

Gulf of Alaska Shallow-water flatfish

Changes

- Data
 - Catch data updated for 2015 and added for 2016 and to October 1`, 2017.
 - Addition of 2017 survey data
- Assessment
 - Current biomass, splits in ABC by area and species determined using the random effects model.

Current Biomass and ABC splits - Random effects model

- 1. Random effects model run on survey biomass for sum of species excluding rock sole. Rock sole current biomass from the rock sole model.
- 2. Random effects model run by area using survey biomass for all species (including rock sole) to get area split for ABC.
- 3. Random effects model run by species (excluding rock sole) to get split in ABC by species.

Tier 5 except rock sole Tier 3a.

- OFL Biomass $*F$, where $F=M=0.2$ all species except Rock sole
- ABC Biomass $*0.75 *F$ all species except Rock sole

GOA shallow-water flatfish catch was 2,369 t in 2017 (to October 1), lower than the ABC of 44,514 t.

| Stock/ Assemblage | Area | 2017 OFL¹ | ABC¹ | TAC¹ | Catch² | 2018 OFL | ABC | 2019 OFL | ABC |
|------------------------------|--------------|---------------------------------|------------------------|------------------------|--------------------------|---------------------|---------------|---------------------|---------------|
| Shallow water flatfish | W | -- | 20,921 | 13,250 | 259 | -- | 25,206 | -- | 25,54 |
| | C | -- | 19,306 | 19,306 | 2,109 | -- | 25,315 | -- | 25,65 |
| | WYAK | -- | 3,188 | 3,188 | <1 | -- | 2,242 | -- | 2,27 |
| | SEO | -- | 1,099 | 1,099 | <1 | -- | 1,925 | -- | 1,95 |
| | Total | | 54,583 | 44,514 | 36,843 | 2,369 | 67,240 | 54,688 | 68,114 |

Biomass, OFL and ABC increased from last assessment due to increases in biomass and F35% for rock sole and an increase in biomass estimated for other species in the shallow-water complex

| Quantity | As estimated or <i>specified last year for:</i> | | As estimated or <i>recommended this year for:</i> | |
|--|--|----------|--|----------|
| | 2017 | 2018 | 2018 | 2019 |
| <i>M</i> (natural mortality rate) ¹ | 0.2 | 0.2 | 0.2 | 0.2 |
| Tier | 3a and 5 | 3a and 5 | 3a and 5 | 3a and 5 |
| Biomass (t) | 299,858 | 301,047 | 339,152 | 343,018 |
| F_{OFL} | * | * | * | * |
| $maxF_{ABC}$ | * | * | * | * |
| F_{ABC} | * | * | * | * |
| OFL (t) | 54,583 | 54,893 | 67,240 | 68,114 |
| maxABC (t) | 44,514 | 44,770 | 54,688 | 55,422 |
| ABC (t) | 44,514 | 44,770 | 54,688 | 55,422 |
| Status | As determined <i>this year for:</i> | | | |
| | 2015 | 2016 | 2016 | 2017 |
| Overfishing | No | NA | No | NA |

Catch has been declining, however is low compared to ABC. Catch in 2015 was 3,358 t in 2016 3,807 t and 2,369 t to October 1, 2017.

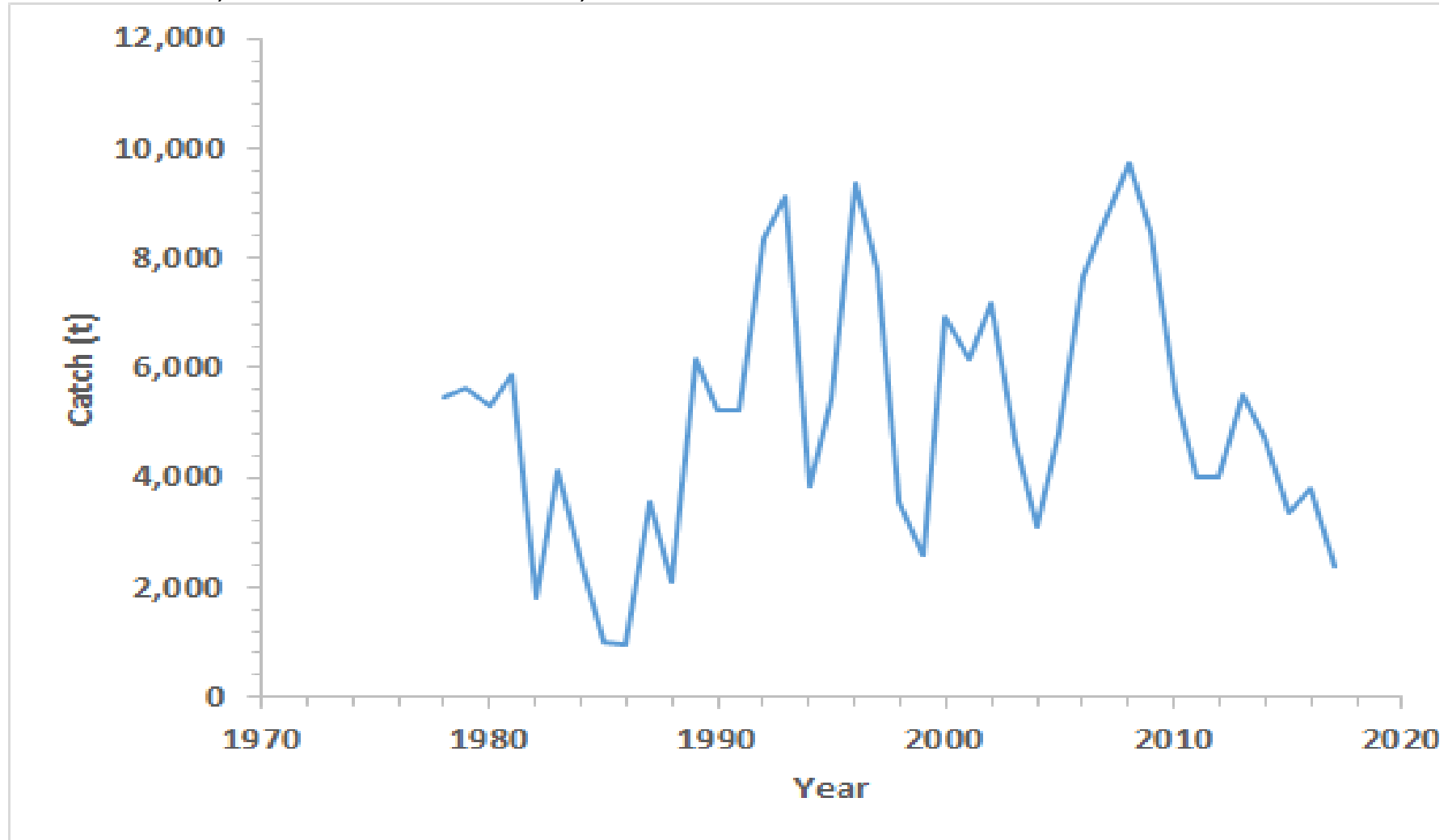


Figure 4.1. Catch (t) of shallow-water flatfish from 1978 to October 1, 2017.

The likelihood equation for the random effects model is,

$$\sum_{i=1}^{yrs} \left\{ 0.5 \left(\log(2\pi\sigma_i^2) + \left(\frac{(\hat{B}_i - B_i)^2}{\sigma_i^2} \right) \right) \right\} + \sum_{t=2}^{yrs} \left\{ 0.5 \left(\log(2\pi\sigma_p^2) + \left(\frac{(\hat{B}_t - \hat{B}_{t-1})^2}{\sigma_p^2} \right) \right) \right\}$$

Where,

B_i is the log of observed biomass in year i ,

\hat{B}_i is the model estimated log biomass in year t ,

σ_i^2 is the variance of observed log biomass in year i ,

σ_p^2 is the variance of the deviations in log survey biomass between years (i.e. process error variance), σ_p^2 was estimated as $e^{(2\lambda)}$, where λ is a parameter estimated in the random effects model and,

Yrs is the number of years of survey biomass values.

Random effects models

- There were 11 random models fit to the shallow-water flatfish survey data.
- 4 models for the area fits for all species including rock sole for the area apportionments
- 6 models for the fits by species to split the ABC by species for comparison to catch
- 1 model for the fit to all species excluding rock sole to get 2017 biomass

GOA shallow-water flatfish biomass (excluding rock sole) increased from 2015 to 2017. Estimated biomass of rock sole from the assessment model increased as well.

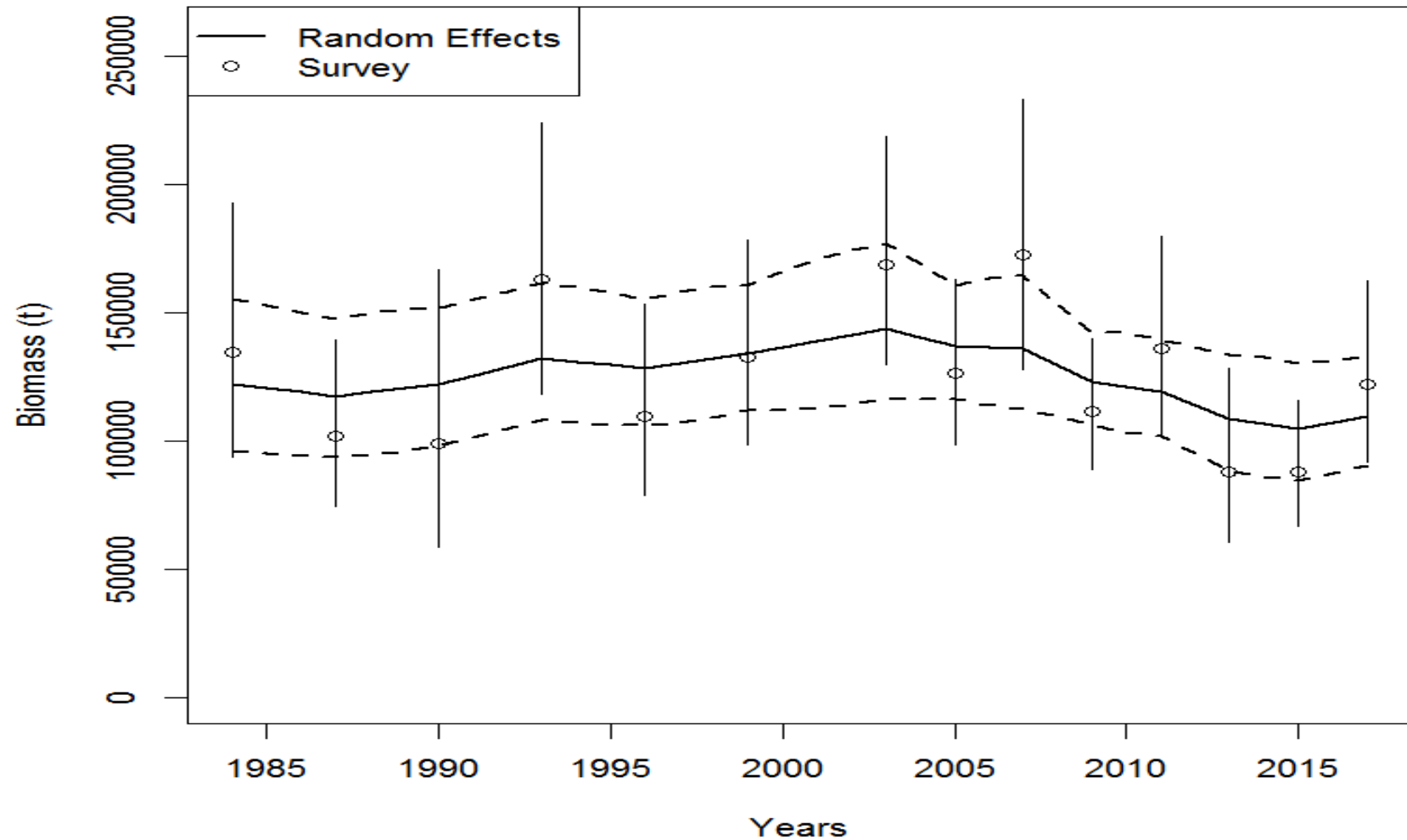


Figure 4.8. Fit of random effects model to shallow-water flatfish survey biomass 1984 to 2017 (excluding Rock sole). Dashed lines are 95% CI.

| | 2016 | 2016 | |
|-----------------|-------|--------|--------|
| Species | Catch | ABC | OFL |
| Rock sole | 3,009 | 31,000 | 36,700 |
| Yellowfin sole | <1 | 4,150 | 5,533 |
| Butter sole | 500 | 2,133 | 2,844 |
| Starry flounder | 62 | 3,597 | 4,796 |
| English sole | 35 | 2,438 | 3,251 |
| Sand sole | <1 | 96 | 129 |
| Alaska plaice | 3 | 950 | 1,267 |
| Total | 3,608 | 44,364 | 54,520 |

Biomass, OFL and ABC increased from last assessment due to increases in biomass and F35% for rock sole and an increase in biomass estimated for other species in the shallow-water complex

| Quantity | As estimated or <i>specified last year for:</i> | | As estimated or <i>recommended this year for:</i> | |
|--|--|----------|--|----------|
| | 2017 | 2018 | 2018 | 2019 |
| <i>M</i> (natural mortality rate) ¹ | 0.2 | 0.2 | 0.2 | 0.2 |
| Tier | 3a and 5 | 3a and 5 | 3a and 5 | 3a and 5 |
| Biomass (t) | 299,858 | 301,047 | 339,152 | 343,018 |
| F_{OFL} | * | * | * | * |
| $maxF_{ABC}$ | * | * | * | * |
| F_{ABC} | * | * | * | * |
| OFL (t) | 54,583 | 54,893 | 67,240 | 68,114 |
| maxABC (t) | 44,514 | 44,770 | 54,688 | 55,422 |
| ABC (t) | 44,514 | 44,770 | 54,688 | 55,422 |
| Status | As determined <i>this year for:</i> | | | |
| | 2015 | 2016 | 2016 | 2017 |
| Overfishing | No | NA | No | NA |