Bay red king crab, Adak red king crab, Pribilof blue king crab). Expanded studies are needed in the areas of genetics, mark-recapture, reproductive biology, larval distribution, and advection. Such boundaries are to be evaluated so that the risks and consequences of management actions are clear.	Urgent	Urgent	Partially underway
175	Develop age-structured models for scallop assessment	Age structured models for scallops are needed to increase understanding of population dynamics and harvestable surpluses.	Strategic	Important	Partially underway

Research ID	Title	Description	Council/SSC Priority	Plan Team	Research Status
207	Analyses of fishery effort and observer data for scallops	Potential for standardization of CPUE data. Evaluate factors contributing to variable CPUE.	Urgent	Urgent	Underway
223	Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios to assess impacts to recruitment, growth, and spatial distributions.	Quantify the effects of historical climate variability and climate change on recruitment, growth, and spatial distribution. Develop standard environmental scenarios (e.g., from GCMs) for present and future variability based on observed patterns.	Strategic	Strategic	Partially underway
224	Climate and oceanographic information covering a wider range of seasons	There is a need for climate and oceanographic information that covers a wider range of seasons than is presently available.	Strategic	Strategic	Partially underway
251	Modeling studies of ecosystem productivity	Modeling studies of ecosystem productivity in different regions (EBS, GOA, and AI). For example, studies could evaluate the appropriateness of the 2 million t OY cap.	Important	Strategic	Underway
361	Effects of Ocean Acidification on Scallops	Laboratory studies are needed to understand the mineralization of scallop shells through their life cycle and under current spatial variability and future scenarios of ocean acidification.	Strategic	Urgent	No action
362	Monitoring potential water quality impacts	Seasonal water quality monitoring in known scallop areas are needed to determine whether conditions are detrimental to scallop growth and survival.	Important	Important	No action
363	Area-specific variability in scallop population processes	Investigate area-specific variability in vital population processes including growth, recruitment, natural mortality and movement including mark-recapture tagging studies. Bed-specific growth could be analyzed from archived shells.	Important	Important	Partially underway

Research ID	Title	Description	Council/SSC Priority	Plan Team	Research Status
367	Continue to improve stock assessment methodology with respect to uncertainty	Recent studies have made advances in determining effective sample size, effective number of parameters, Bayesian parameterizations, and how to weight datasets in assessments with multiple datasets. However, results appear to vary from paper to paper, and no general rules have emerged. Thus, our ability to characterize uncertainty remains elusive.	Urgent	Strategic	No action
472	Evaluate causes of variable meat size, undersized meats in scallops	1) Exploratory tows in the Bering Sea (District Q) and some areas open to harvest around Yakutat (District D) have shown scallops with disproportionately small meats relative to shell height. The cause of this condition as well as potential for recovery is unknown to industry. 2) Samples from Bering Sea scallops with weak meats were collected and sent to the ADF&G Anchorage Pathology Lab for analysis of any evidence of diseases and/or parasites. The results showed that the scallops were infected with an apicomplexan-like parasite. To further evaluate the geographic extent and infection rates of this parasite, a sampling effort was initiated in July 2015 to collect samples from select locations across the state, from Yakutat to the Bering Sea.	Important	Important	Partially underway
511	Computerized image analysis of current camera sled data	Assessment of existing database of cam sled images is needed to provide scallop counts and sizes, contributing to abundance estimates. Additionally, sediment and habitat type and presence of other organisms can be assessed.	Urgent	Urgent	Underway
513	Evaluate extent and importance of parasites in scallop populations		Important	Important	Partially underway
551	Estimate scallop survey catchability	Catchability of scallops in the fishery independent survey is needed to generate abundance estimates of scallops. Currently the survey provides only CPUE data.	Urgent	Critical Ongoing Monitoring	No action

Research ID	Title	Description	Council/SSC Priority	Plan Team	Research Status
552	Expand statewide scallop survey	The State of Alaska fishery independent dredge survey has been conducted in a limited number of known beds. Expansion of the survey beyond the edges of known beds into previously un-surveyed areas will improve knowledge of bed size and true scallop distribution.	Critical Ongoing Monitoring	Critical Ongoing Monitoring	Underway
553	Population structure of scallops	Currently scallop beds are monitored independently. Knowledge of source/sink dynamics and meta-populations processes will improve the ability to manage weathervane scallops at the stock level.	Important	Important	No action
New	Age validation for scallop shells	The combination of O18 (an oxygen isotope) analysis and a benthic temperature model can be used to validate that the bands in cross sections of scallop shells are indeed annuli and can be used to determine scallop age. This method is less time consuming than other methods that require mark and recapture of scallops.	Pending	Important	No action

Next SPT Meeting (2018)

The 2018 Scallop Plan team meeting will be held in Kodiak on February 21st in Kodiak at the ADF&G Office.

Scallop Plan Team Meeting Agenda

February 22, 2017
Fishermen's Hall
Kodiak, AK

9:00 am

- Introductions and approval of agenda, schedule for SAFE compilation / minutes assignments (Smith)

9:15 am

- Status of Statewide Scallop Stocks and SAFE report-Catch specifications by area
 - Southeast (Smith)
 - Central Region (Byerly)
 - Westward Region (Nichols)

10:00 am

- Monitoring ocean acidification and its potential effect on the scallop stocks (Foy)

10:45-11:00 am

- Break

11:00-11:15

- Update on scallop parasite studies (Burt)

11:15-12:30

- Progress on new scallop assessment program (Williams & Smith)
 - Fishery Independent
 - Fleet based sampling

12:30-1:30pm Lunch

1:30 pm

- Alternative data-poor methods for scallop management (Kruse)

2:30 pm

- Review/respond to SSC comments
- Research Needs
 - Research priorities: review and revise (Armstrong)
 - Potential for additional analyses on MSY
- New business
 - SPT meeting for 2018

Adjourn