Draft SSC Report
December 2021

GOA ESR and Groundfish Specifications

C4 Gulf of Alaska Ecosystem Status Report (1 of 8)

Noteworthy Topics

- There was a mid-July die-off of kittiwakes and gulls on Middleton Island. Tests for avian influenza and products of harmful algal blooms (saxitoxin and domoic acid) were negative, but tests for *Clostridia botulinum* and botulism toxin type C were positive. It is likely, but not yet confirmed, that these birds ingested Clostridia organisms while bathing in a small freshwater pond on Middleton Island.
- Observations of four unique North Pacific Right Whales along the shelf southeast of Kodiak Island (Albatross Bank, with two near Barnabas Trough, and two near the Trinity Islands).
- The SSC *recommends* that the GOA fishing fleets be made aware of where these whales were sighted and requested to do their best to avoid harming them.

C4 Gulf of Alaska Ecosystem Status Report (2 of 8)

Noteworthy Topics (cont.)

- Key metrics of stability in the groundfish community, including high total biomass, low average biomass, variability over time, high species richness and diversity, and stable (eastern GOA) or slightly increasing (western GOA) mean length and lifespan of groundfish, point to overall high stability and resilience in the GOA (represented by species regularly caught by the AFSC bottom trawl survey).
- The SSC *notes* that while this is a promising key message of stability for groundfish (in bottom trawl) to perturbations, it will be important to keep in mind the overall stability/resilience of the ecosystem.

C4 Gulf of Alaska Ecosystem Status Report (3 of 8)

Western GOA Synthesis - Climate

- Ocean temperatures cooled in both winter 2020-2021 and summer 2021
  - Cooling occurred both in the surface and at depth
- Westerly winds in spring and summer 2021 created upwelling-favorable condition
- Strong, persistent eddies were present at the shelf edge near Seward and Kodiak
- Downwelling favorable winds in Shelikoff Strait likely aided the retention of pollock larvae
- In sum, it appears that the western GOA physical system is returning to a more normal state after the heatwaves of 2014-2016 and 2019.

C4 Gulf of Alaska Ecosystem Status Report (4 of 8)

Western GOA Synthesis - Biology

- Spring phytoplankton bloom early, but biomass was below average
- Around Kodiak Is. Large copepods were in low abundance- more characteristic of warm conditions
- The abundance of large copepods was average to above average in the large phytoplankton bloom on the Seward Line
- Capelin, a cold-water forage fish has remained depleted since 2014, as have eulachon

C4 Gulf of Alaska Ecosystem Status Report (5 of 8)

Western GOA Synthesis - Biology (cont.)

- Herring and sand lance, which prefer warmer waters, were locally abundant
- Age-1 pollock were locally abundant
- Pacific cod condition near Kodiak was above the long-term mean in 2021, but the condition of many other species remained below
- Piscivorous seabirds had average to above average reproductive success (glaucous-winged gull, common murres, and tufted puffins on Chowiet Is.

C4 Gulf of Alaska Ecosystem Status Report (6 of 8)

Eastern GOA Synthesis - Climate and Biology

- SSTs were near average to above average
- Temperatures at 200 m were above average
- Chlorophyll-a concentrations were below average, as has been the case for the past 6 years
- Zooplankton density in Icy Strait increased from 2020
  - Euphausiid and small copepod numbers were up
  - Reproductive success of planktivorous seabirds on St Lazaria Is. was low, suggesting that large crustacean zooplankton may have been scarce in shelf and slope waters

C4 Gulf of Alaska Ecosystem Status Report (7 of 8)

Eastern GOA Synthesis - Climate and Biology (cont.)

- Forage fish biomass, particularly Pacific herring, continue to increase
- Juvenile salmon in Icy Strait had above average energy density, but were below average in numbers
- Returns of salmon, other than pink salmon were low, with sockeye returns to Auke Creek the 10th lowest on record

C4 Gulf of Alaska Ecosystem Status Report (8 of 8)

Prince William Sound Synthesis

- Ocean temperatures there returned to normal after the 2014-2016 and 2019 heat waves.
- The stock of Pacific Herring in the Sound has increased
- Humpbacked whale numbers remain low
- Intertidal algae abundances remained low
- Mussels (plankton feeders) were near or above long-term mean abundances

C4 GOA Groundfish Harvest Specifications

Walleye pollock (1 of 3)

- Full assessment, updated with new data fishery (2020 catch-at-age) and survey data (NMFS and ADF&G bottom trawl surveys, Shelikof Strait and summer acoustic surveys). No model changes.
- Recent trends are relatively consistent across 3 of 4 surveys, suggesting an increase in biomass from last year.
- Projected 2022 female spawning biomass is 8.4% above $B_{40\%}$.
- The stock is in Tier 3a
- The SSC *supports* continued use of Model 19.1, in agreement with authors and plan team, for setting OFLs (2022 OFL = 170,133t) and ABCs
- The SSC *supports* the author and PT determination that no additional reduction from maxABCs (2022 ABC = 144,444t) is needed based on the risk table (level 1)

C4 GOA Groundfish Harvest Specifications

Walleye pollock (2 of 3)

- The SSC *recommends* prioritizing research on any model components that affect the scale of the population estimates
  - In particular catchability, survey selectivity and data weighting issues
- The SSC *supports* the Plan Team recommendation to investigate alternative methodologies for projecting weight-at-age and notes that this is an issue across all age-structured assessments that could benefit from additional guidance to assessment authors.

C4 GOA Groundfish Harvest Specifications

Walleye pollock (3 of 3)

- The SSC *supports* the Tier 5 assessment for Southeast Alaska pollock using the random effects model and the resulting OFL and ABC
- The SSC *recommends* that the authors and Plan Team re-evaluate whether assessing the Southeast Alaska pollock as a separate stock is justified or whether available data support a single, gulf-wide stock assessment

C4 GOA Groundfish Harvest Specifications

Pacific cod (1 of 2)

- Three model alternatives with updated data
- Recent trends show modest improvement from 2019 and 2020.
- Author recommended new model with new environmental linkages for growth, natural mortality and recruitment and age-0 beach seine index
- The SSC *recommends* the base model (19.0) rather than the author PT recommended model because:
  - Beach seine index had minimal impact on recruitment estimation
  - Not all growth links were significant
- Projected 2022 female spawning biomass is at $B_{29\%}$
- The stock is in Tier 3b; 2022 OFL = 39,555t

C4 GOA Groundfish Harvest Specifications

Pacific cod (2 of 2)

- The SSC *supports* the author and PT determination that no additional reduction from maxABCs (2022 ABC = 32,811t) is needed based on the risk table
- The SSC *commends* the authors efforts toward ecosystem enhanced stock assessment models
- The SSC *recommends* carefully evaluating environmental linkages and including only those that clearly improve the model
  - In particular evaluation of the value of the age-0 beach seine index
  - Use the ESP to track and evaluate potential covariates before operational model
- The SSC *recommends* the standard apportionment method, but encourages exploration of adding other indices (IPHC and AFSC LL)

C4 GOA Groundfish Harvest Specifications

Northern/Southern Rock Sole (1 of 3)

- Full assessment; four-year assessment cycle (next assessment in 2025); combined with shallow water flatfish for harvest specifications
- Evidence of differences in growth for both species within the GOA
- The SSC *recommends* Model 21.2 for northern rock sole and 21.1 for southern rock sole, in agreement with the authors and GOA PT
  - Two-area model allows for separate estimation of growth by area, improvement to survey biomass fits in recent years
  - Spawning stock biomass estimated to be above B35%
  - Results place both species in Tier 3a

C4 GOA Groundfish Harvest Specifications

Northern/Southern Rock Sole (2 of 3)

- The SSC *recommends* the use of maxABC for both species, in agreement with authors and GOA PT
- The split area growth models presented in Sept/Oct were not viable. Subsequently a coding error was corrected making these models viable. The SSC *reiterates* its policy of trying to limit models that come forward in December that have not had the full benefit of the entire review process. The detailed description of the model performance allowed the SSC to support the use of these models.
- The SSC *supports* the author's list of planned investigations

C4 GOA Groundfish Harvest Specifications

Northern/Southern Rock Sole (3 of 3)

- Additional recommendations:
- Investigate using observer data to evaluate the current 50/50 split assumption between northern and southern rock sole catch
- Data weighting should continue to be explored
- Review available biological information:
  - Movement, recruitment between areas, and potential mechanisms of spatially defined differential growth
- Multiple flatfish stocks appear to have area-specific growth and demographic characteristics. Future research should take a comprehensive view, across species, on demographic and biological mechanisms.

C4 GOA Groundfish Harvest Specifications

Other Shallow-water flatfish (1 of 2)

- Full assessment, decline in biomass since 2001, but up 1% in 2021
  - decline Alaska plaice butter sole, starry flounder, yellowfin sole
  - increase English sole, sand sole

- Tier 5, catch is well below ABC
- The SSC *recommends* random effects model in agreement with authors and PT
  - Accepted model from last full assessment (2017), continues to perform well

C4 GOA Groundfish Harvest Specifications

Other Shallow-water flatfish and Complex (2 of 2)

- ABC = maxABC
- The SSC *noted* English sole (more southern species) increasing abundance and catch, while yellowfin sole (more northern species) decreasing
- The SSC *appreciates* examination of multiple species in risk table for well-rounded evaluation for stock complex

- **The SSC accepts the author and Plan Team recommendations for OFLs and ABCs for the Shallow water complex (including northern/southern rock sole); 2022 OFL = 62,273t, maxABC = 50,610t**

C4 GOA Groundfish Harvest Specifications

Deepwater Flatfish Complex (1 of 1)

- Partial assessment; 4-year cycle; last fully assessed in 2019
- Includes: Dover sole (Tier 3), Greenland turbot (Tier 6), Deepsea sole (Tier 6), and Kamchatka flounder (Tier 6; new addition to complex)
- Dover sole and Kamchatka flounder survey biomass decreased slightly from 2019
- Deepsea sole survey biomass increased since 2019, and Greenland turbot was not encountered
- The SSC *concurs* with the complex-level harvest specifications and the use of maxABC, and area apportionments in agreement with the authors and GOA PT
    - 2022 OFL = 7,026t, maxABC = 5,908t

C4 GOA Groundfish Harvest Specifications

Rex sole (1 of 2)

- Full assessment, total biomass and SSB increasing
- SSB small increase, above $B_{35\%}$ entire time series
- Tier 3a
- The SSC *recommends* Model 21.0 in agreement with authors and PT
  - Francis methods for data weighting; removed 1984 and 1987 survey data; and catchability was estimated using a normal prior with mean 1.2 and standard deviation of 0.175
  - Better fits to survey biomass indices and acknowledges more uncertainty
  - The SSC *accepts* the author and Plan Team estimates of OFL. 2022 OFL = 23,302t

C4 GOA Groundfish Harvest Specifications

Rex sole (2 of 2)

- The SSC *accepts* the author and Plan Team proposed ABCs.
  - 2022 ABC = maxABC (19,141t)
- The SSC *endorses* authors' intent to develop ageing error matrix (2017 SSC recommendation)
- The SSC *supports* further exploration of natural mortality rates and updated maturity-at-age information
- The SSC *supports* research into mechanisms (genetic, environmental) behind differences in growth between areas
- The SSC *recommends* exploration of mechanisms of different growth patterns between areas done in broader context (i.e. other flatfish species with/without similar pattern)

C4 GOA Groundfish Harvest Specifications

Arrowtooth Flounder (1 of 3)

- Full Assessment
  - Stock is in Tier 3a, with the 2022 projected female spawning stock biomass well above B40%
  - Female spawning biomass has been in decline since the high levels observed in the 2000's; however, trawl survey indices have been stable/slightly increasing since 2017
- The SSC *concurs* with GPT and author model recommended model, OFLs and ABCs.
  - 2022 OFL = 143,100t
  - Risk level 1 for all categories
  - SSC *recommends* that no reduction be taken from maxABC (2022 ABC = 119,779t)

C4 GOA Groundfish Harvest Specifications

Arrowtooth Flounder (2 of 3)

- The SSC supports the author's and GPT recommended future work
  - Investigate the lack of fit in female survey age and fishery length compositions, including interactions between female natural mortality and selectivity
  - Consider incorporating estimates of predation mortality from the CEATTLE model
  - Re-examine growth assumptions, update age-length conversion matrices, and consider alternative surveys and VAST estimates.
  - Investigate use of AFSC and the IPHC survey in future assessments. SSC requested the author's also consider hook competition in this evaluation.

C4 GOA Groundfish Harvest Specifications

Arrowtooth Flounder (3 of 3)

- SSC requested the authors explore whether the current 5-year averaging method for end-of year catch projections are adequate given changes in harvest by the trawl fishery

C4 GOA Groundfish Harvest Specifications

Flathead sole (1 of 1)

- Partial; full assessment delayed until 2022; survey biomass decreasing in WGOA, increasing slightly in central and eastern GOA
- Projected SSB well above B35%
- Tier 3a
- The SSC *recommends* projected harvest specifications and use of maxABC, in agreement with the authors and PT
    - 2022 OFL = 48,928t, maxABC = 40,175t
- The SSC *accepts* the PT and author recommended area apportionments based on update survey data
- The SSC *concurs* with PT recommendations to limit updating area apportionments to years with full assessments in the future

C4 GOA Groundfish Harvest Specifications

Pacific Ocean Perch (1 of 3)

- Updated version of off cycle full assessment in preparation for 2021 CIE review.
- Female spawning biomass for 2022 is estimated at 216,635 t down 2% from the estimated 2021 biomass of 222,301 t.
- The 2022 biomass is still above the B40% value of 132,767 t.
- Tier 3a, Risk Table 2. Total reported catches well below ABC.
- The SSC *recommends* model 20.1 and OFLs in agreement with authors and PT.
    - 2022 OFL = 45,580t
- The SSC reviewed and accepted model changes in December 2020. The 2020 model 20.1 includes a revised aging error matrix, updated fishery age compositions and a prior on trawl survey catchability and natural mortality. In 2021, the authors did not make any substantial changes to the assessment model.

C4 GOA Groundfish Harvest Specifications

Pacific Ocean Perch (2 of 3)

- The SSC *accepts* the author and Plan Team recommended ABCs (2022 = maxABC (38,268t)
  - A substantial retrospective pattern exists in the assessment with consistent under estimation of the biomass. While this retrospective pattern is of concern and should be addressed, recognizing the consistent under estimation there is no need to reduce the ABC below the maxABC.

C4 Groundfish Harvest Specifications

Pacific Ocean Perch (3 of 3)

- The SSC *recommends* addressing the review comments provided by the CIE to examine following the proposed timeline:
  - 1) the feasibility of incorporating hydroacoustic information into the assessment;
  - 2) the sensitivity of the model to changes in catchability and selectivity;
  - 3) the quality and utility of the VAST model for POP abundance and apportionment;
  - 4) data weighting for compositional data,
  - 5) the current plus age group level; and
  - 6) how fishery-dependent ages are being collected.

C4 GOA Groundfish Harvest Specifications

Northern rockfish (1 of 1)

- Partial assessment; 2021 survey biomass estimates sharply declined from 2019 and were below the long-term mean; time series is highly variable
- Projected SSB above B35%
- Tier 3a
- The SSC *recommends* the projected harvest specifications, use of maxABC and area apportionments in agreement with the authors and PT
    - 2022 OFL = 6,143t, maxABC = 5,146t
- The SSC *supports* the authors exploration of alternative length and age bin structures and alternative data weighting methods for the next assessment

C4 GOA Groundfish Harvest Specifications

Rougheye and Blackspotted Rockfish (1 of 2)

- Full assessment, trawl survey biomass declined 56% and longline survey declined 36% from 2019 survey
- The SSC *concurs* with the continued use of model 15.4, which places RE/BS in Tier 3a, and current area apportionment.
- The SSC *supports* the authors' and PT's recommended OFLs and ABCs for 2022 and 2023 and no reduction from maxABC
    - 2022 OFL = 947t, maxABC = 788t

C4 GOA Groundfish Harvest Specifications

Rougheye and Blackspotted Rockfish (2 of 2)

- The SSC *recommends* estimate survey indices using the same depth strata definitions and to examine weighting CPUE by a variable other than total geographic area (e.g. EFH).
- The SSC *notes* that if the current trend in retrospective bias continues the author will need to revisit risk table ranks and reassess whether a reduction from max ABC is necessary.

C4 GOA Groundfish Harvest Specifications

Dusky rockfish (1 of 1)

- Partial; survey biomass increasing and above long-term mean
- Projected SSB above B35%
- Tier 3a
- The SSC *accepts* the author and PT recommended harvest specifications and area apportionments
- The SSC *accepts* the stair-step ABC reduction for 2022 and 2023 (~23% reduction), as first recommended by the SSC in 2020, in agreement with the authors and PT
    - 2022 OFL = 8,614, ABC = 5,372t
- The SSC *supports* revisiting the stair-step reduction approach at the next full assessment

C4 GOA Groundfish Harvest Specifications

Shortraker rockfish (1 of 2)

- Full assessment; biennial schedule
- GOA trawl survey biomass decreased 39% and LL survey RPW increased by 29% in 2021; both were within the range of estimates over the last decade and stable population trend
- Catch decreasing since 2018
- Tier 5
- The SSC *supports* the random effects (RE) model applied to both the trawl and longline survey as recommended by the PT and authors.
  - Support PT and author OFL and ABC (no reduction from maxABC)
  - 2022 and 2023 OFLs = 940t, maxABCs = 705t
  - Support apportionment based on RE model

C3 GOA Groundfish Harvest Specifications

Shortraker rockfish (2 of 2)

- The SSC *notes* that discard rates for fixed gear under full retention mandates remain high and an overall review is pending to determine how well this new regulation has been implemented and communicated with industry.
- The SSC *recommends* authors re-examine natural mortality estimate
- The SSC *suggests* shortraker is good candidate to for PT to examine when developing best practices for data weighting

C4 GOA Groundfish Harvest Specifications

Demersal Shelf Rockfish (1 of 3)

- Full assessment with another planned for 2022 (on two year cycle in even years). The estimated yelloweye rockfish biomass increased from 15,800 t to 17,273 t from 2021 to 2022, a 9% increase.
- Yelloweye rockfish is the largest component of the DSR complex managed using the Tier 4 harvest rule. The ABC and OFL for non-yelloweye DSR (canary, China, copper, quillback, rosethorn, and tiger rockfish) use the Tier 6 harvest rule. Tier 6 ABC and OFL are added to the Tier 4 values for yelloweye to determine the DSR complex ABC and OFL.
- The SSC recommends the ROV survey density estimate with habitat area-based expansion in agreement with authors and PT.
- Currently only available method given low abundance and challenging survey methods in rocky habitat.

C4 GOA Groundfish Harvest Specifications

Demersal Shelf Rockfish (2 of 3)

- Historically the lower end of the 90% CI on yelloweye biomass estimates from the assessment have been used for setting the ABC. A buffer was added based on applying F = M = 0.02 rather thant the $F_{40\%}$= 0.026 to derive the ABC.
- The SSC believes that this method for setting the ABC and it's buffer is inconsistent with the current use of risk tables and the Tier-based calculation of $F_{ABC} = F_{40\%}$. This 90% buffer and using an F = 0.02 would have reduced the maxABC for 2022-2023 by 43%.
- The SSC recommends that the OFL and maxABC be estimated using the standard Tier 4 values of $F_{35\%}$ and $F_{40\%}$, applied to the point estimate of biomass.
- The SSC recognizes that this Tier 4 calculation represents a large increase from previous maxABCs and that precaution is still warranted, thus retaining the F=M=0.02 or 22% ABC buffer. This overall approach differs from the authors and PT.
- 2022 and 2023 OFL = 579t, ABC = 365t

C4 GOA Groundfish Harvest Specifications

Demersal Shelf Rockfish (3 of 3)

- The SSC recommends detailed documentation of estimation methods and careful review of the risk tables accounting for Tier classification.

C4 GOA Groundfish Harvest Specifications

Other rockfish complex (1 of 2)

- Full assessment, biomass declined 3% from 2019 survey, Tier 5 species relative abundance shifted toward lower M species
- Tiers 4/5/6, catch below ABC but catch exceeded area ABC for WGOA/CGOA
- The SSC *recommends* Tier 4 and 5 Random Effects model (15.1), Tier 6 max catch 2013-2016 (17.1) in agreement with authors and PT
- However, the SSC *recommends* rolling over specifications from 2021 in agreement with PT
  - 2022 and 2023 OFL = 5,320t
  - Accepted model from last assessment, questions about methodology for Tier 5 OFL calculation and ability of survey to track abundance and species composition

C4 Groundfish Harvest Specifications

Other rockfish complex (2 of 2)

- 2022 and 2023 ABC = maxABC (4,054t)
- The SSC *recommends* several areas of investigation with updates next year
  - Revisit the tier level assignments
  - Re-examining need for area-specific ABCs
  - Incorporate information from 2022 untrawlable ground survey
  - Evaluate weighted M method and alternatives (Tier 5 species)
  - Investigate estimates of catchability
- The SSC *looks forward to* timeline for spatial management analysis

C4 Groundfish Harvest Specifications

Atka Mackerel (1 of 1)

- Full assessment; trawl survey biomass estimates greatly increased in 2021, but fluctuate widely and are not considered reliable estimates
- Annual catches have been well below the ABC for several decades
- Tier 6
- The SSC *agrees* with the authors' continued Tier 6 determination
- The SSC *accepts* the authors' and PT recommended harvest specifications, with no reduction from maxABC
    - 2022 and 2023 OFL = 6,200t, maxABC = 4,700t
- The SSC *requests* that a risk table continue to be included in the next full assessment

C4 GOA Groundfish Harvest Specifications

Skates (1 of 1)

- Full assessment; biennial cycle
- Includes 1) big skate, 2) longnose skate and 3) other skates
- Big skate survey biomass increased and longnose decreased from 2019, but steady over time
- Other skates survey biomass increased from 2019 but generally declined over last decade
- Tier 5 complex; uses multiple random effects models and M = 0.1
- The SSC *concurs* with the Tier 5 harvest specifications and the use of maxABC, in agreement with the authors and GOA PT
- The SSC *concurs* with the GOA PT recommendation to review the natural mortality rate used

C4 GOA Groundfish Harvest Specifications

Octopus (1 of 1)

- Full assessment, biennial
- Complex of seven species for which trawl survey estimates are unreliable (2021 survey estimate was an order of magnitude lower than 2019)
- Tier 6 assessment, maximum catch from 2003–2019
- The SSC *recommends* OFL, ABC (no reduction from maxABC) in agreement with authors and PT
    - 2022 and 2023 OFL = 1,307t, maxABC = 980t