Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

C S A S | **S C C S**

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Research Document 2009/019

Document de recherche 2009/019

Stock Assessment for British Columbia Herring in 2008 and Forecasts of the Potential Catch in 2009

Évaluation des stocks de harengs de la Colombie-Britannique en 2008 et prévisions de prises potentielles en 2009

J. Schweigert[1], L.B. Christensen[1], and V.Haist[2]

[1]Fisheries and Oceans Canada
Science Branch
Pacific Biological Station
Nanaimo, B.C. V9T 6N7

[2]Haist Consulting
1262 Marina Way
Nanoose Bay, B.C. V9P 9C1

ISSN 1499-3848 (Printed / Imprimé)
ISSN 1919-5044 (Online / En ligne)

Canada

Correct citation for this publication:

Schweigert J, Christensen LB, Haist V. 2009. Stock Assessment for British Columbia Herring in 2008 and Forecasts of the Potential Catch in 2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/019. iv + 61 p.

ABSTRACT

Herring stock abundance in British Columbia waters was assessed for 2008 and forecasts were made for 2009 using a slight variation on the herring catch-age model (HCAMv2) adopted last year (HCAM). Assessments were completed for the major stock assessment regions and for the minor stocks in Areas 2W and 27. All available biological data on total harvest spawn deposition, and age and size composition of the spawning runs were used to determine current abundance levels. The 2008 season represented the second year of post-Larocque assessment and again resulted in a reduced data collection program. Reduced biological sample collection occurred in all areas and dive survey coverage was reduced. Additionally, some deep spawning was detected on the west coast of Vancouver Island but was not adequately surveyed. Nevertheless, all available data were included in and summarized from an Access database and utilized in the stock assessment. On a coast-wide basis, herring abundance decreased in 2008. The estimated pre-fishery biomass was 77,500 metric tonnes (t), which represents a 27% decrease, from the 2007 stock level (105,100 t). The recruitment of the 2005-year class in 2008 was generally poor throughout the coast, a result of unusual environmental conditions during the egg to juvenile stage. Abundance decreased slightly in all areas but to a greater extent in the two southern stocks. The stock projections for 2009 indicate reduced abundance in three assessment areas that will not support harvest: Queen Charlotte Islands, west coast of Vancouver Island, and the Central Coast. The estimated harvestable surplus of BC herring in 2009 (20% of the 2009 forecast spawning stock biomass); in the two remaining areas is 3,468 tonnes in the Prince Rupert area and 11,797 tonnes in the Strait of Georgia.

RÉSUMÉ

On a procédé à l’évaluation de l’abondance des stocks de harengs dans les eaux de la Colombie-Britannique en 2008 et à l'établissement de prévisions pour 2009 en utilisant une variante (MPAHv2) du modèle des prises selon l'âge pour le hareng adopté l'an passé (MPAH). Les évaluations ont été menées pour les principales zones d’évaluation des stocks et pour les stocks moins importants des zones 2W et 27. Toutes les données biologiques disponibles sur les prélèvements totaux, la ponte et la composition selon l’âge et la taille des reproducteurs en migration ont été prises en compte pour déterminer les niveaux d’abondance actuels. La saison 2008, qui constitue la deuxième évaluation post-Larocque, a de nouveau été marquée par un programme de collecte de données réduit. La collecte d’échantillons biologiques a été réduite dans toutes les zones, tout comme la couverture des relevés effectués en plongée. En outre, certains reproducteurs ayant été détectés dans les eaux profondes de la côte ouest de l’île de Vancouver n’ont pas fait l’objet d’un relevé adéquat. Toutes les données disponibles ont néanmoins été incluses dans une base de données Access, résumées et utilisées pour l’évaluation des stocks. Pour l'ensemble de la côte, l'abondance du hareng a diminué en 2008. La biomasse d'avant les pêches a été estimée à 77 500 tonnes métriques (t), ce qui représente une diminution de 27 % par rapport au niveau des stocks de 2007 (105 100 t). En 2008, le recrutement de la classe d'âge de 2005 a été globalement médiocre en tous points de la côte, à cause de conditions environnementales exceptionnelles pendant la période allant de la ponte au stade juvénile. L'abondance a diminué légèrement dans toutes les zones, et dans des proportions plus importantes dans les deux stocks du sud. Les projections de stocks pour 2009 indiquent que l’abondance ne pourra soutenir la pêche dans trois zones d’évaluation : les îles de la Reine-Charlotte, la côte ouest de l’île de Vancouver et la côte centrale. L'estimation du surplus de hareng exploitable en Colombie-Britannique en 2009 (20 % de la biomasse prévue du stock reproducteur de 2009) dans les deux autres zones s'établit à 3 468 tonnes pour la zone de Prince Rupert et 11 797 tonnes pour le détroit de Georgie.

INTRODUCTION

The stock assessment for Pacific herring presented here follows on the methodology adopted in 2006 (Haist and Schweigert, 2006) and applies the recently revised and simplified model structure presented in Christensen et al. (2008) also known as the Herring Catch Age Model version 2 (HCAMv2). Full documentation of the model will be published as a Canadian Science Advisory Secretariat (CSAS) research document. The stock assessment and forecasts presented here essentially follow the assessment framework described in Schweigert (2005). In this document, stock assessments are presented for the five major migratory stocks and for the two significant minor stocks.

STOCK CONSIDERATIONS

The stock groupings used for the current assessments are identical to those used since 1993 (Fig. 1.). The Queen Charlotte Islands stock assessment region includes most of Statistical Area 2E, spanning from Cumshewa Inlet in the north to Louscoone Inlet in the south. The Prince Rupert District stock assessment region encompasses Statistical Areas 3 to 5. The Central Coast assessment region separates the major migratory stocks from the minor spawning populations in the mainland inlets. The Central Coast assessment region includes Statistical Area 7 plus Kitasu Bay in Area 6 and Kwakshua Channel in Area 8. The Strait of Georgia stock assessment region includes all of Statistical Areas 14 to 19, 28, and 29, excluding section 293, and Deepwater Bay and Okisollo Channel in Area 13. The west coast of Vancouver Island assessment region encompasses Statistical Areas 23 to 25. The minor stocks include all of Area 27 and Area 2W from Langara Island south to but not including Louscoone Inlet. Haist and Rosenfeld (1988) outline the current geographical stock boundaries.

DATA BASE

The primary data sources for the stock assessments are spawn survey data, commercial catch landing data, and age composition data from biological samples of commercial fishery, pre-fishery charter, and research catches. These data are available in an Access database for the period 1951 to 2008. This time span includes the reduction fishery period to 1968 and the subsequent roe fishery period that began in 1972.

In 2005, the Federal Court of Canada ruled that the DFO can no longer use fish to finance activities related to science and fisheries management (the Larocque decision). In previous years, the sale of fish was used to fund assessment surveys through the Herring Conservation and Research Society, however funding for 2008 activities was provided by DFO. The level of funding provided in 2008 was substantially more than was provided in 2007, but less than had been provided in recent years through the Herring Conservation and Research Society.

Dive surveys were conducted in all major and minor assessment regions with the exception of Area 2W. This area and parts of Area 2E were surveyed using a combination of snorkeling and surface survey techniques. As in earlier years, a few minor spawning beds outside the main assessment areas were surveyed by SCUBA or surface methods in 2008 when resources permitted. Additionally, deeper spawning was again noted in a few locations on the WCVI through raking or spot dives but weather and logistic problems prevented a complete assessment of egg deposition for these locations.

Catch information is obtained from landing slips or monitoring of plant offload data. Historically, landing slip data were summed by fishery season (seasons run from July 1 to June 30). Beginning in the 1997/98 season, roe catch figures are based on verified plant offload weights, a result of the introduction of the individual vessel quota ('pool fishery') system for all fisheries except the Strait of Georgia and Prince Rupert gillnet fisheries which were open fisheries. Beginning in the 1998/99 season, verified plant offload weights are available for all food and roe fisheries coast-wide. The history of catches in the major assessment areas is shown Figure 2.

Beginning with the 2006 assessment, no catch was assumed for the SOK fishery as there is no basis for verifying the harvest removed from the population. Instead, the validated landed weight of SOK product was used to estimate the egg removal from the spawning grounds and these data were converted to tonnes of fish equivalents based on data provided in Shields et al. (1985). These estimates were then added to the estimated spawning biomass for each area over the course of the SOK fishery from 1975 to present.

Age structure data are used in the assessment model. The information from catch samples is used for years when there were commercial fisheries. Pre-fishery charters began in 1975 and these samples are used in addition to samples taken from the catch, particularly in areas with no fisheries, or when catch samples are few in number or not representative of the entire catch. Additional data used in both models are annual estimates of the mean weight-at-age. During the 2007/08 season a total of 218 herring samples (75 roe, 29 food and bait, 90 test fishery, 11 SOK, and 13 research samples) were collected and processed, as compared to 198 in 2007 and 212 in 2006. Note that each sample comprises a bucket of fish, containing in excess of 100 herring. Of the test fishery, roe and SOK samples, none were collected in non-assessment areas, 10 were taken in the Queen Charlotte Islands assessment area (another 3 from Area 2W), 56 in the Prince Rupert area, 17 in the Central Coast, 101 in the Strait of Georgia, and 14 on the west coast of Vancouver Island, plus 13 offshore research samples with another 4 from Area 27. The age composition estimates for each major assessment region for 1951-2008 are presented in Figure 3 and Appendix Tables 1.1-1.5. The age composition for the two minor stocks is presented in Appendix Tables 1.6 and 1.7.

The year of life convention for ageing adopted in the 1991 assessment is used. Fish which were previously named age 3 are now referred to as the 2^+ age class.

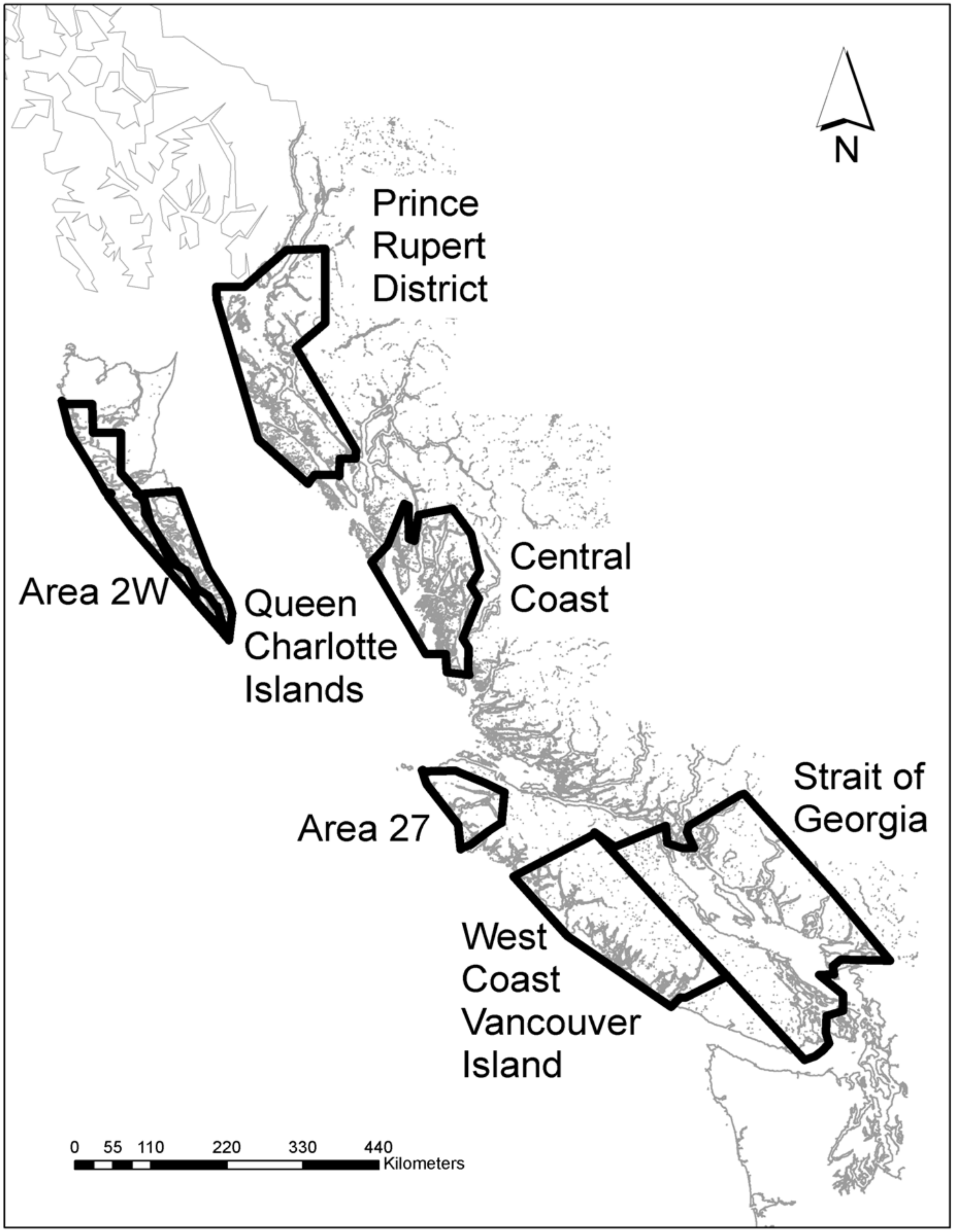


Figure 1. The five major British Columbia herring stock assessment regions: Prince Rupert District (PRD), Queen Charlotte Islands (QCI), Central Coast (CC), west coast Vancouver Island (WCVI), the Strait of Georgia (SOG) and minor stocks in Areas 2W and 27.

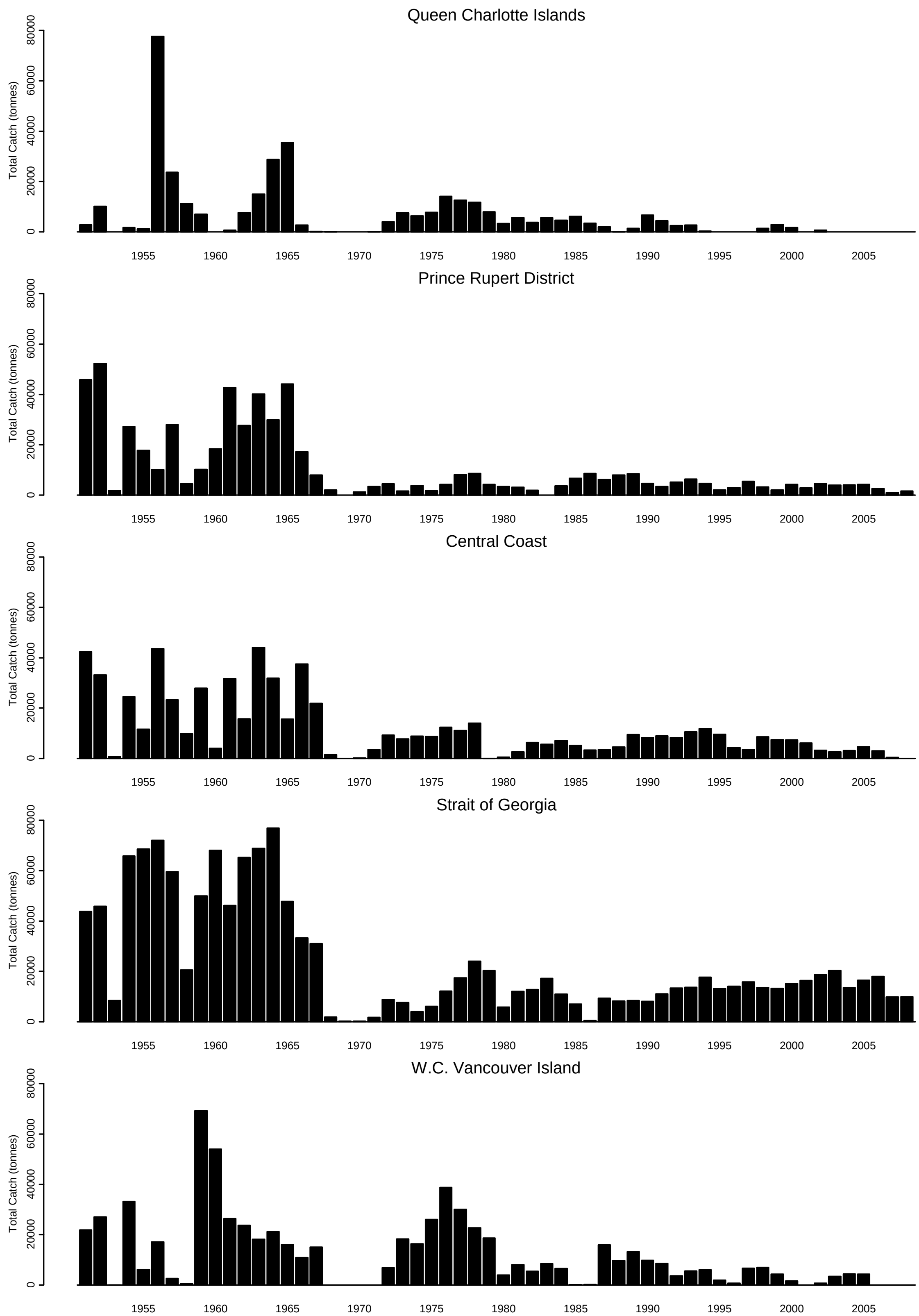
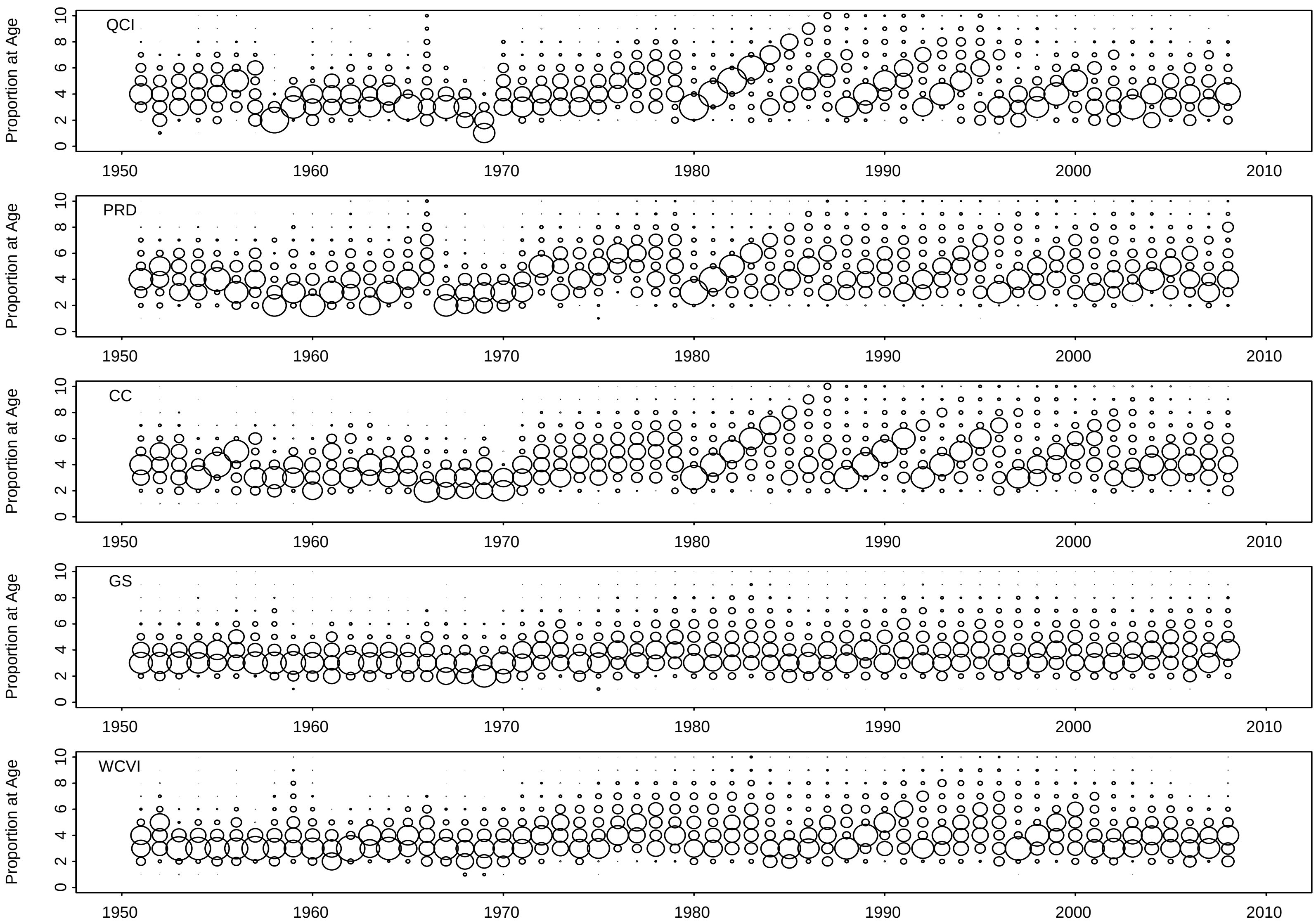


Figure 2. Estimated total catch from all fisheries except spawn-on-kelp for each assessment region from 1951-2008.



.

Figure 3. Bubble plots represent observed age composition for the five major assessment regions from 1951-2008. Biological samples from the test fishery, roe and SOK fisheries (all periods) are combined in these figures. These data are used in the catch-age analysis.

GENERALIZED HERRING CATCH-AGE MODEL

In this section we provide a brief overview of the generalized herring catch-age model (HCAM) and note the changes adopted in HCAMv2 (Christensen et al 2008), including descriptions of the options for population and fishery dynamics and the likelihoods used in fitting the model to data observations. The model is described in detail in Haist and Schweigert (2006).

Model Dynamics

The state, or current status of the populations, partitions the fish by characters that define their distinct status. The possible characters include: age class, sex, maturity (called availability to reflect their being available to fisheries), and stock. Changes in state, or transition processes include: recruitment, natural mortality, fishing mortality, and ageing.

Time steps or fishing periods

The HCAM structure allows for a variable number of time steps (periods) each year, where each time step may have an associated fishery and natural mortality. The HCAMv2 implementation separates the annual herring catch into three categories: a winter fishery; a spawning-season seine fishery (SN); and a spawning-season gillnet fishery (GN).

Selectivity/Availability Options

The model structure allows the distinction of fish that are available to the fishery from those that are not. The separation into available and non-available fish, which is modeled as age-specific, occurs at the beginning of the year. The available fish are subject to both fishing and natural mortality while the unavailable fish are subject to natural morality only.

The model structure in HCAMv2 has been changed to more closely model the fishery and the biology. In HCAMv2, it is assumed that all sexually mature fish are available to the fishery but that not all available fish are selected. Accordingly, a fixed maturity ogive is used to determine available fish and selectivity functions are determined for each of the three fishing periods: fall, spring roe, spring gillnet. A number of options are available for the parameterization of age-specific fishery selectivity. In HCAMv2 logistic selectivity functions are used for all three fisheries, with selectivity modeled as a function of age for the first two fisheries and selectivity modeled as a function of weight for the third (spring GN) fishery. Unlike the version of HCAM used in the past two herring assessments, annual selectivity deviations are not estimated.

Fishery Dynamics and the Catch Equations

The fishery dynamics can be modeled using either the instantaneous (Baranov) form of the catch, equation where fishing and natural mortality occur simultaneously, or a discrete form of the catch equation, where natural mortality occurs prior to fishing. Solution of the catch equations can be done analytically (using an iterative Newton-Raphson algorithm for the instantaneous form) or by estimating parameters that define fully-selected fishing mortality rates. In HCAMv2, we have returned to estimating mortality parameters as this seems to provide a more stable solution.

Natural Mortality

A number of options representing different assumptions about natural mortality rates are available. These include: fixed or estimated values for the constant natural mortality rate; age-dependent natural mortality rates; annual deviations from an average natural mortality rate; and a time-series approach using a "random walk" (Gudmundsson 1994) to parameterize annual changes in natural mortality rates (described in Haist and Schweigert 2006, Appendix A). For HCAMv2 the random walk approach is used to model natural mortality.

Stock-Recruitment Assumptions

A Beverton-Holt type stock-recruitment relationship is implemented in HCAMv2, using the "steepness" parameterization (Mace and Doonan 1988, Francis 1992). Estimated parameters of the stock-recruitment relationship are: the unfished equilibrium biomass level (B_0), the steepness (h), and the fraction of R_0 that is expected at 20% of B_0. The variance of the residuals from the stock-recruitment relationship (σ_r) are fixed at 0.6 for the Central Coast and Strait of Georgia stocks and at 0.8 for the Queen Charlotte Islands, Prince Rupert District and West Coast Vancouver Island stocks.

Initializing the Populations

The populations can be initialized either by estimating parameters for the number of fish in each age-class in the first year of the analysis, or by assuming equilibrium conditions in the first year. Equilibrium conditions can be estimated for populations that are subject only to natural mortality prior to the first year or they can be estimated for populations that are subject to a constant exploitation rate and natural mortality prior to the first year. The previous HCAM implementation initialized the populations in the first year of the analysis (1951) whereas HCAMv2 initializes the population in 1946 using constant natural and fishing mortality.

HCAM models a "plus" age-class, which accumulates all fish of the "plus" age and older.

Ageing Errors

Two options for estimating ageing errors are incorporated into the original HCAM. The first option estimates two vectors for ageing errors – these represent the probabilities at each age of under-ageing fish by one year and the probabilities at each age of over-ageing fish by one year. The second option is based on an ageing error model developed by Francis (2003). The basis of this model is the assumption that for each ring in the ageing structure there is a probability that the ring will not be counted and second a probability that two rings will be counted. Thus, the probability of ageing error increases with age and may be asymmetrical. No ageing error is assumed in the HCAMv2 implementation of the analysis.

Parameter Estimation

HCAM is structured for Bayesian estimation, though by not specifying parameter priors maximum likelihood estimation can be done. HCAM uses the ADMB model package (Otter Research 2000). ADMB allows multi-phase estimation, where initially some parameters are held fixed while the minimization is carried out, then some of the fixed parameters are freed and the minimization carried out, etc. For Bayesian analyses, ADMB uses the MCMC algorithm (Gelman et al. 1995) to estimate the joint posterior probability densities. Posterior densities are based on MCMC chains of length 1 million in this analysis.

Likelihoods

For age composition data, HCAM has two likelihood options: the multinomial distribution and a robust-normal distribution (Fournier et al. 1990, Starr et al. 1999). HCAMv2 uses a multinomial distribution when fitting age composition data.

For fitting the spawn index data, HCAMv2 (and HCAM) uses a lognormal distribution.

Priors

The priors implemented in HCAM include uniform, normal, and lognormal distributions (Haist and Schweigert 2006, Appendix A). HCAMv2 has implemented a number of priors in fitting the data, described in detail in Christensen et al, 2008 (Appendix 1).

Residuals

To assess deviations from model assumptions we examine two types of residuals: raw residuals, to evaluate differences between observed and predicted levels of egg deposition, and Standardized Pearson's residuals, to summarize the fit of the age-structured model to the observed catch-at-age data.

FORMULATION OF THE HCAM MODEL

The herring catch-age model (HCAM) analysis presented at the 2006 spring PSARC meeting (Haist and Schweigert 2006) combined features of the model used for herring assessments prior to 2006 (Schweigert 2005) and an alternative developed for the objectives based fishery management initiative (OBFM) referred as the new age-structured model (NASM, Fu et al. 2004). The HCAM code is designed to be general and it can be run to mimic both the recent or existing herring age-structure model (EASM) and the new age-structure model (NASM) as well as various combinations of these and others. The Pelagics Subcommittee adopted HCAM for future assessments in 2006 and a modified version was applied in 2007. However, minor retrospective patterns persisted and additional work on model structure was undertaken prior to the 2008 assessment. As a result, a newer version of HCAM, HCAMv2, was implemented for the 2008 assessment. Based on extensive testing and review of the results, we believe that HCAMv2 addresses many of the outstanding issues with the previous version.

STOCK TRENDS AND ABUNDANCE FORECASTS

Estimates of the spawn index, spawning biomass, and pre-fishery stock biomass over the period of 1951 to 2008 from the HCAMv2 implementation are presented in Figures 4 and 5 for the northern and southern migratory herring stocks. All five major herring stocks in British Columbia showed small or marginal decline in 2008. In addition, all stocks except for the Strait of Georgia and Prince Rupert are again below the Cutoff level.

Residual and Retrospective Analysis

An examination of residuals provides the basis for assessing the fit of a model to the available data. In this case, model estimates of population egg production were compared to the observed egg deposition and the by-year differences, the raw residuals, were reviewed to judge model fit. The results of this comparison are shown in Figures 6 and 7 for the five major stocks.

It is evident that the residuals have decreased somewhat over time in all areas since the inception of dive surveys in 1988.

Standardized Pearson's residuals are used to summarize the fit of the age-structured model to the observed catch-at-age data. Residuals are presented in Figures 8 to 12 for each of the five major stocks over time (broken down by fishing period). There is no evidence of persistent over or underestimation of age composition in any area for any of the three fishing periods indicating a good agreement between the observed data and model predictions of age composition. A few larger residuals remain in each area and require further investigation.

Estimates of fishing mortality (F) from 1951-2008 are presented in Figure 13. The very high fishing mortality rates during the reduction fishery era give way to low and stable levels in all stocks beginning in the early 1980s. Fishing mortality rates estimated by HCAMv2 are similar to those estimated by HCAM.

Estimates of average annual instantaneous natural mortality rate (M) range widely between stocks and over time with the highest levels observed in the QCI and WCVI (Figure 14). All stocks except the Strait of Georgia indicate an increasing trend in natural mortality since the early 1990s with the most marked effect in the Central and WCVI stocks. All stocks except the WCVI show a peak in natural mortality during the stock collapse of the late 1960s. The deviations from the average natural mortality are presented in Figure 15 reflecting the results in Figure 14: higher deviations in the late 1960s with collapsing stocks in all but the WCVI and negative deviations in the early 1970s as stocks recovered. In recent years, positive deviations occur in the CC and the WCVI, coinciding with declines in stock biomass.

A retrospective analysis of HCAMv2 is presented for each of the major herring stocks in Figures 16. The plots show the stock trajectory determined for each year since 1998 demonstrating the effect of additional data on model performance relative to the estimates from the stock trajectory in the current year. In general, the retrospective patterns are very stable for all stocks with some minor exceptions for the Strait of Georgia and Prince Rupert stocks. Incidences of over- and under-estimation of spawning biomass in the terminal year occur with the same frequency, thus this analysis appears to be unbiased.

Trace plots from the sub-sampling of the MCMC posterior distribution for estimating the 2008 spawning stock biomass are presented in Figures 17 and 18. The plots show a substantial amount of variation for each stock but there is no evidence of trends over the course of the simulations and less of a tendency for short term cycles as occurred with the HCAM assessment in 2007.

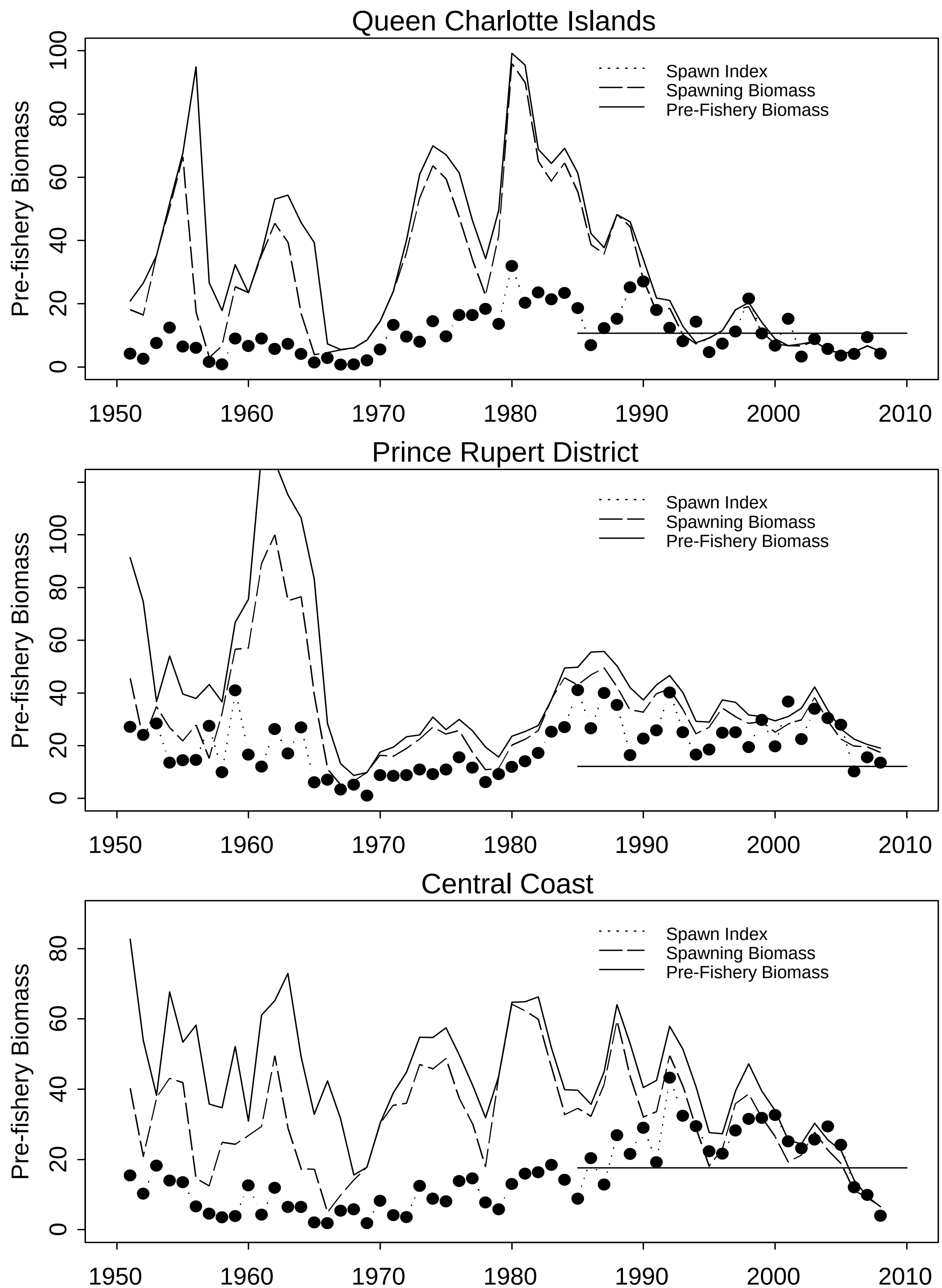


Figure 4. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAMv2) analyses for northern B.C. herring stock assessment regions, 1951-2008. Horizontal line indicates the Cutoff level.

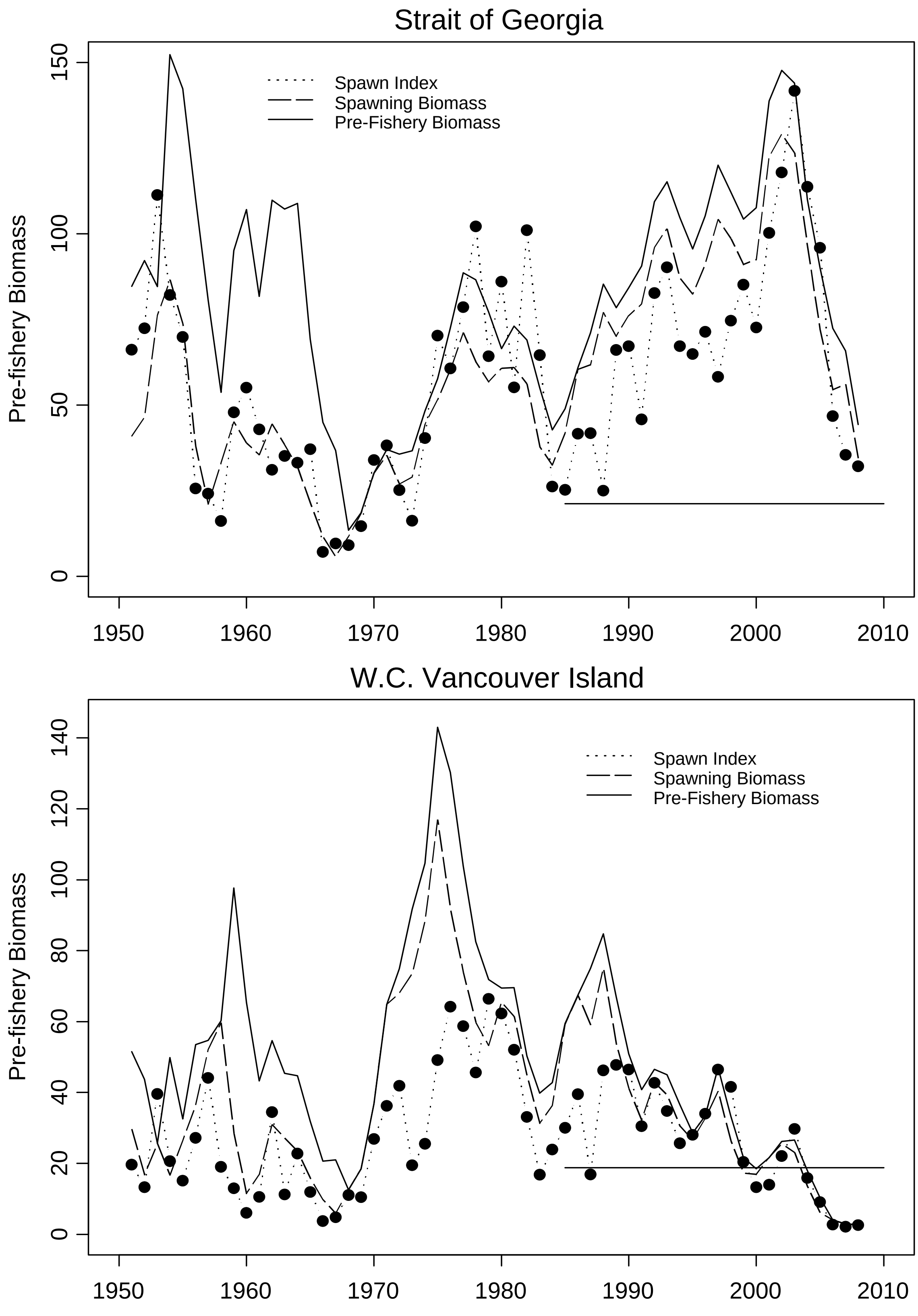
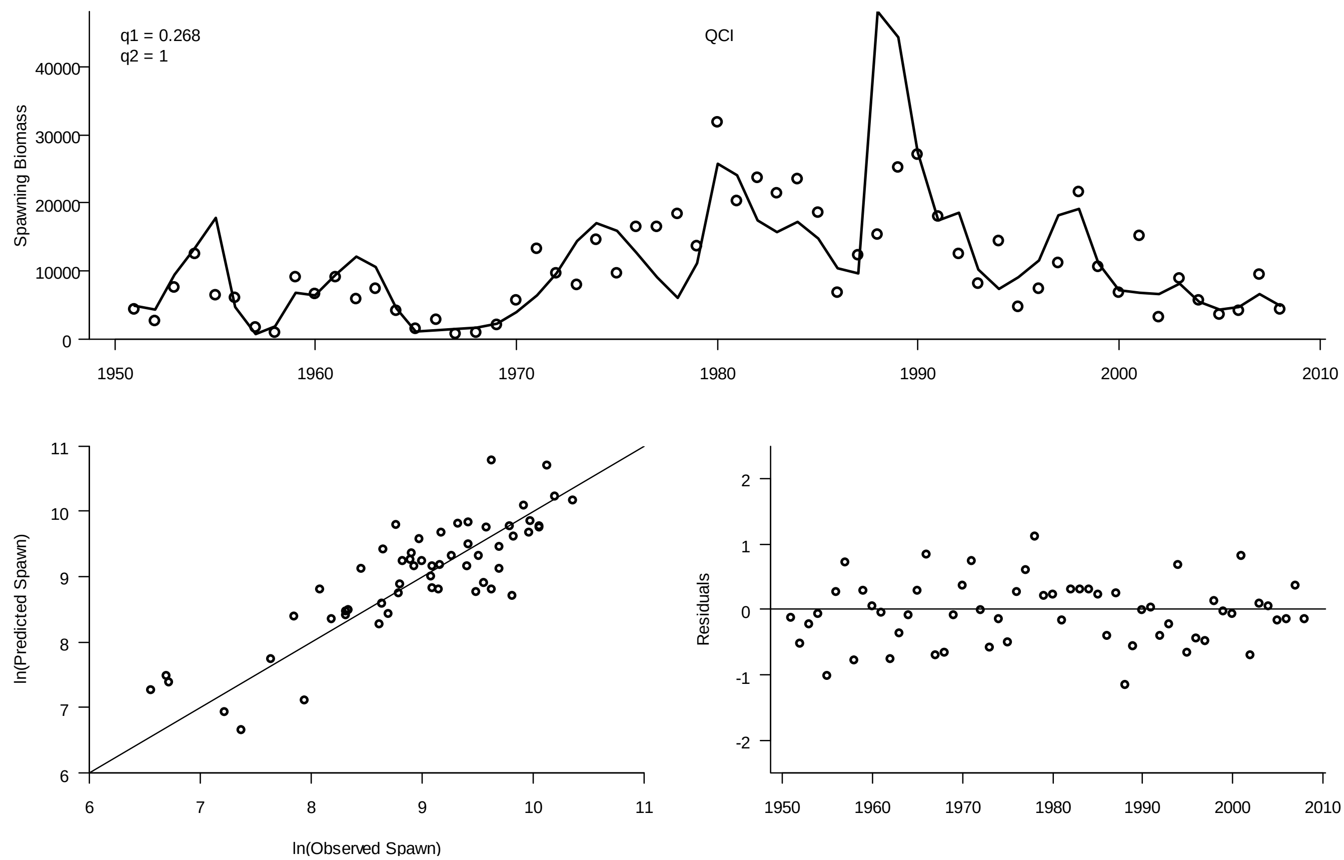
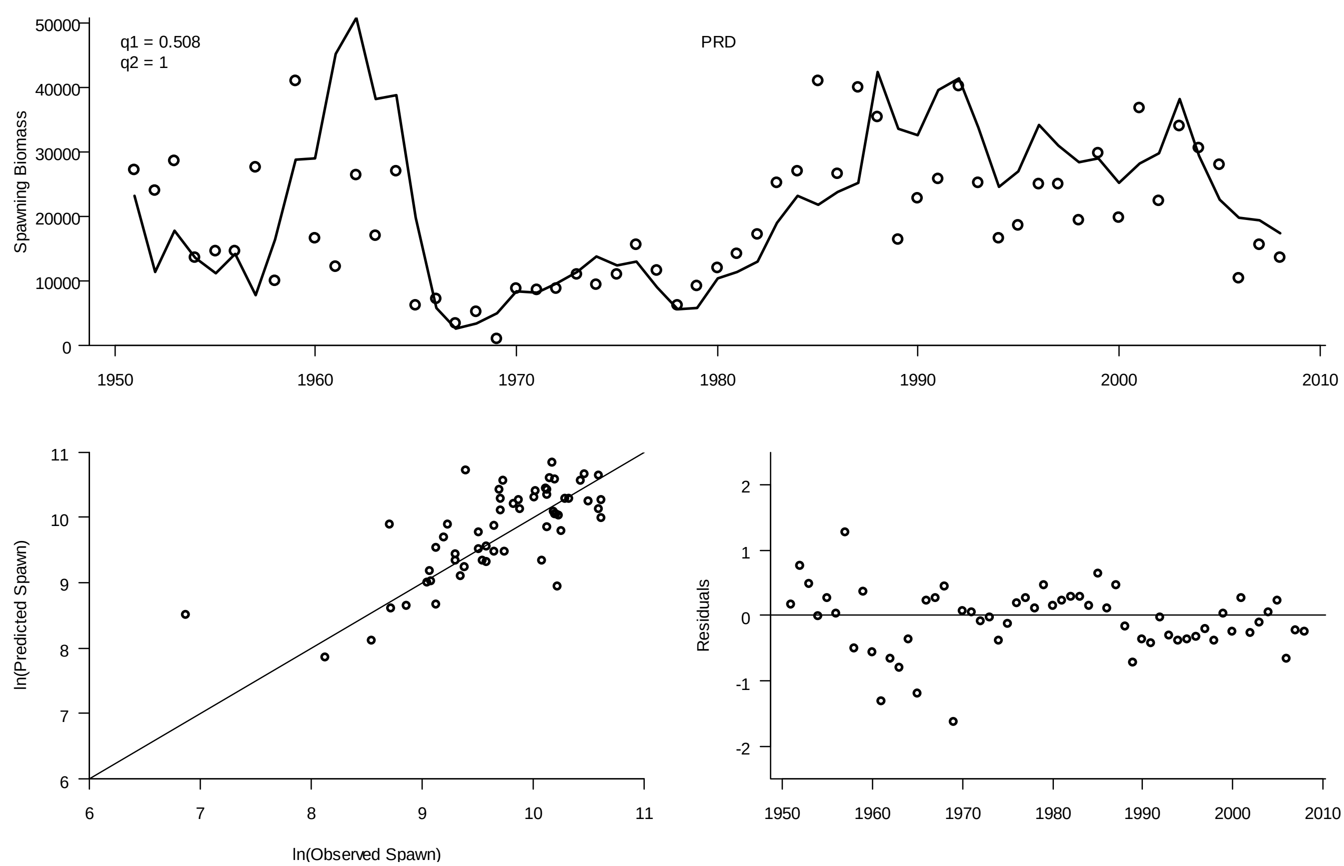


Figure 5. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAMv2) analyses for southern B.C. herring stock assessment regions, 1951-2008. Horizontal line indicates the Cutoff level.


q1 = 0.268
q2 = 1
QCI
Spawning Biomass
ln(Predicted Spawn)
ln(Observed Spawn)
Residuals


q1 = 0.508
q2 = 1
PRD
Spawning Biomass
ln(Predicted Spawn)
ln(Observed Spawn)
Residuals

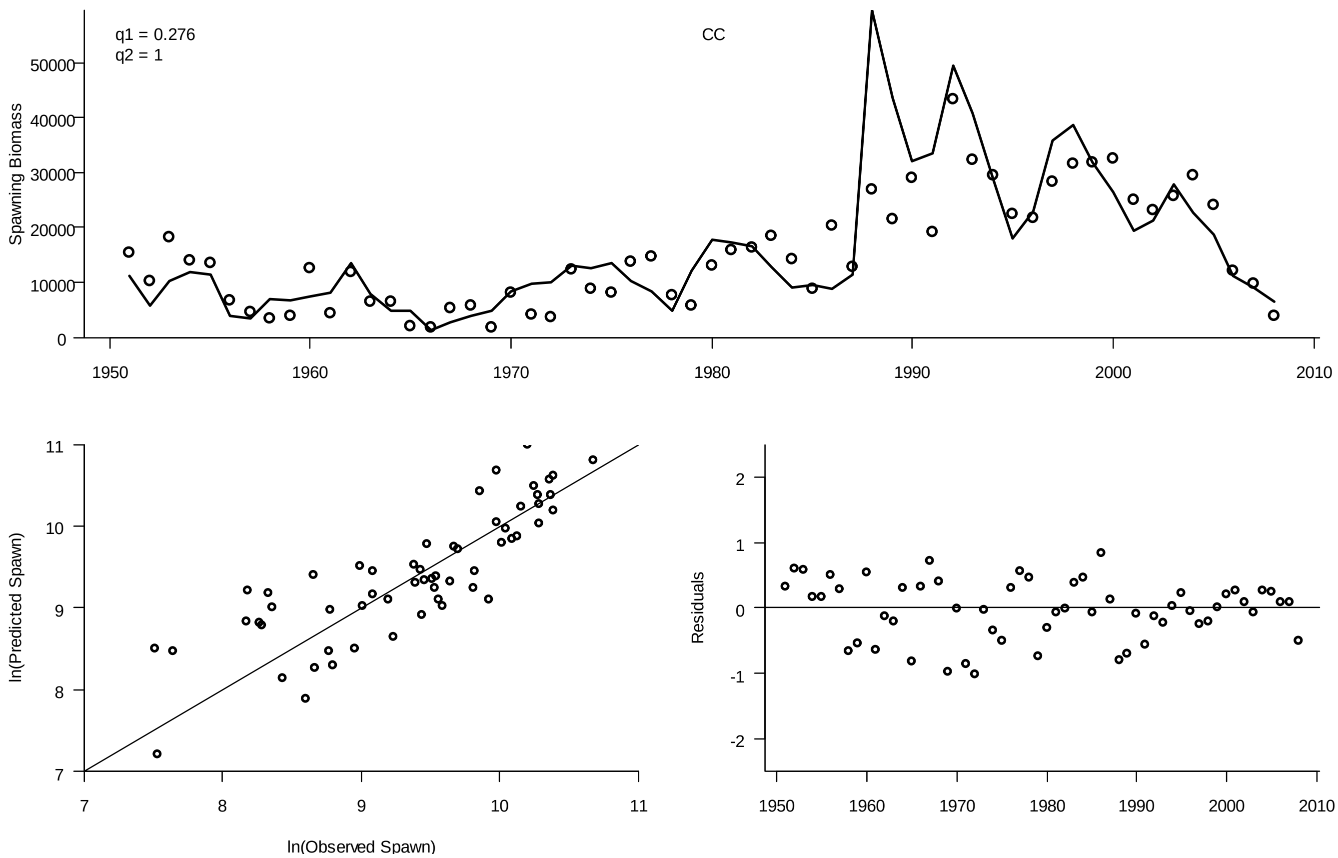


Figure 6. Comparisons of observed and model derived predictions of herring spawn for the three northern assessment regions for the period 1951-2008. Top panel: Time series of observed spawn (open circle) and predicted spawn (solid line) from 1951-2008. Bottom left: Comparison of log (observed spawn) versus log (predicted spawn). Bottom right: Time series of residuals calculated as the difference between observed and predictions of spawn (where both variables were log transformed).

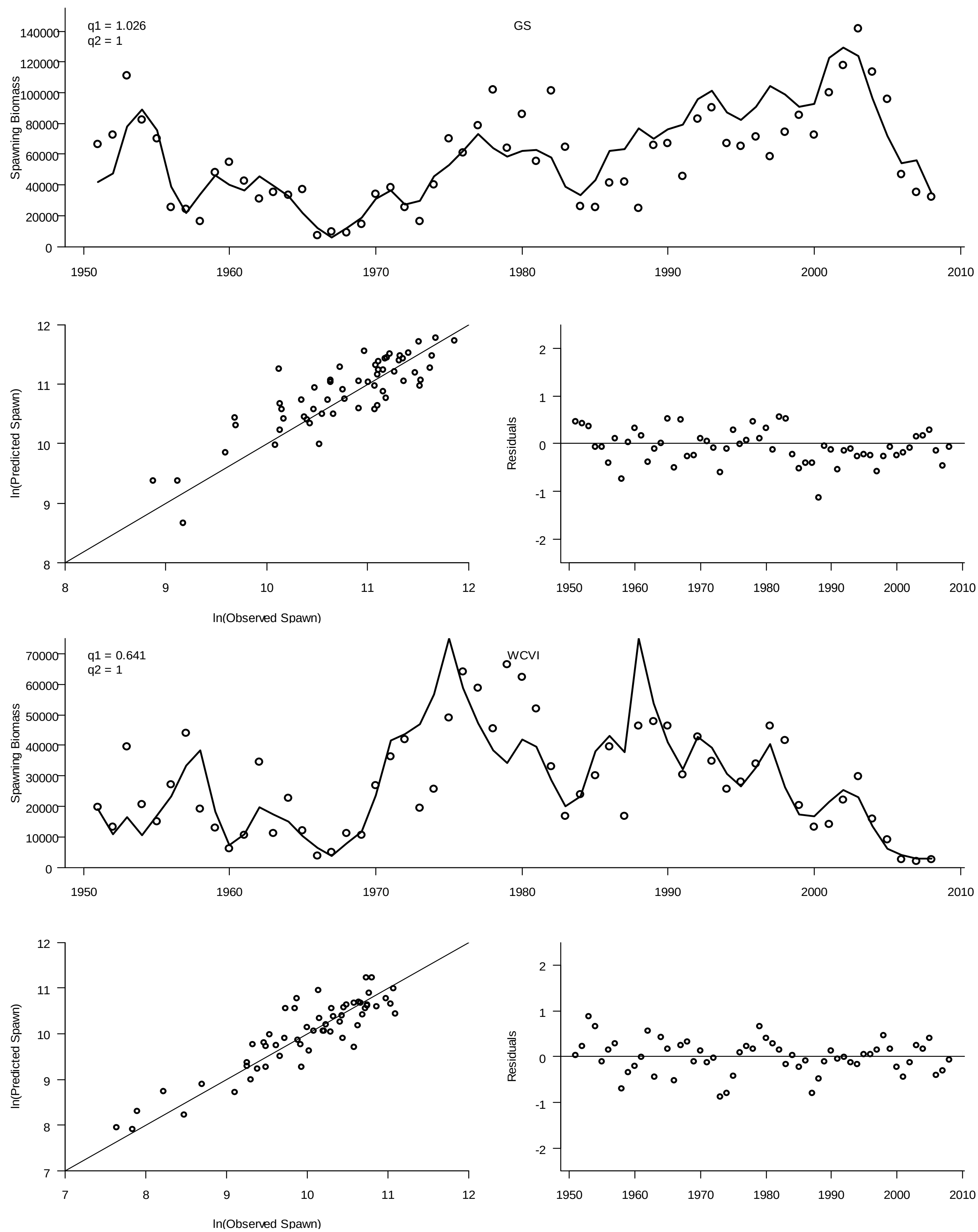


Figure 7. Comparisons of observed and model derived predictions of herring spawn for the two southern assessment regions for the period 1951-2008. Top panel: Time series of observed spawn (open circle) and predicted spawn (solid line) from 1951-2008. Bottom left: Comparison of log (observed spawn) versus log (predicted spawn). Bottom right: Time series of residuals calculated as the difference between observed and predictions of spawn (where both variables were log transformed).

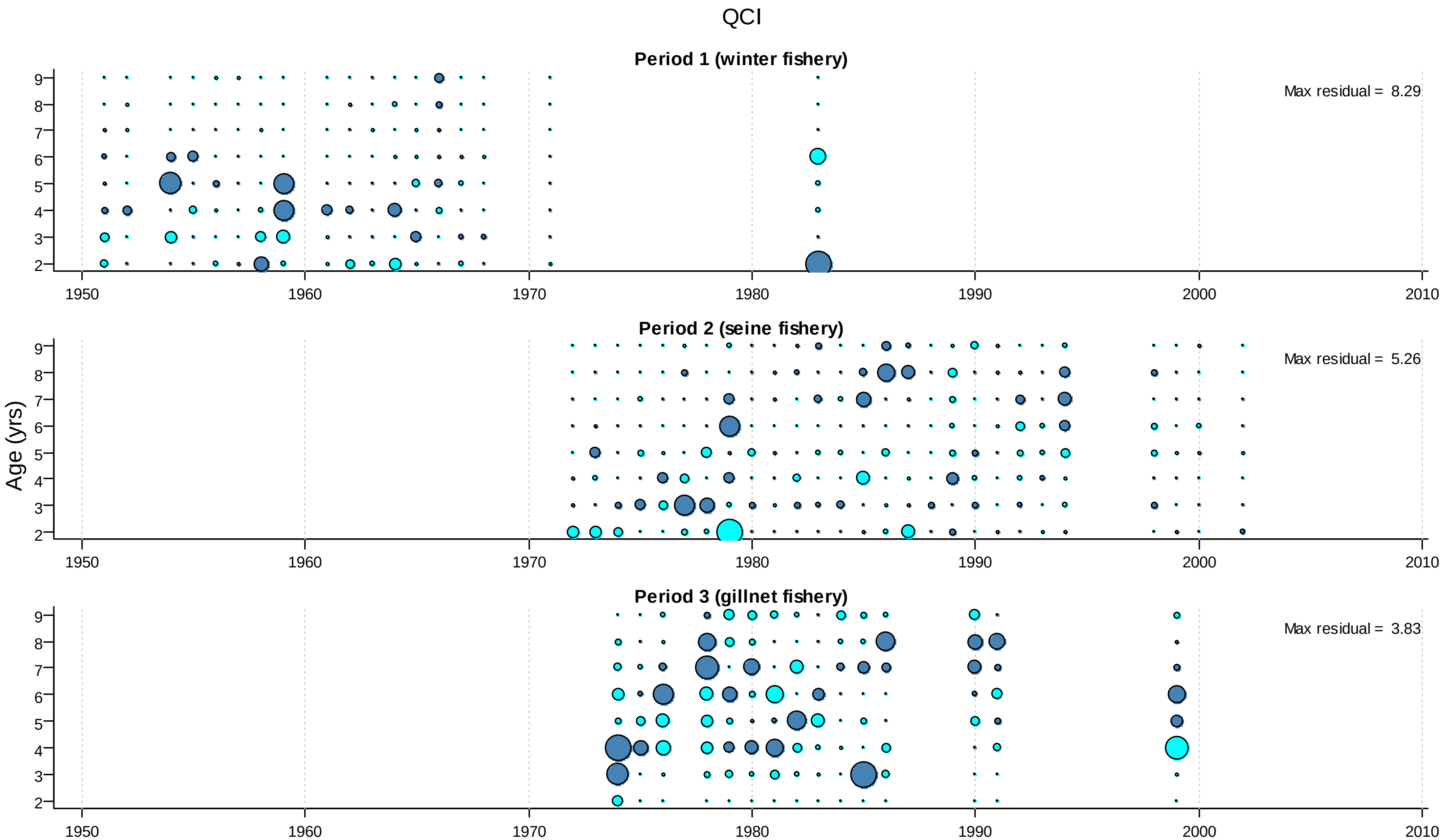


Figure 8. Standardized Pearson's residuals compare model estimates of population age-structured to the observed catch-at-age data by year and fishing period for the Queen Charlotte Islands, 1951-2008. Dark blue circles are positive residuals and light blue circles are negative residuals.

Figure 9. Standardized Pearson's residuals compare model estimates of population age-structure to the observed catch-at-age data by year and fishing period for the Prince Rupert District for 1951-2008. Dark blue circles are positive residuals and light blue circles are negative residuals.

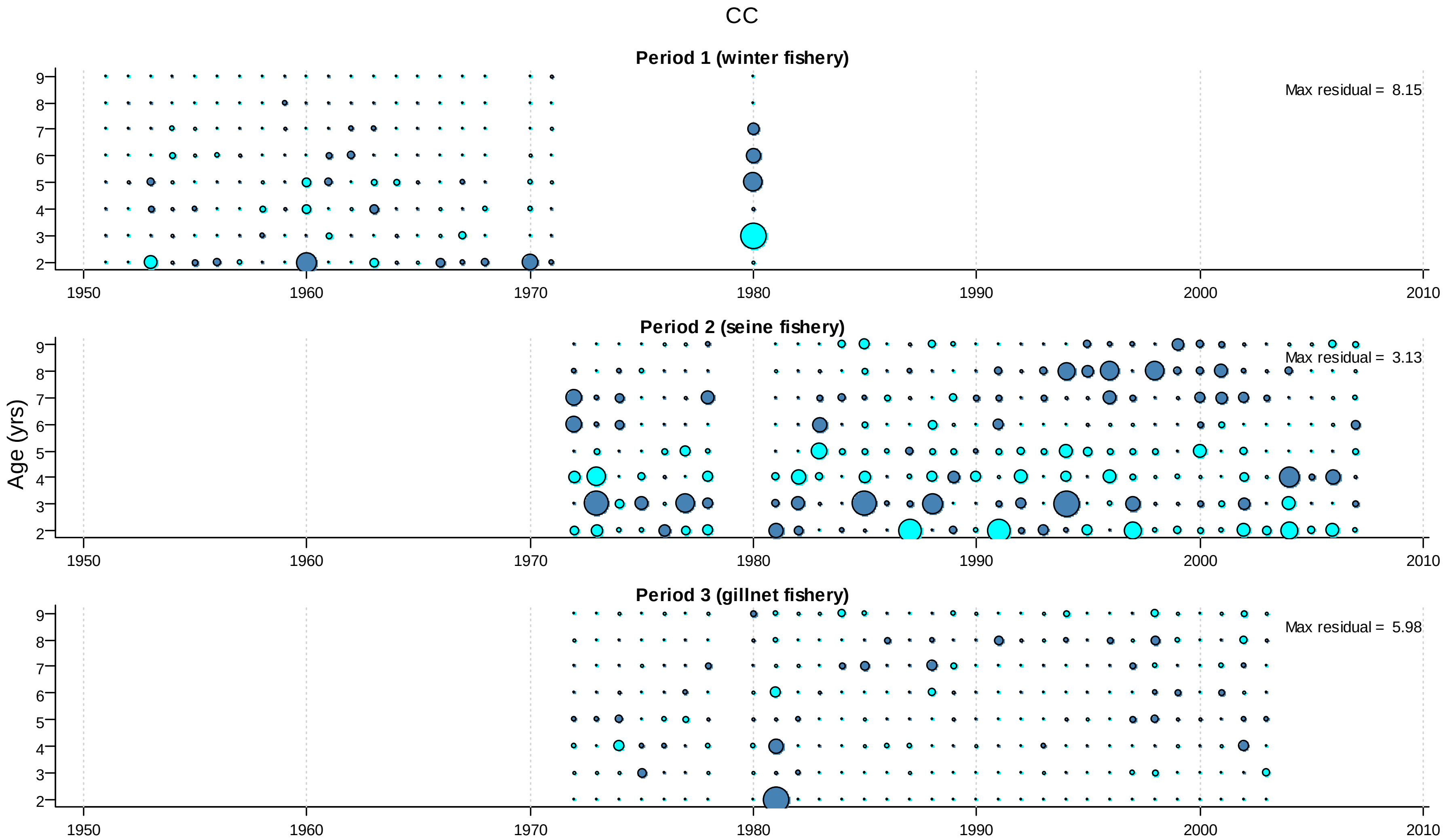


Figure 10. Standardized Pearson's residuals compare model estimates of population age-structure to the observed catch-at-age data by year and fishing period for the Central Coast for 1951-2008. Dark blue circles indicate positive residuals and light blue circles are negative residuals.

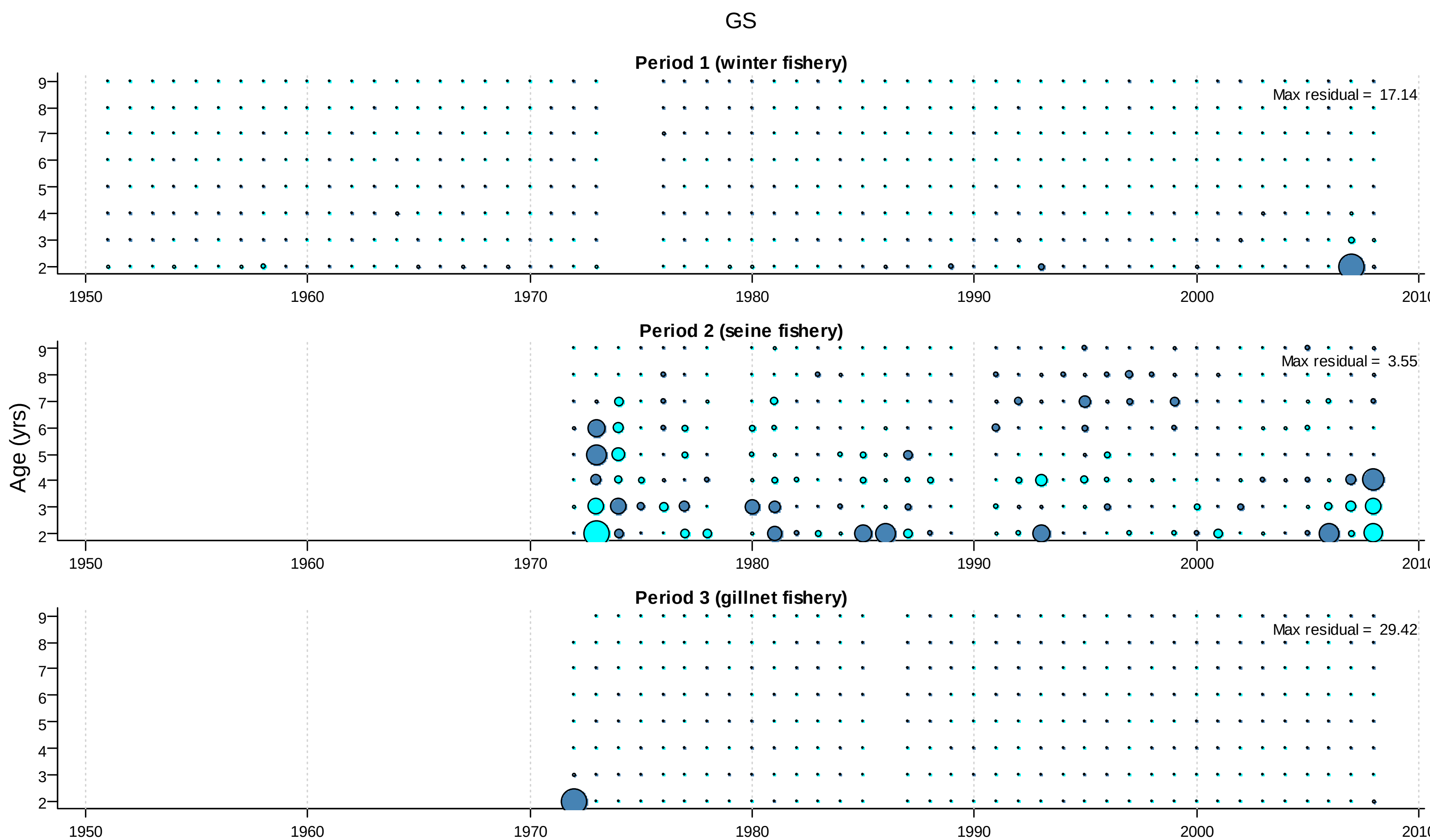


Figure 11. Standardized Pearson's residuals compare model estimates of population age-structure to the observed catch-at-age data by year and fishing period for the Strait of Georgia for 1951-2008. Dark blue circles indicate positive residuals and light blue circles are negative residuals.

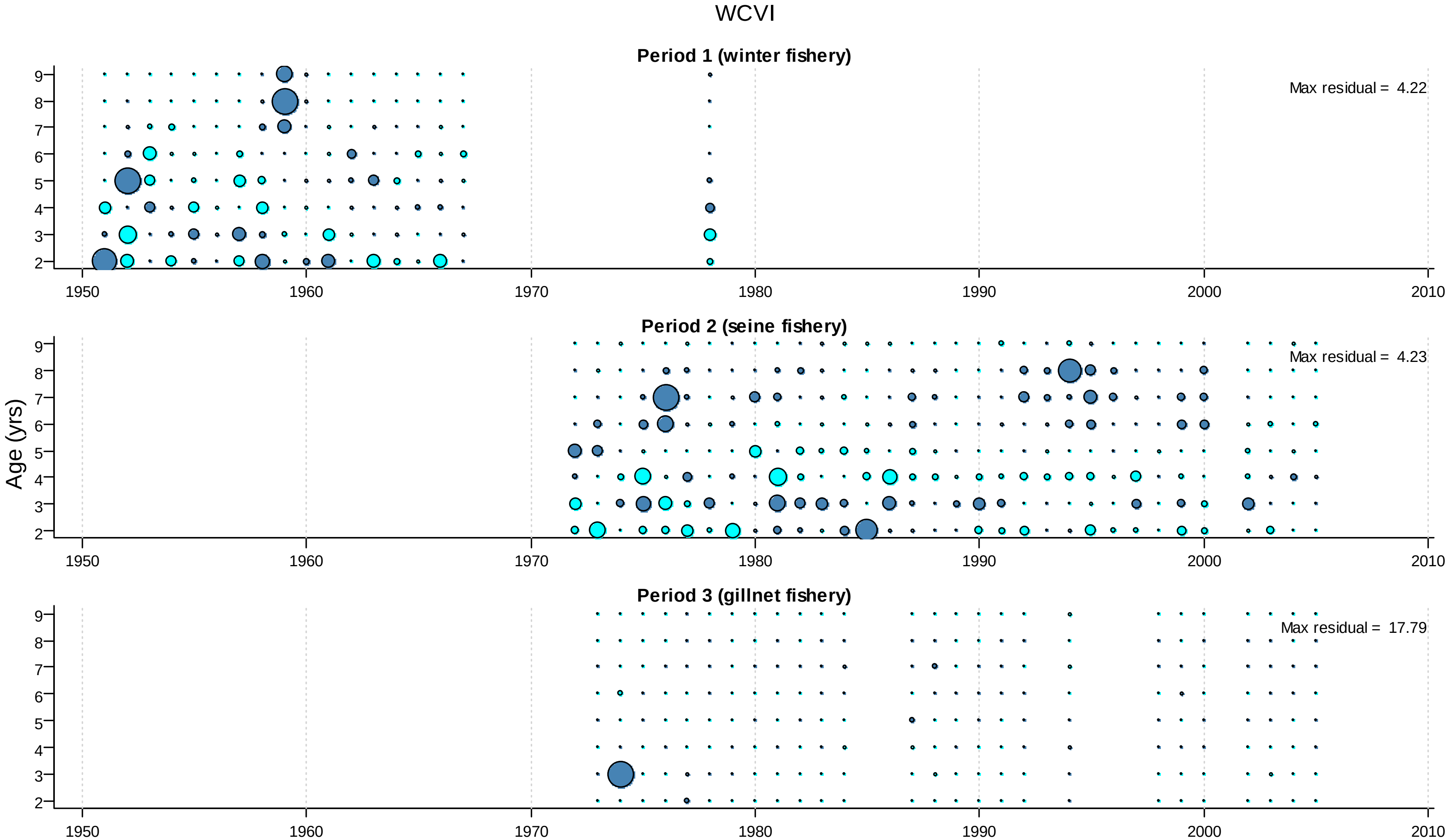


Figure 12. Standardized Pearson's residuals compare model estimates of population age-structure to the observed catch-at-age data by year and fishing period for the west coast of Vancouver Island for 1951-2008. Dark blue circles represent positive residuals and light blue circles are negative residuals.

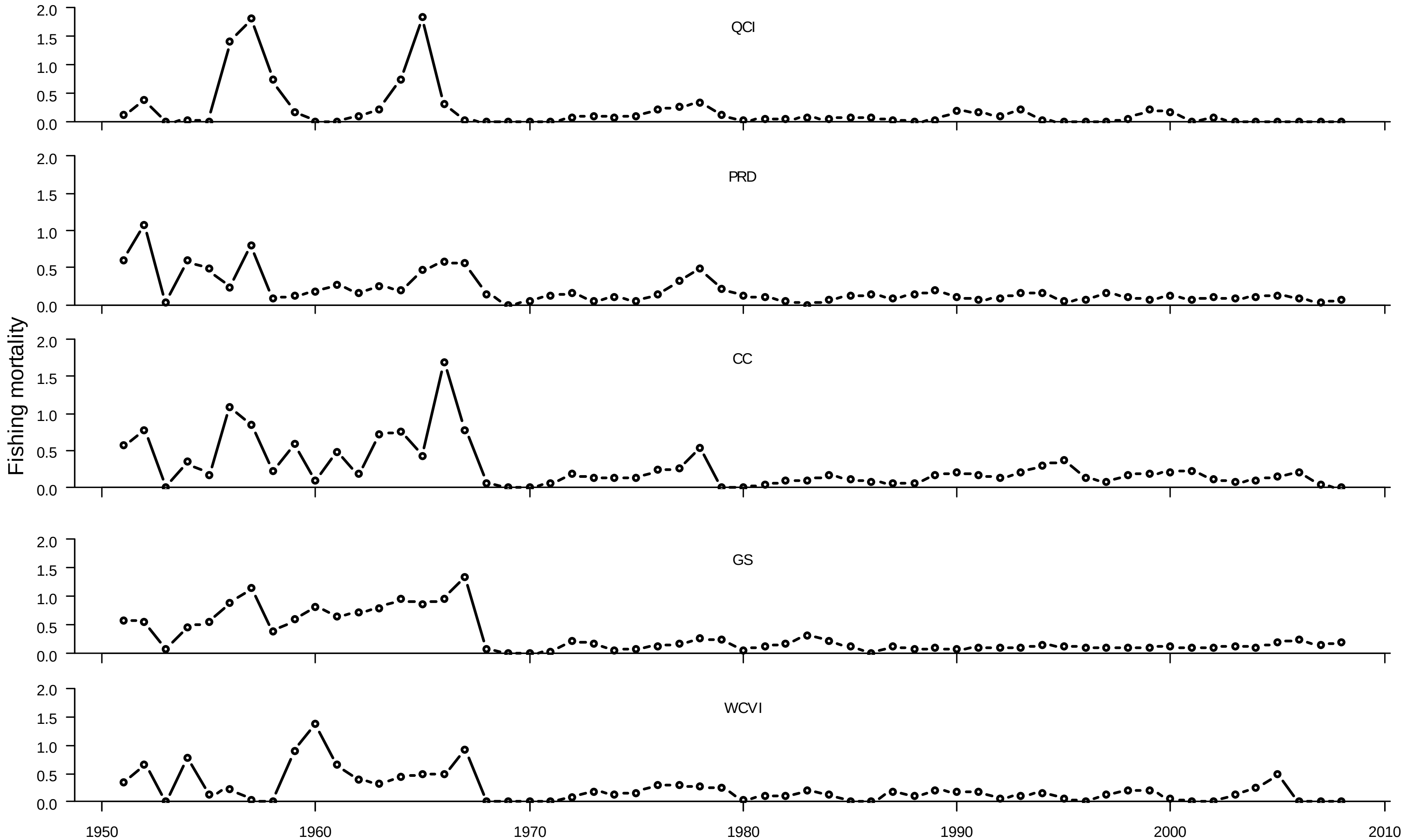


Figure 13. Estimates of annual instantaneous fishing mortality (F) for major B.C. herring stocks from 1951-2008.

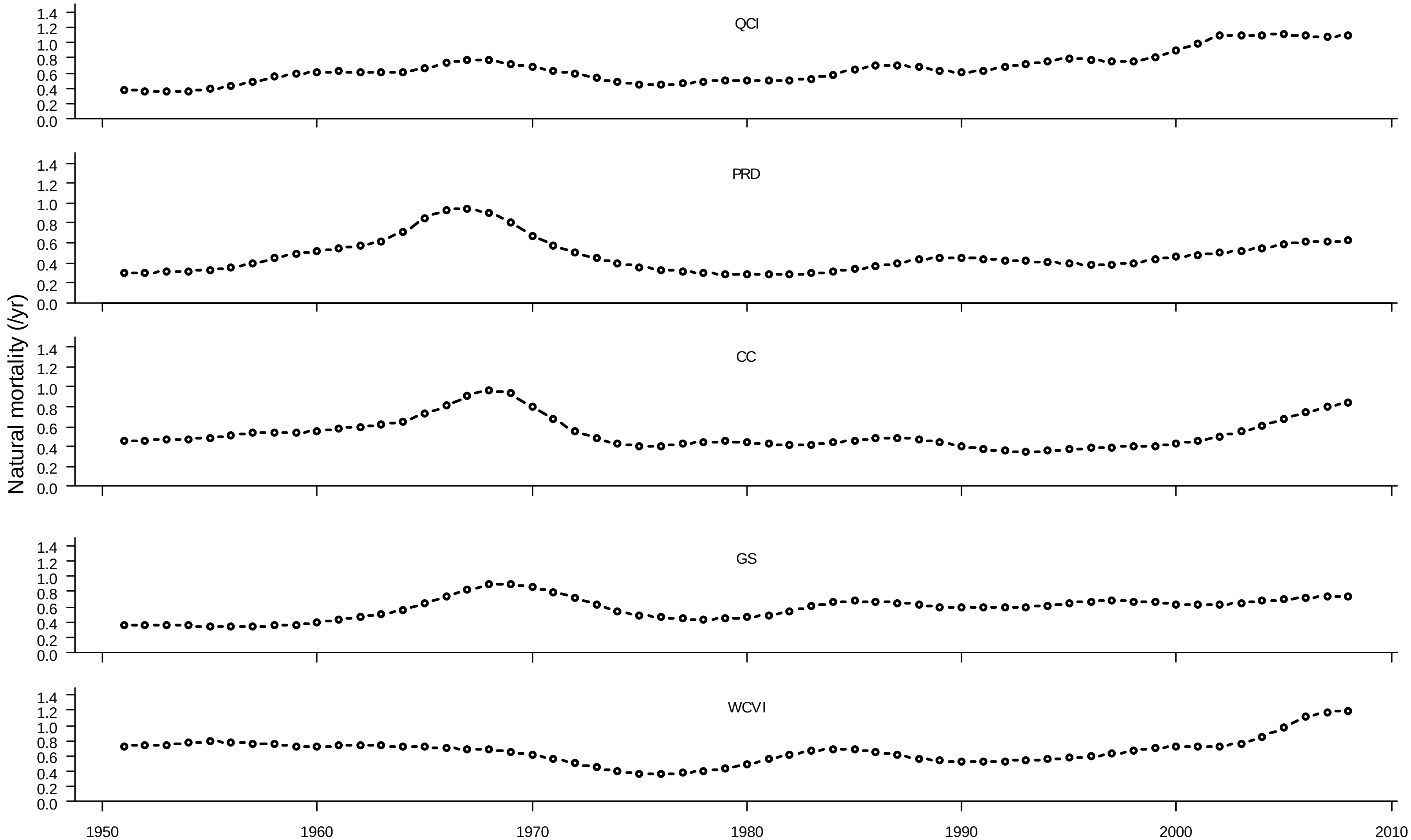


Figure 14. Estimate of the annual instantaneous natural mortality rate (M) for the B.C. herring stocks from 1951-2008, calculated using a random walk approach.

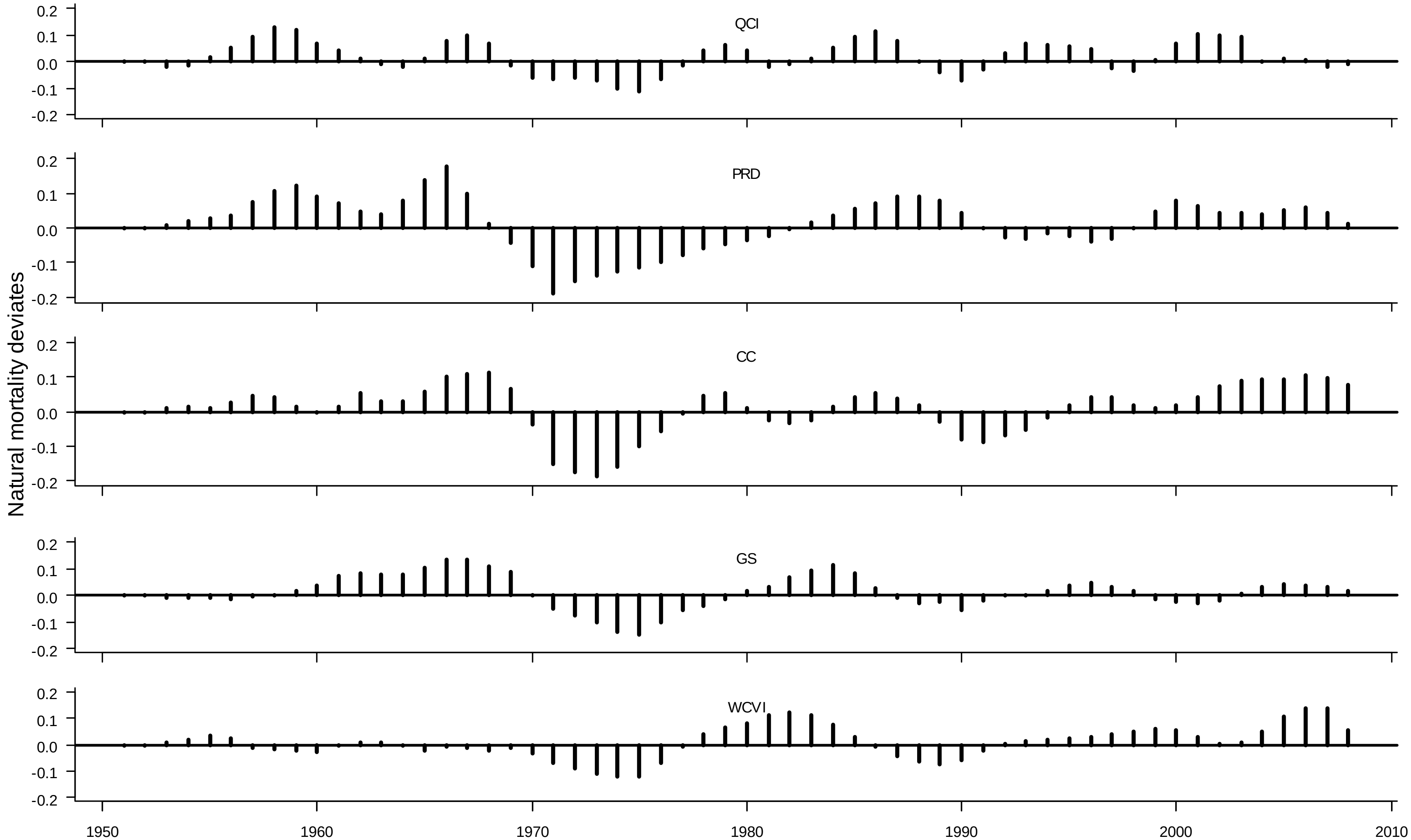


Figure 15. Estimated deviation of the annual instantaneous natural mortality rate (M) from the random walk for the B.C. herring stocks from 1951-2008.

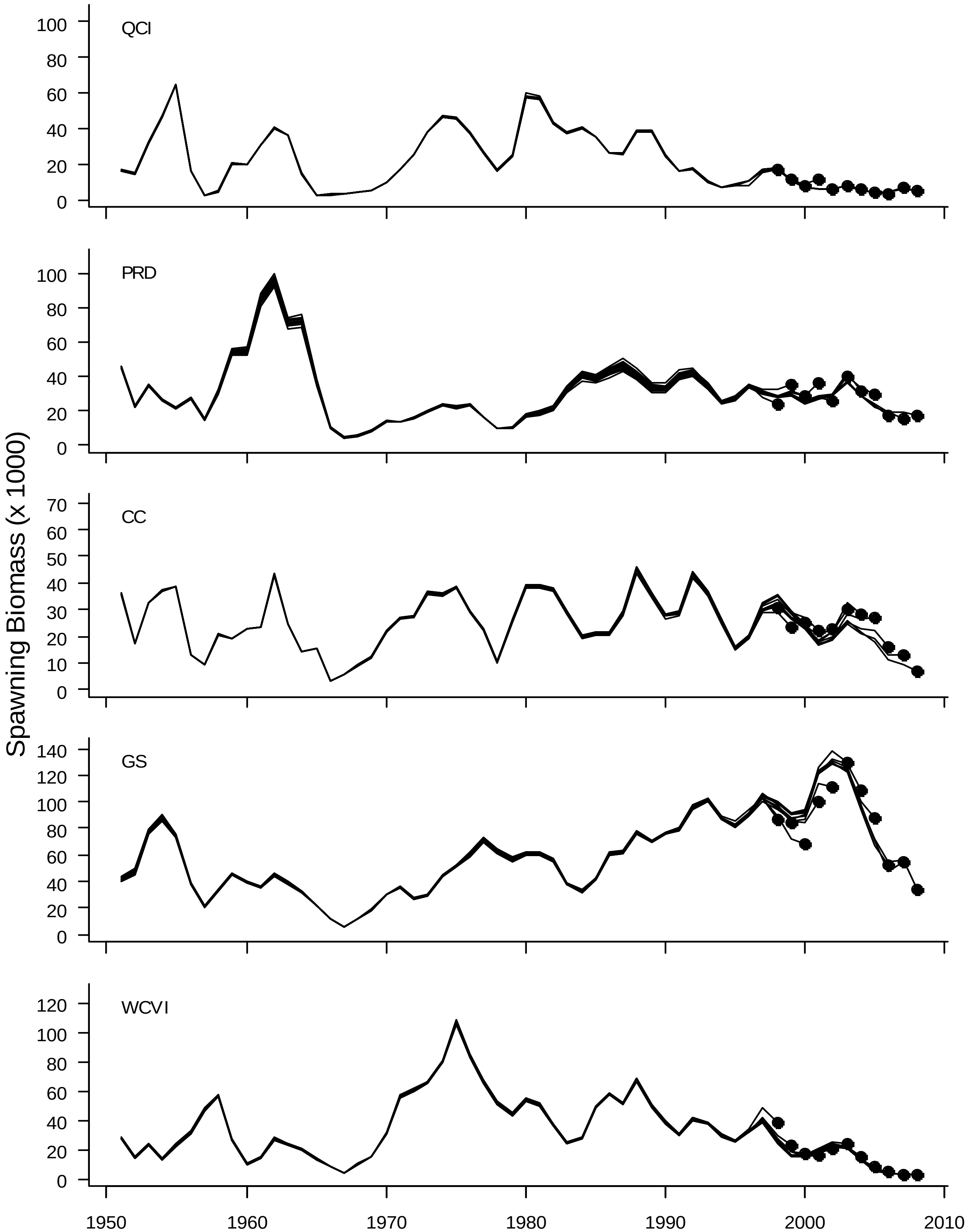
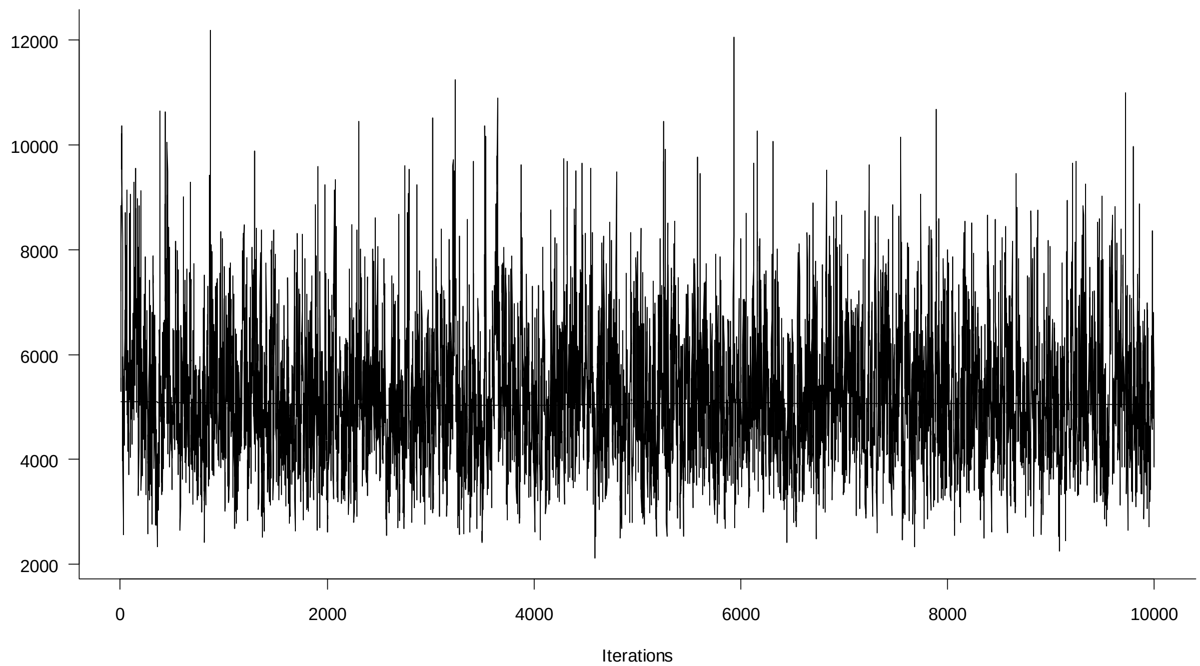


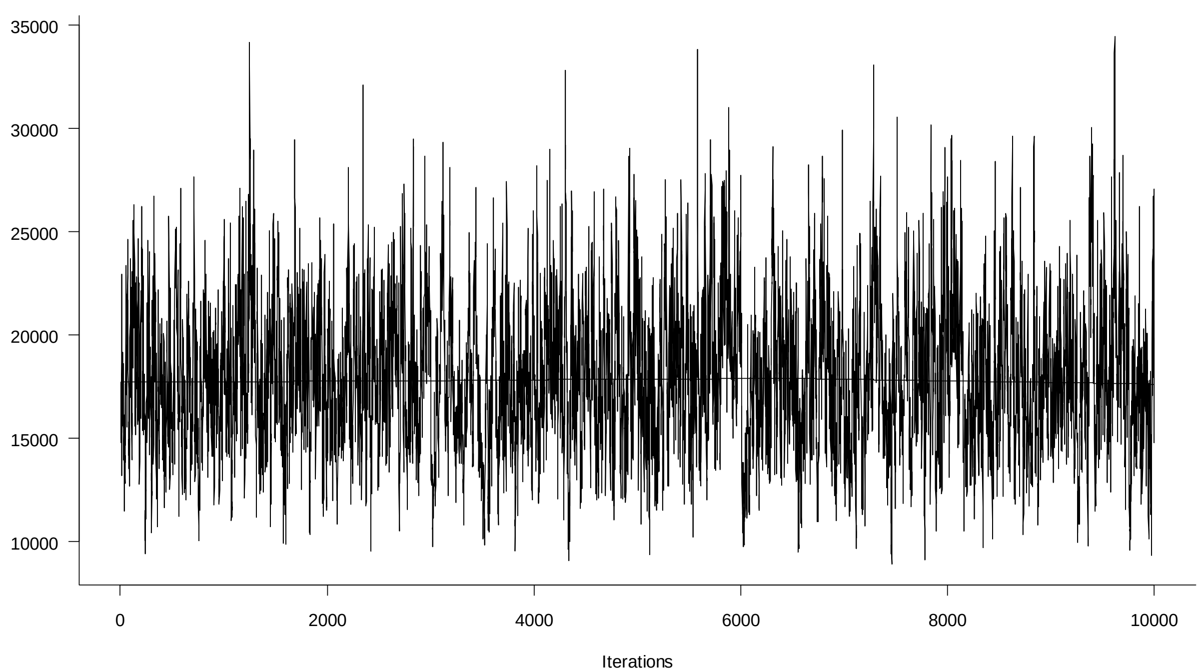
Figure 16. Estimates of spawning stock biomass from retrospective analyses (1998-2008) for the five major assessment regions using HCAMv2. Solid circles represent terminal year estimate for the reconstruction.

QCI



12000
10000
8000
6000
4000
2000
0
2000
4000
6000
8000
10000
Iterations

PRD



35000
30000
25000
20000
15000
10000
0
2000
4000
6000
8000
10000
Iterations

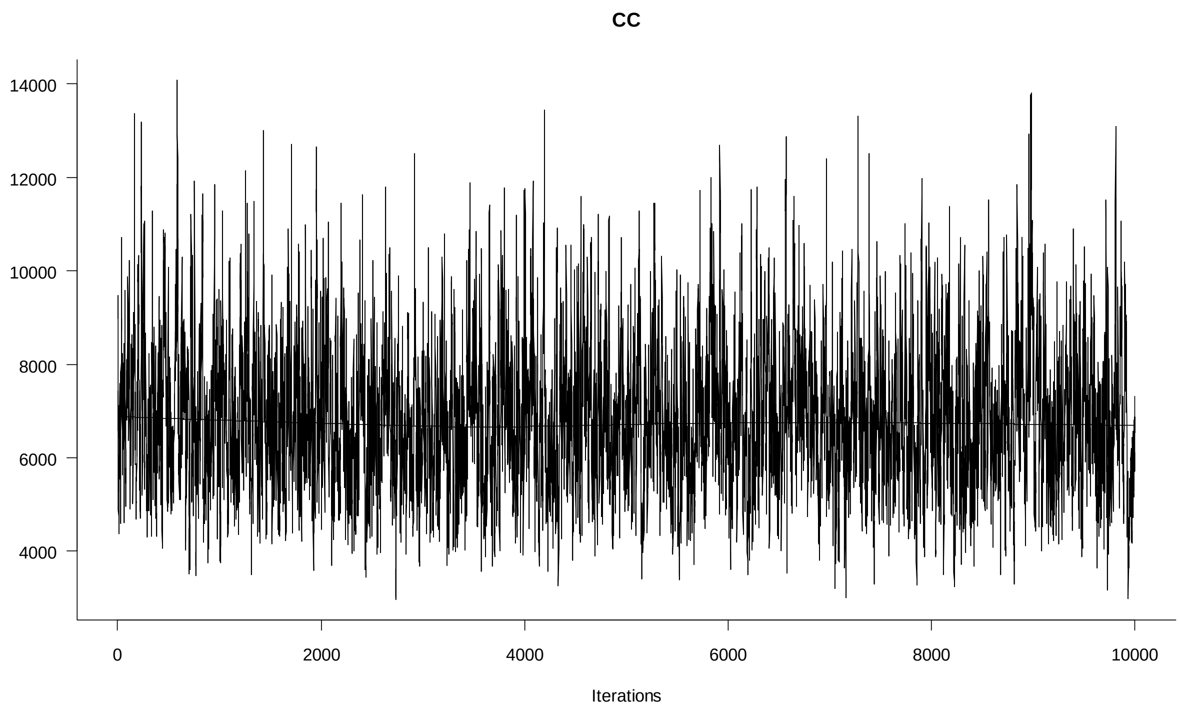


Figure 17. Trace plots from the MCMC analysis showing the sub-samples of estimated spawning biomass in 2008 for the three northern assessment regions.

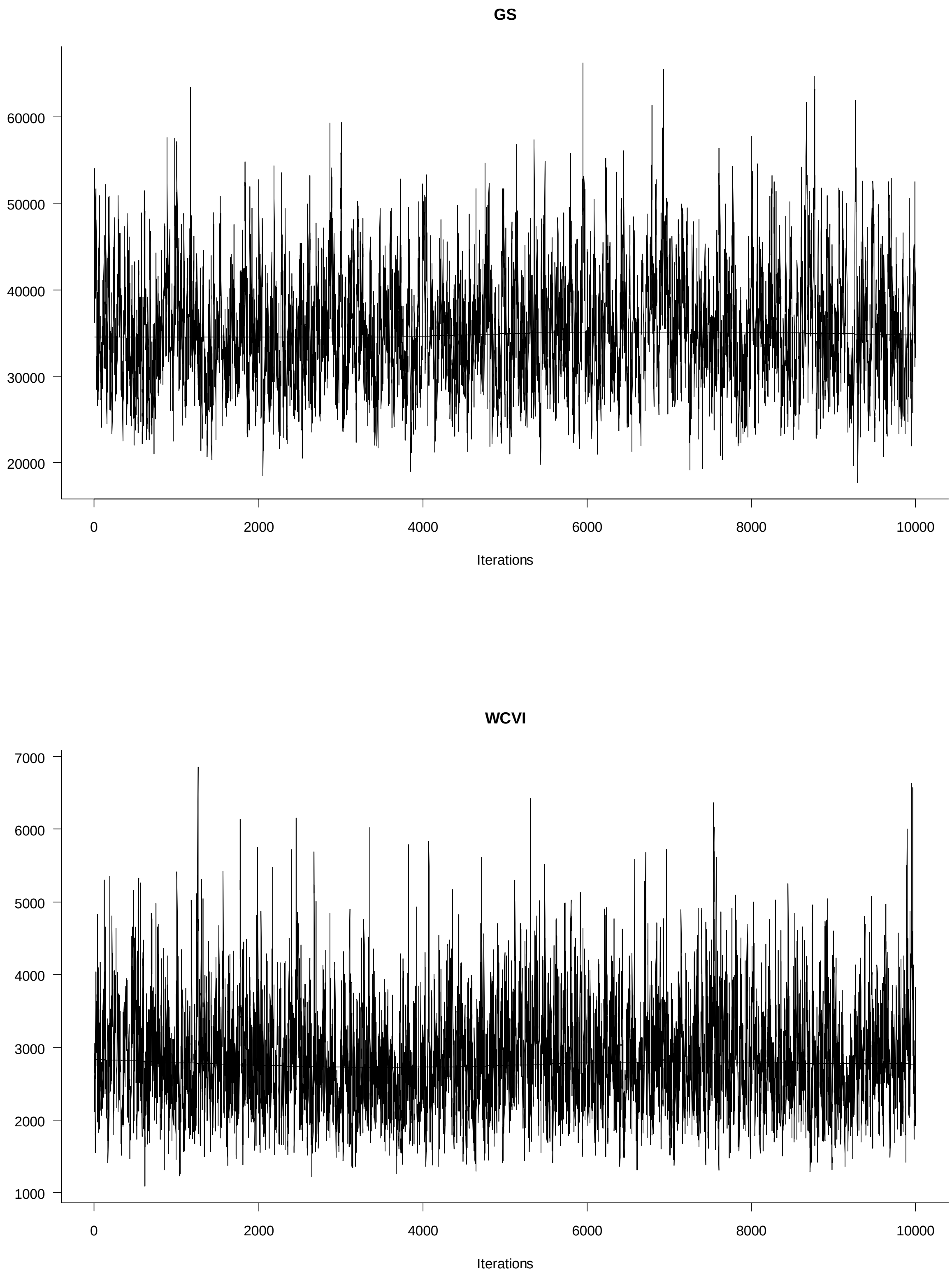


Figure 18. Trace plots from the MCMC analysis showing the sub-samples of estimated spawning biomass in 2008 for the two southern assessment regions.

ABUNDANCE FORECASTS

Forecasts of pre-fishery spawning stock abundance for 2008 and 2009 are calculated slightly differently than in previous assessments. Forecasts of the pre-fishery biomass were determined by summing the prediction of age 4 and older biomass with the forecasts of age 2^+ recruits for a poor, average, and good recruitment as determined from the posterior distributions of the Bayesian analysis rather than the simple average calculated in the past. The results are presented in Figures 19 and 20. Poor, average, and good recruitment levels were calculated as the mean of the lowest 33%, the mid 33%, and the highest 33% of the estimates of historical age 2^+ abundance. The calculation was conducted for each of the 1 million simulations and the distribution of forecasts is based on the sub-sample of 10,000 traces from the MCMC analysis.

Queen Charlotte Islands

The posterior distribution for the estimate of 2008 spawning biomass is presented in Figure 19 and suggests abundance of about 5,000 tonnes. The distribution of forecast biomass with poor and average recruitment indicates that abundance will likely be less than 5,000 tonnes in 2009. A good recruitment in 2009 is very poorly determined but could increase biomass to about 10-15,000 tonnes bringing the stock above the Cutoff level (Figure 19). Recruitment to this stock has been generally poor for the past decade (Fig. 21) with the last good year-class occurring in 1995. Subsequent year-classes have all been poor except 2000 and 2004. The spawning run in 2008 was composed primarily of age 3^+ fish from the 2004 year-class constituting 63% of the run while age 2^+ fish from the recruiting 2005 year-class contributed only 7% (Appendix 1.1). The forecast for 2009 with a poor recruitment is 3,600 tonnes and 5,700 tonnes with an average recruitment (Table 1).

Prince Rupert District

The posterior distribution from the MCMC simulation indicates that the spawning biomass in 2008 was between 10 and 30,000 tonnes but most probably just under 20,000 tonnes (Fig. 19). The distributions of forecast biomass with poor or average recruitment will result in abundance of just over 10,000 and just below 20,000 tonnes, above the Cutoff level of 12,100 tonnes for this assessment region. A good recruitment would increase abundance to about 30,000 tonnes. Recruitment to this stock has been consistent, with good year-classes occurring roughly every few years since 1980 (Figure 21). While the 1998, 2000, and 2004 year-classes were good, the 2001, 2003 and the 2005 year-classes were all poor. The spawning run consisted of about 57% age 3^+ fish from the 2004 year-class and only 10% from the recruiting 2005 year-class (Appendix 1.2). The forecast run size to the Prince Rupert District in 2009 with poor recruitment is 13,800 tonnes and with average recruitment 17,300 tonnes (Table 1).

Central Coast

The estimate of the 2008 spawning biomass and 2009 pre-fishery forecasts are presented in Figure 19. The posterior distribution indicates that spawning abundance in 2008 was between 5 and 10,000 tonnes, most probably about 7,000 tonnes. The forecast for 2009 with poor recruitment would result in a similar level of abundance. An average recruitment would result in run size of about 10,000 tonnes whereas a good recruitment would increase abundance to between 15-25,000 tonnes. The projected abundance with poor or average recruitment leaves the stock below the Cutoff of 17,600 tonnes for this assessment region. Recruitment to this stock has been characterized by intermittent strong year-classes with the most recent one being the 2000 which was only 3% of the run as 8 year olds in 2008. The bulk of the spawning run consisted of the 2004 year-class (45% while the recruiting 2005 year-class contributed 10% of the run (Appendix 1.3). The average to good 2002 year-class made up 16% of the run. The forecast run size to the Central Coast in 2009 with poor recruitment is 6,200 tonnes and with average recruitment is 9,800 tonnes (Table 1).

Strait of Georgia

The Strait of Georgia herring stock remains the most productive on the coast although it has decreased substantially over the last few years. The posterior distribution of the 2008 spawning biomass and the pre-fishery forecasts for 2009 is presented in Figure 20. The 2008 biomass was between 20-50,000 tonnes, most probably about 35,000 tonnes. Given poor recruitment, a similar level is projected for 2009. An average recruitment would produce a run of about 40,000 tonnes while a good recruitment would return the stock to about 60,000 tonnes. Although abundance declined substantially in 2006 and to a lesser extent in 2007 and 2008, the stock remains well above the Cutoff of 21,200 tonnes for this assessment region. Recruitment to this stock has been characterized by consistent strong year-classes every second or third year since the mid-1980s (Fig. 19). The recent year-classes from 1997-2000 were among the largest ever observed in this assessment region. The more recent 2001-2003 year-classes were weaker. The strong 2004 year-class contributed 65% of the 2008 spawning run while the weaker 2003 year-class added 17% and the recruiting 2005 appears weak at 7% of the run (Appendix 1.4). The forecast run size to the Strait of Georgia in 2009 is 31,000 with poor recruitment and 41,000 tonnes with average recruitment (Table 1).

West Coast Vancouver Island

Abundance in the west coast of Vancouver Island assessment region has fluctuated dramatically from the historic high of the mid-1970s to the recent depressed levels (Fig. 7). The posterior distribution form the MCMC simulation indicates that the spawning biomass in 2008 was again below 5,000 tonnes, levels not seen since the collapse of the late 1960s although the stock has been only lightly fished during the past decade (Figure 20). The forecast pre-fishery abundance for 2009 indicates that a poor recruitment should increase abundance to nearly 5,000 tonnes. An average recruitment would double abundance to around 8,000 tonnes well below the Cutoff level of 18,800 tonnes for this assessment region. A good recruitment would increase abundance to 10-20,000 tonnes but this is very poorly determined (Figure 20). Recruitment to this stock has been characterized by periods of good and bad recruitment prior to 1980. Subsequently, average or better year-classes have been intermittent, occurring about every 4-5 years. The last strong year-class occurred in 1994 (Fig. 22). The last five year-classes have all been poor. The majority of the 2008 run was comprised of only three year-classes (Appendix Table 1.5). The 2003 year-class contributed 11%, the 2004 contributed 54% while the recruiting 2005 year-class, while poor, contributed 25%. The forecast run size to the west coast of Vancouver Island in 2009 with a poor recruitment is 3,900 tonnes and with an average recruitment is 7,800 tonnes (Table 1).

Table 1. Estimated 50th percentiles of the posterior distributions from Bayesian analysis of 2008 spawning biomass and forecasts of the 2009 pre-fishery biomass with poor, average, and good recruitment.

			Forecast Biomass			Available Harvest		
	2008 SB	2009 – 3+	Poor	Avg	Good	Poor	Avg	Good
QCI	4872	1910	3647	5658	15205	0	0	3041
PRD	17360	10836	13782	17342	30397	1682	3468	6079
CC	6534	3242	6207	9775	19266	0	0	1666
SG	34383	19176	31002	40999	58985	6200	8200	11797
WCVI	2730	806	3894	7772	16070	0	0	0

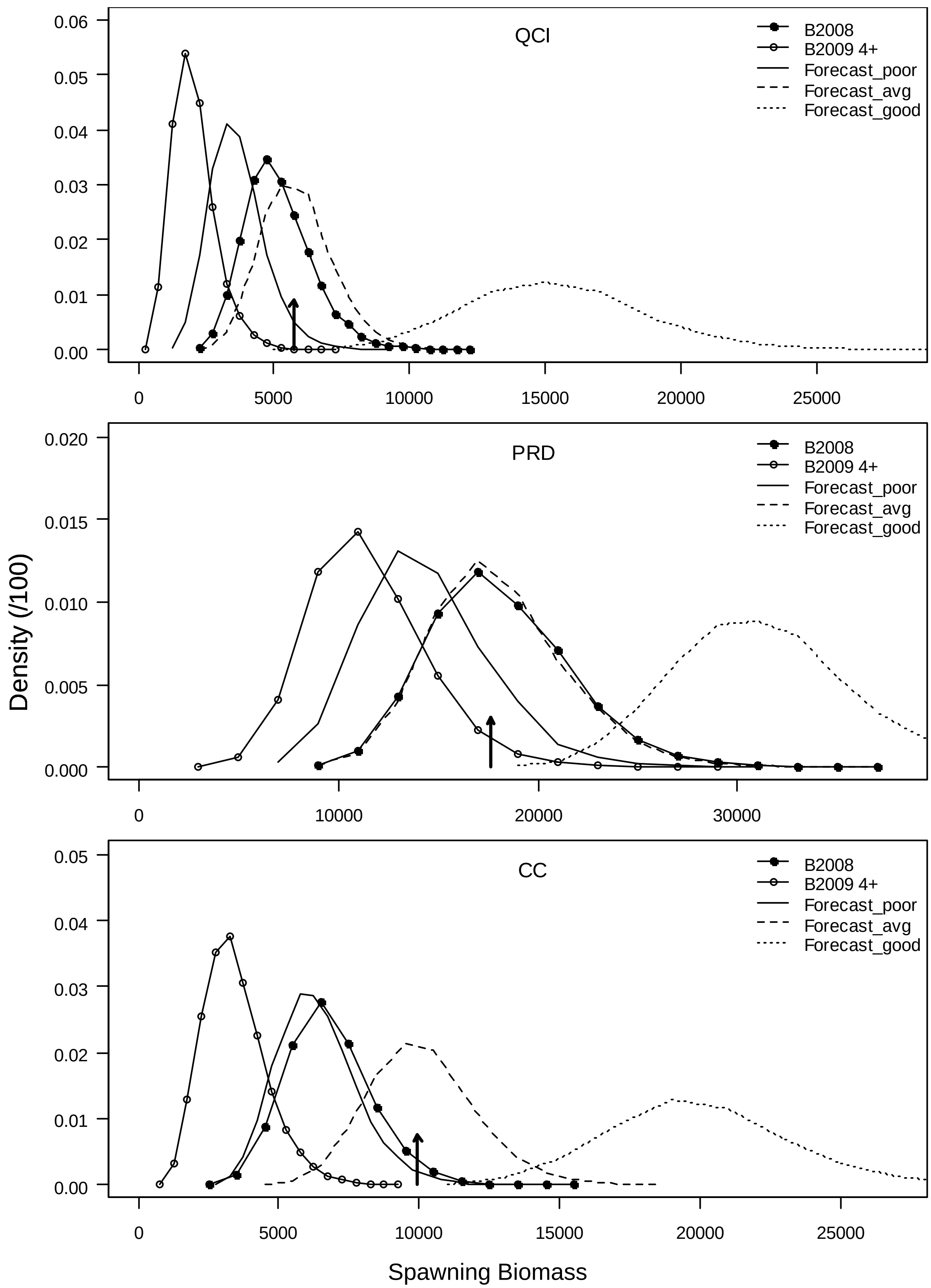


Figure 19. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for spawning biomass in 2008 and the forecast pre-fishery biomass in 2009 for the northern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

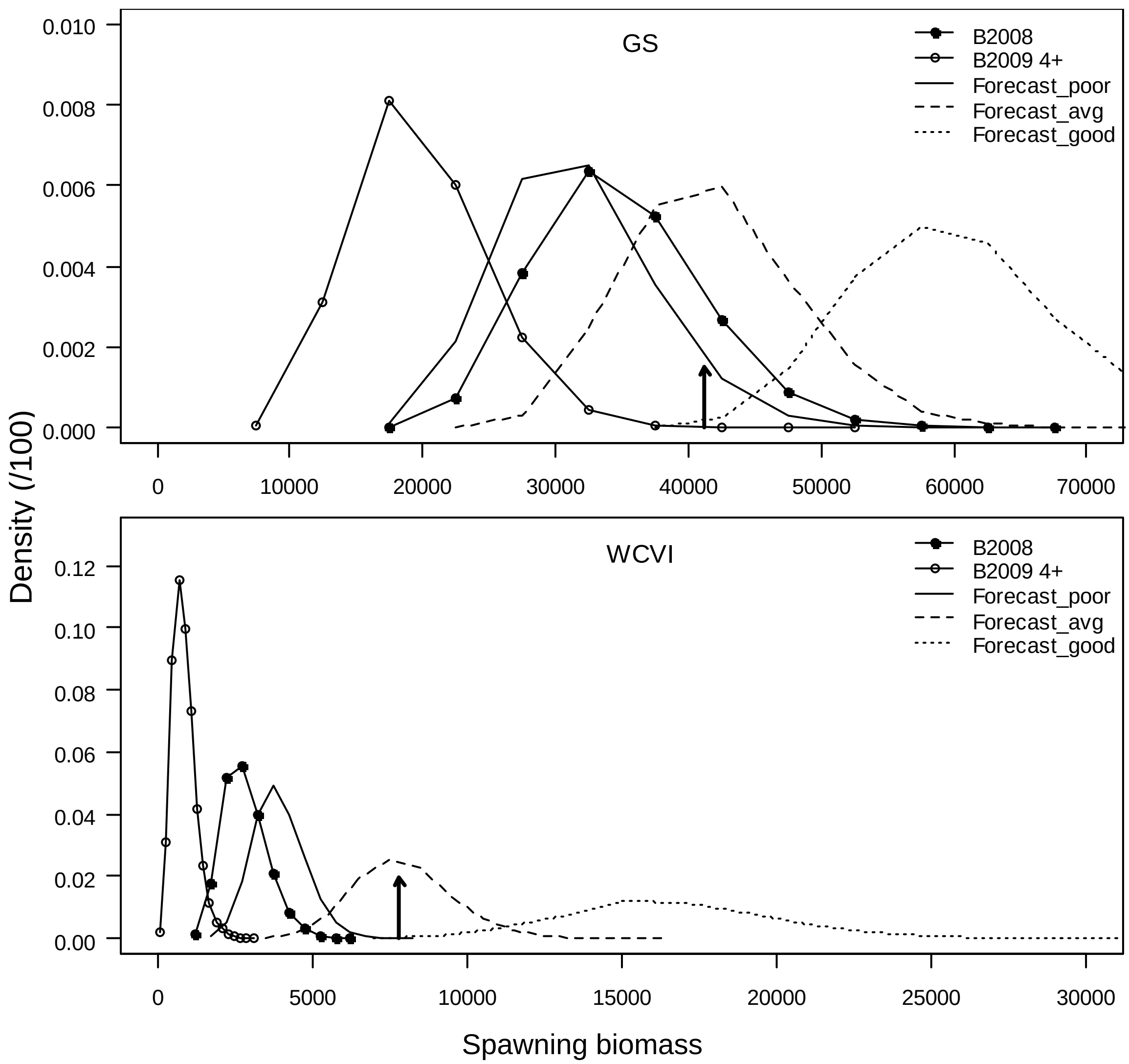


Figure 20. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for the 2008 spawning biomass and the forecast pre-fishery biomass for 2009 for the southern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

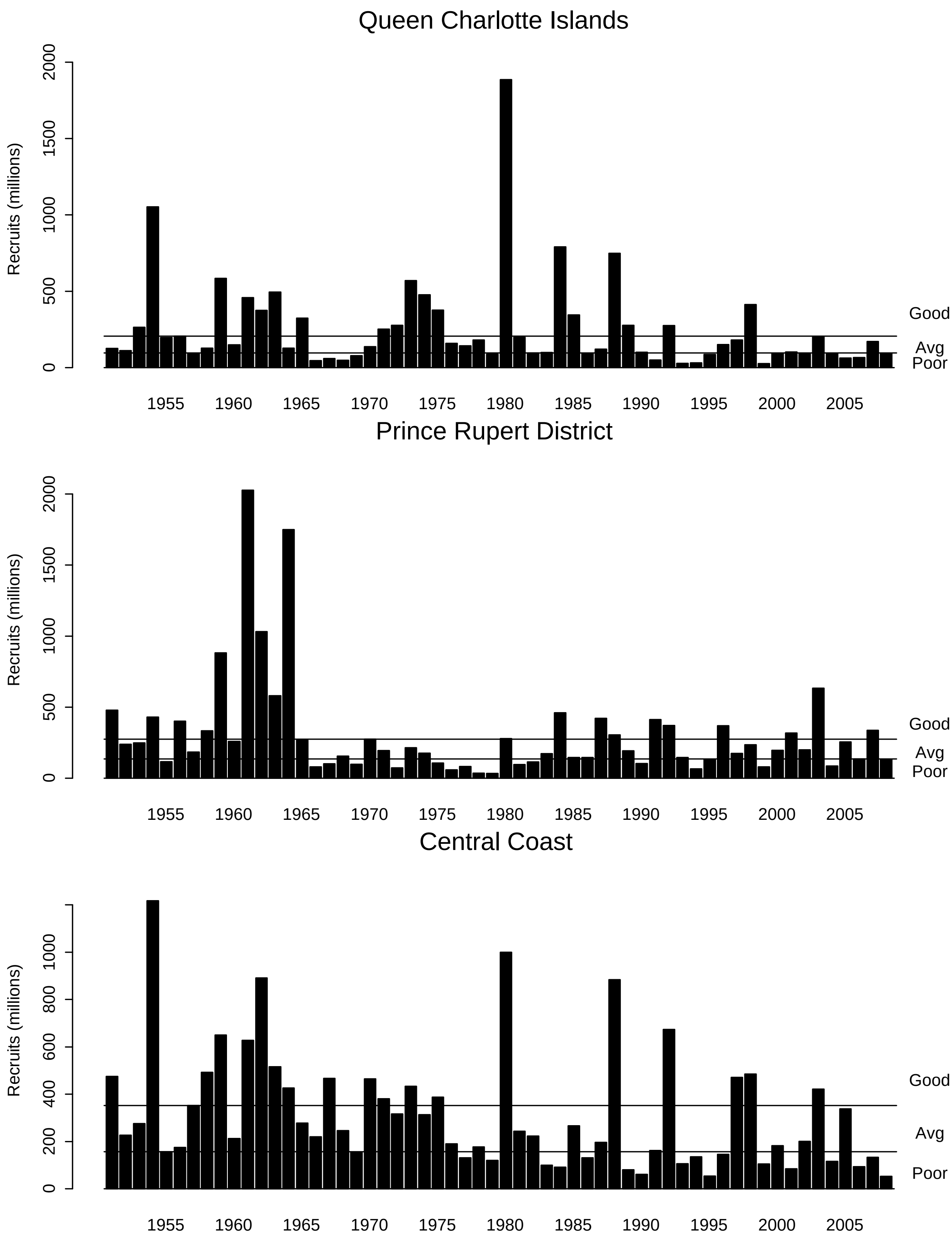


Figure 21. Estimates of abundance of recruiting age 2+ year-classes from age-structured analysis for northern B.C. herring stock assessment regions, 1951-2008. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

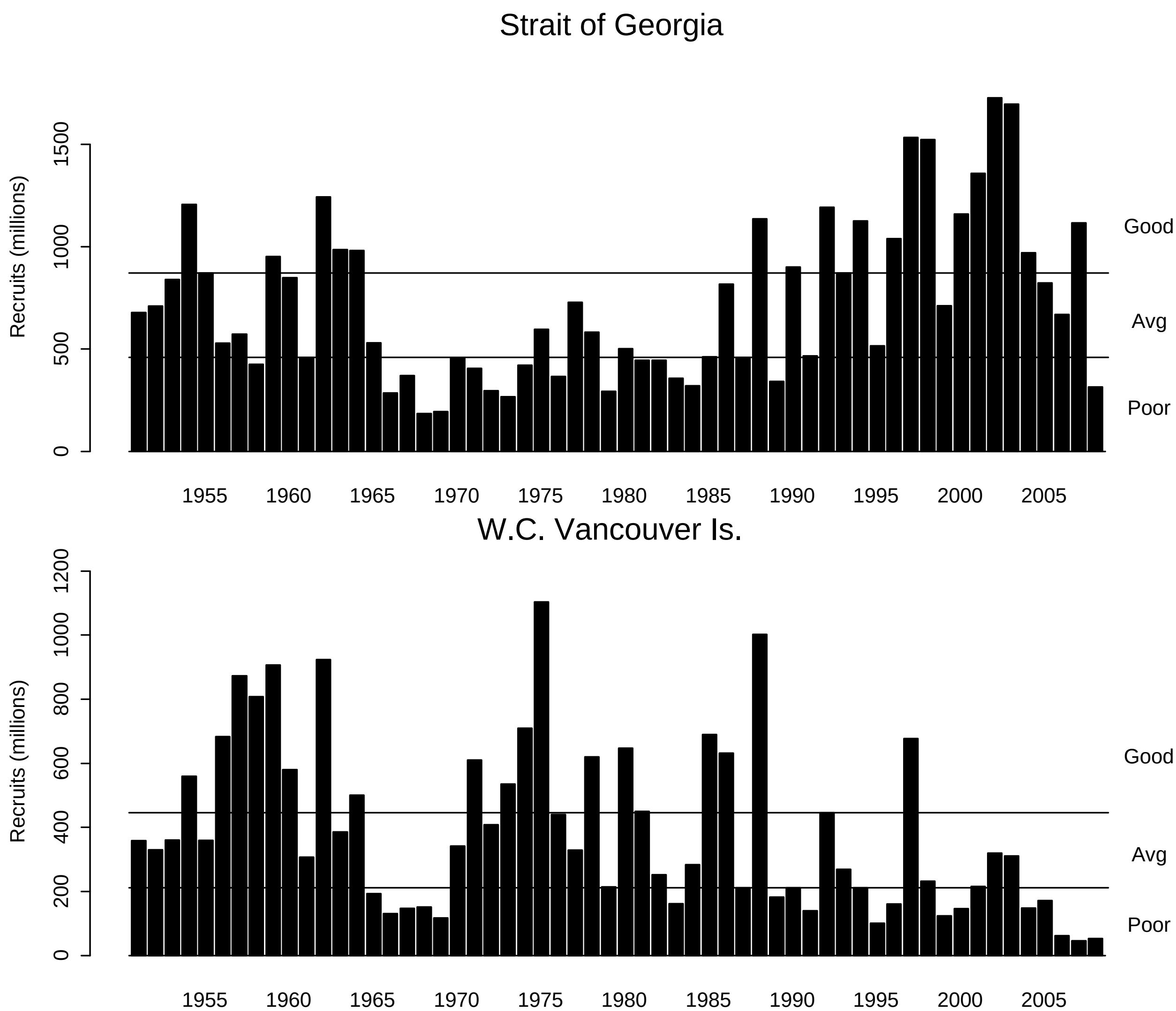


Figure 22. Estimates of abundance of recruiting age 2+ year-classes from age-structured analysis for southern B.C. herring stock assessment regions, 1951-2008. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

MINOR STOCKS – AREA 27 & 2W

Abundance estimates for the minor herring stocks in Areas 2W and 27 were obtained using the HCAMv2 assessment model. Because of data limitations for these two stocks the time series were shortened to the period 1978-2008. For Area 27, the model was fit using the same assumptions as for the major assessment areas. For A2W, the model was fit assuming a single spawn survey proportionality constant for the entire time series. We felt that this was more appropriate because the available spawn estimates with dive are limited and much of the time period is surveyed by surface methods. We also increased the standard deviation on the spawn data from 0.30 to 0.35 in this analysis to allow for greater uncertainty in the spawn data. Given the data limitations in these two areas we continue to recommend a harvest rate of 10% of the forecast biomass rather than 10% of the estimate of current biomass as was the policy in the past.

Area 27

The availability of consistent age structure and spawn deposition data for this stock began in the late 1970s. Some limited biological sampling data was available in the early 1970s but usually consisted of a single sample and was insufficient for catch-age analysis. As a result, the HCAM and HCAMv2 analysis for this stock was begun in 1977/78 to present. The available information on catch and spawning biomass as estimated from the escapement model is presented in Table 3. The HCAMv2 analysis of this stock is consistent and fits the spawn deposition data closely suggesting a spawning biomass ranging between 1-5,000 tonnes (Figure 23). The lowest level occurred in 2001 and the stock has been increasing slowly since then with a modest decline in 2008. The forecast biomass for 2009 based on the HCAMv2 model and assuming an average recruitment is 1324 tonnes (Table 2).

Area 2W

The availability of relatively consistent age structure and spawn deposition estimates for this stock began in the late 1970s and the time series for the model was started in 1978. Unfortunately, there was also a period from 1995-1997 when no biological samples were collected and spawn surveys appear to have been limited through the 1990s. The time series of available catch and spawn deposition data are presented in Table 4 as in previous assessments with spawning biomass determined using the escapement model. The estimate of spawning biomass for the available data suggests a stock varying around 2,000 tonnes but reaching as much as 10,000 tonnes (Figure 23). The limited spawn survey coverage and absence of age structure data through the mid-1990s make it difficult to determine stock size and the model fits closely to the available spawn estimates. The more recent spawn surveys and biological sampling data suggest a stock size of approximately 2,000 tonnes. The forecast biomass for the stock in Area 2W based on the HCAMv2 model and assuming an average recruitment is 1654 tonnes (Table 2).

Table 2. Forecasts of the 2008 biomass for the minor stocks in Areas 27 and 2W assuming poor, average, and good recruitment.

			Forecast Biomass			Available Harvest*		
	2008 SB	2009 – 4+	Poor	Avg	Good	Poor	Avg	Good
Area 27	1443	833	1143	1324	2142	114	132	214
Area 2W	2063	1453	1543	1654	3054	154	165	305

*Assumes a 10% harvest rate.

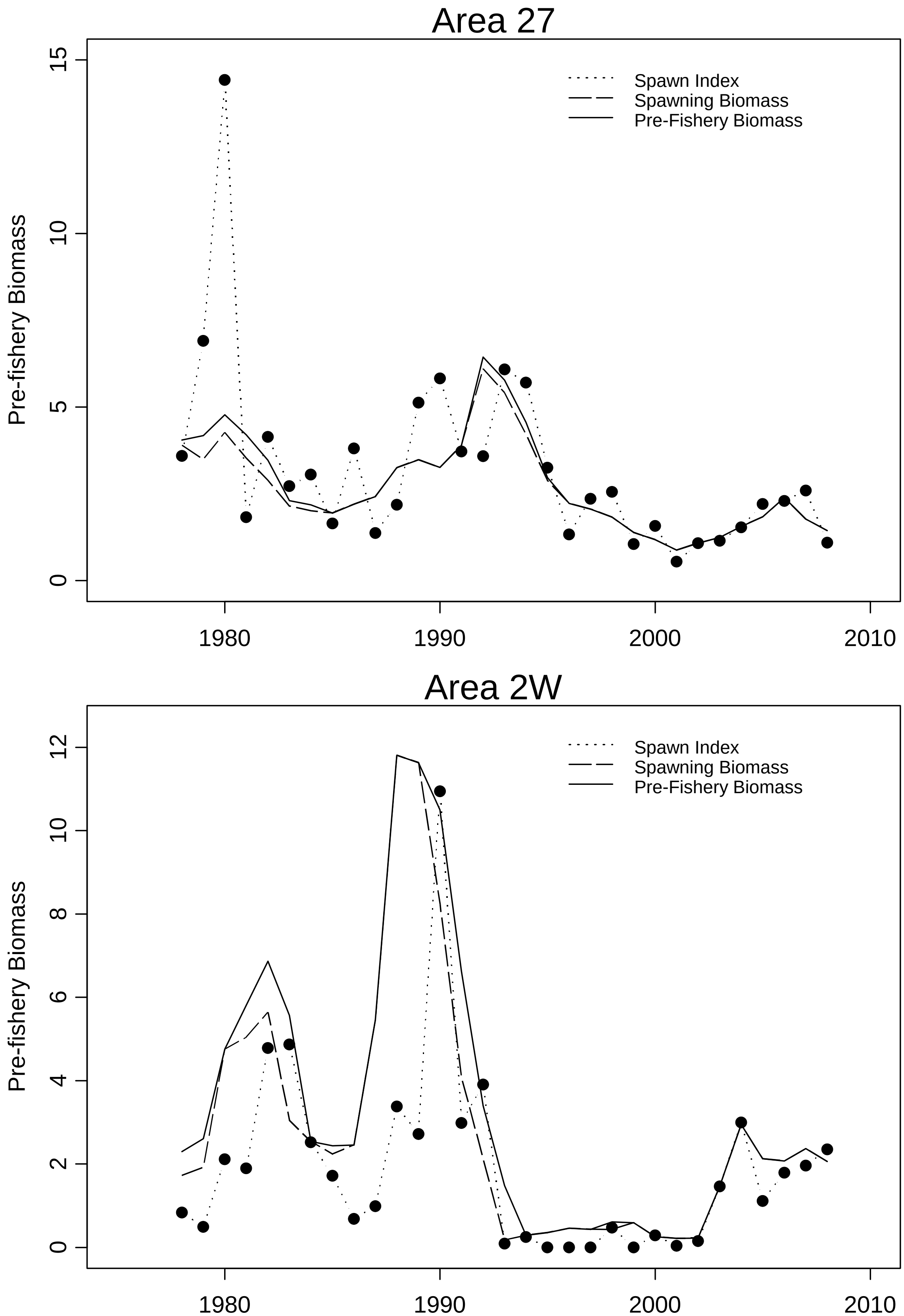


Figure 23. Estimated pre-fishery biomass for the minor stocks in Area 27 and Area 2W.

Table 3. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 27 for 1951-2008.

	Spawn (mt)				Catch (mt)				Total
Season	Surface	Macro	Dive	Total*	Seine	Gillnet	Other	Total	Stock
19501	1,955.24			1,955.24					1,955.24
19512	484.38			484.38					484.38
19523	4,618.03			4,618.03					4,618.03
19534	2,646.44			2,646.44	1,919.89			1,919.89	4,566.33
19545	574.87			574.87	5,938.70			5,938.70	6,513.58
19556	1.47			1.47					1.47
19567	184.03			184.03					184.03
19578	38.62			38.62					38.62
19589	60.47			60.47	407.22			407.22	467.69
19590	223.95			223.95					223.95
19601	168.99			168.99	1,149.06			1,149.06	1,318.05
19612	101.62			101.62	173.05			173.05	274.67
19623	407.30			407.30	30.75			30.75	438.05
19634	0.00			0.00	322.55			322.55	322.55
19645	2,516.54			2,516.54	769.08			769.08	3,285.62
19656	81.73			81.73	951.48			951.48	1,033.21
19667	46.24			46.24	51.42			51.42	97.66
19678	141.68			141.68					141.68
19689T	2,198.42			2,198.42					2,198.42
19690	2,433.72			2,433.72					2,433.72
19701	290.00			290.00					290.00
19712	250.29			250.29					250.29
19723	2,578.17			2,578.17					2,578.17
19734	0.00			0.00	507.91	18.33		526.25	526.25
19745	1,606.18			1,606.18					1,606.18
19756	210.44			210.44		78.62		78.62	289.06
19767	638.19		0.00	638.19					638.19
19778	3,595.03			3,595.03	74.98	75.12	0.00	150.10	3,745.13
19789	6,908.61			6,908.61	422.13	270.40	0.00	692.53	7,601.13
19790	14,419.06			14,419.06		519.26	0.00	519.26	14,938.32
19801	1,828.32			1,828.32		670.95	0.00	670.95	2,499.27
19812	4,136.53			4,136.53	238.49	332.09	0.00	570.58	4,707.11
19823	2,500.47			2,500.47		162.93	0.00	162.93	2,663.41
19834	3,004.22			3,004.22		170.71	0.00	170.71	3,174.93
19845	370.26		1011.75	1,382.00			0.00	0.00	1,382.00
19856	47.10	284.64	3,162.95	3,494.69			0.00	0.00	3,494.69
19867	952.33			952.33			0.00	0.00	952.33
19878	1,612.23			1,612.23			0.00	0.00	1,612.23
19889	1,684.74	122.10	2,804.86	4,611.70			0.00	0.00	4,611.70
19890	3,565.45	37.96	1,608.78	5,212.19			0.00	0.00	5,212.19
19901	2,011.68	11.15	1,190.53	3,213.37	0.09		0.00	0.09	3,213.46
19912	55.30	613.94	2,109.40	2,778.64	335.43		0.00	335.43	3,114.07
19923	1,394.34	2,536.51	1,645.78	5,576.63		366.85	0.00	366.85	5,943.49
19934		1,967.85	3,260.94	5,228.78		344.55	0.00	344.55	5,573.33
19945		559.20	1,924.89	2,484.09	87.57		0.01	87.58	2,571.67
19956		14.41	1,319.05	1,333.46			0.02	0.02	1,333.48
19967		61.77	1,901.13	1,962.90			0.00	0.00	1,962.90
19978		214.65	1,940.96	2,155.61			0.00	0.00	2,155.61
19989		153.05	504.40	657.46			0.00	0.00	657.46
19990			1,300.92	1,300.92			0.00	0.00	1,300.92
20001			220.49	220.49			0.00	0.00	220.49
20012		100.68	816.48	917.16			0.00	0.00	917.16
20023		140.56	765.21	905.77			0.00	0.00	905.77
20034		230.06	923.83	1,153.89			0.00	0.00	1,153.89
20045		178.70	1618.23	1,796.93			0.00	0.00	1,796.93
20056		511.29	1425.00	1,936.28			0.00	0.00	1,936.28
20067	601.94	289.87	1,261.89	2,153.61			0.00	0.00	2,153.61
20078	0.00	136.96	612.73	1,093.20			0.00	0.00	1,093.20

* Includes SOK egg removals

Table 4. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 2W for 1951 to 2008.

	Spawn (mt)				Catch (mt)				Total
Season	Surface	Macro	Dive	Total*	Seine	Gillnet	Other	Total	Stock
19523	202.90			202.90					202.90
19567	3.82			3.82	105.83			105.83	109.65
19578	156.88			156.88					156.88
19589	1,915.96			1,915.96					1,915.96
19590	1,569.27			1,569.27					1,569.27
19601	558.49			558.49					558.49
19612	1,715.31			1,715.31					1,715.31
19623	1,436.26			1,436.26					1,436.26
19634	968.87			968.87	312.49			312.49	1,281.35
19645	439.48			439.48	1,251.27			1,251.27	1,690.75
19656	23.51			23.51	172.37			172.37	195.87
19667	261.65			261.65					261.65
19678	72.62			72.62					72.62
19689	593.04			593.04					593.04
19690	576.86			576.86					576.86
19701	603.53			603.53					603.53
19712	1,010.77			1,010.77					1,010.77
19723	1,603.60			1,603.60	705.73			705.73	2,309.33
19734	1,674.84			1,674.84	403.25			403.25	2,078.09
19745	1,153.98			1,153.98	449.34			449.34	1,603.31
19756	826.10			826.10					826.10
19767	1,174.40			1,174.40				0.00	1,174.40
19778	831.97			831.97	574.68			574.68	1,406.66
19789	494.02			494.02	690.59			690.59	1,184.61
19790	2,114.38			2,114.38					2,114.38
19801	1,811.18			1,811.18	770.26			770.26	2,581.44
19812	4,781.24			4,781.24	1,225.32			1,225.32	6,006.56
19823	4,869.26			4,869.26	2,518.17			2,518.17	7,387.44
19834	2,522.18			2,522.18					2,522.18
19845	1,719.33			1,719.33	199.47			199.47	1,918.80
19856	683.72			683.72					683.72
19867	988.92			988.92					988.92
19878	3,380.16			3,380.16					3,380.16
19889	2,718.92			2,718.92					2,718.92
19890	2,787.76		8,157.95	10,945.72	2,271.92			2,271.92	13,217.64
19901	355.53	170.74	2,459.14	2,985.41	2,558.29			2,558.29	5,543.70
19912		169.14	3,740.13	3,909.28	1,283.54			1,283.54	5,192.62
19923	0.61	12.54	76.16	89.31	1,305.66			1,305.66	1,394.98
19934		17.13	231.10	248.24					248.24
19978		13.70	455.21	468.91	179.63			179.63	648.53
19990		145.60	142.79	288.39					288.39
20001			34.58	34.58					34.58
20012		13.39	135.89	149.28					149.28
20023	1,461.95			1,461.95					1,461.95
20034	10.94	345.16	2,639.56	2,995.66					2,995.66
20045	226.33	18.08	330.69	575.09					575.09
20056	1,790.51			1,790.51					1,790.51
20067	1,468.69			1,468.69					1,468.69
20078	1,999.61			2,349.47					2,349.47

*Includes SOK egg removals

POTENTIAL HARVESTABLE

The Pacific Science Advice Review Committee (PSARC) has reviewed the biological basis for target exploitation rate, considering both the priority of assuring conservation of the resource and allowing sustainable harvesting opportunities (J. Schweigert and D. Ware. Pacific Biological Station, Nanaimo, BC V9T 6N7. H95-2, unpublished data). The review concluded that 20% is an appropriate exploitation rate for those stocks that are well above Cutoff or minimum spawning biomass threshold levels (PSARC 1995). The 20% harvest rate is based on an analysis of stock dynamics which indicates this level will stabilize both catch and spawning biomass while foregoing minimum yield over the long term (Hall et al. 1988, Zheng et al. 1993). In addition to the 20% harvest rate, a Cutoff level, set at 25% of the estimated unfished biomass, is used to ensure that adequate spawning biomass to sustain each population during natural reductions in stock productivity is maintained. To increase the probability that spawning biomass will be maintained above the Cutoff level, for those stocks which are marginally above Cutoff the following reduced catch level is recommended:

Catch = Forecast Run - Cutoff

This will provide for smaller fisheries in areas where the 20% harvest rate would bring the escapement down to levels below the Cutoff.

Cutoff levels have been established by estimating unfished or virgin biomass with a stock-recruitment relationship or by bootstrapping the historical recruitment time series. The Cutoff levels for the five major migratory stocks are:

	1992/93 Cutoff[a]	1994/95 Cutoff	1996/97 Cutoff	**Current Cutoff**
Queen Charlotte Islands	11700	10700	10700	**10700**
Prince Rupert District	12100	12100	12100	**12100**
Central Coast	10600	18800	17600	**17600**
Strait of Georgia	22100	21200	21200	**21200**
W.C. Vancouver Island	20300	18800	18800	**18800**

[a] - Cutoff level based on simulation model with stock-recruitment relationship, and two assessment areas on the WCVI.

It is important to note that the current Cutoff represents a commercial fishery fishing threshold rather than a conservation threshold or reference point. It is a reference point intended to maintain the reproductive capacity of the stock. Thus, even when a stock is near (or below) the stock-specific Cutoff, conservation concerns may be unwarranted as this information alone is insufficient to conclude that a stock may be at risk. The current commercial fishery Cutoff is used to maintain stock productivity or rebuild stock biomass following years when stock size decreases below the Cutoff.

Predicting recruitment for Pacific herring, as with most fish species, is difficult. In the absence of independent information, the scientific advice has been to assume an average recruitment to minimize forecasting errors. Currently, recruitment forecasting has been tested and validated for only the SG and WCVI stocks by PSARC. This forecast relies upon independent, offshore survey data collected during the summer prior to the recruitment of age-2+ fish to the spawning population. Recruitment forecasting methodologies are being developed for other herring stocks but none are currently in routine use. Therefore, a decision on the level of recruitment to be used in the forecast must be made in the absence of independent data. The decision about recruitment strength must be consistent with the precautionary approach to fisheries management while assuring harvest opportunities are not unduly restricted.

In the absence of alternative recruitment forecasting methods, the following rules have been adopted in developing the abundance forecast:

1. If the pre-fishery biomass was below Cutoff in the previous year, then assume POOR recruitment for the forecast. The modified harvest rule is likely to apply.

2. If the pre-fishery biomass was above Cutoff in the previous year and recruitment has been GOOD in the two previous years, then assume GOOD recruitment for the forecast.

3. If Rule 1 or Rule 2 DOES NOT APPLY then assume AVERAGE recruitment for the forecast. The modified harvest rule may apply.

The harvest of minor stocks is also conducted in a precautionary manner given that no forecast of abundance in the upcoming season is made. The harvest rule for minor stocks has been that a maximum of 10% of the estimated abundance in the current season may be harvested in the coming season. The harvest rule is based on the assumption that minor herring stock dynamics are consistent with the major migratory stocks which can sustain substantially higher rates of harvest. (Hall et al. 1988, Zheng et al. 1993).

SIZE AT AGE TRENDS

Inter-annual changes in growth rate of herring can have significant impacts on the size at age and consequently on estimates of stock productivity and availability to the harvesting sectors. Concern about declining size of herring in the late 1990s continues with no obvious indication of an increase in recent years except perhaps with age 3 fish in a few areas in 2008 (Fig. 21). Trends in size at age continues to be monitored and since 1999 have been incorporated into the management decision making process by providing an indication of the proportion of the stock estimated to be available to the gillnet sector.

ACKNOWLEDGEMENTS

Chuck Fort and Kristen Daniel updated the catch, biological sampling and spawn survey data bases and reviewed all 2008 assessment data. Howard Stiff provided programming support for the Access databases used to summarize the assessment data series. Funding for test fishing and spawn surveys was provided by DFO through Larocque relief funds through a contact to the HCRS. The industry through a modified test fishing program augmented biological sampling support in Georgia Strait and the Prince Rupert area. Jaclyn Cleary provided helpful comments on the final version of the report and prepared some of the figures.

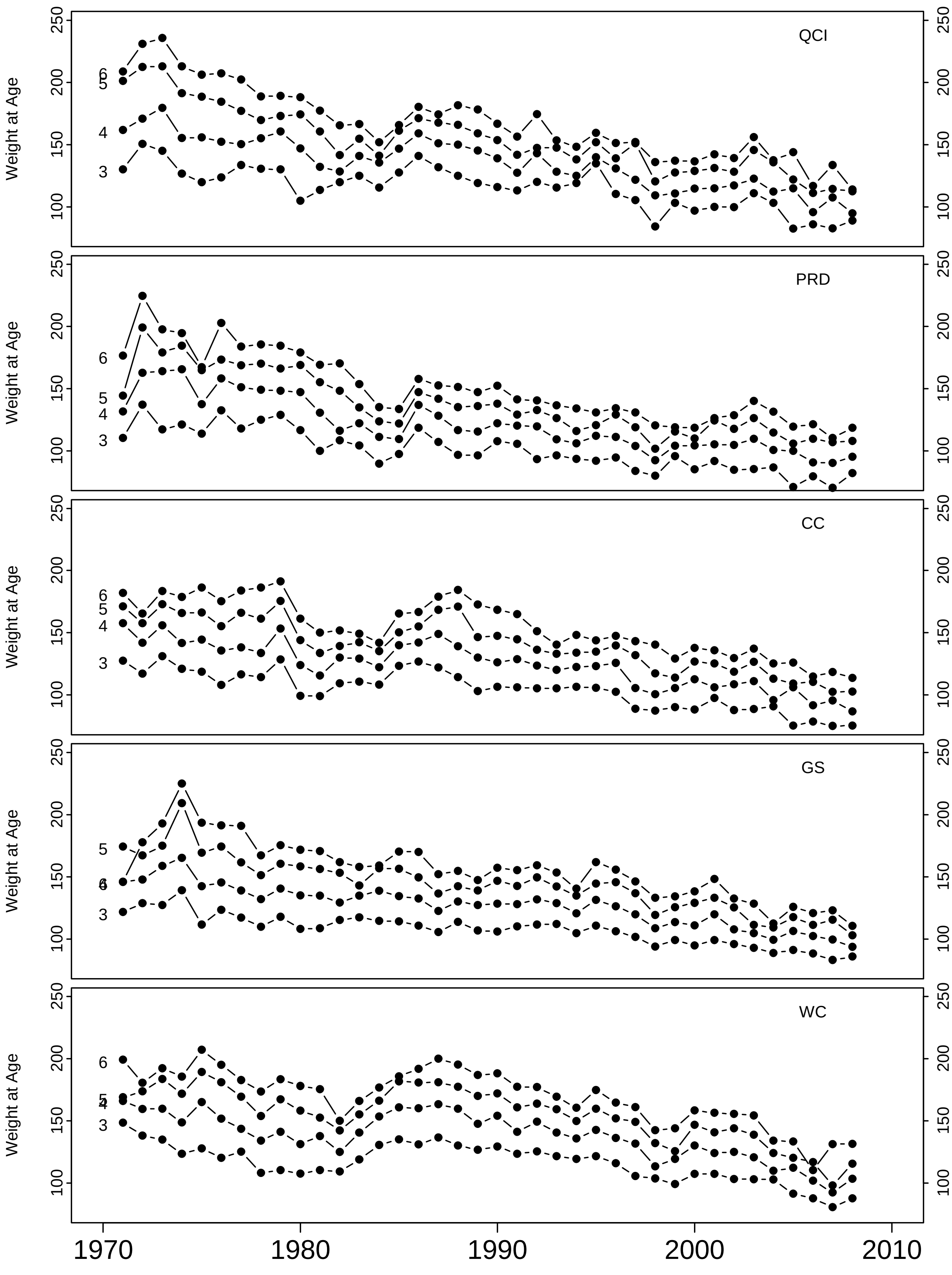


Figure 24. Estimates of weight-at-age (g) for 3-6 year old herring from 1951-2008 for the five major assessment regions.

REFERENCES

Christensen, L.B., Haist, V., and J. Schweigert. 2008. Modeling herring population dynamics: herring catch-at-age model version 2. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/073. iv + 64 p.

Fournier, D. A., Sibert, J. R., Majkowski, J., and J. Hampton. 1990. MULTIFAN: a likelihood-based method for estimating growth parameters and age composition from multiple length frequency data sets illustrated using data for southern bluefin tuna (*Thunnus maccoyii*). Can. J. Fish. Aquat. Sci. 47: 301–317.

Francis, R.I.C.C. 2003. Analyses supporting the 2002 stock assessment of hoki. New Zealand Fisheries Assessment Report 2003/5. 34 p.

Francis, R.I.C.C. 1992. Use of risk analysis to assess fishery management strategies: a case study using orange roughy (*Hoplostethus atlanticus*) on the Chatham Rise, New Zealand. Can. J. Fish. Aquat. Sci. 49: 922-930.

Fu, C., Schweigert, J.F., and C.C. Wood. 2004. An evaluation of alternative age-structured models for risk assessment of Pacific herring stocks in British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/011: 59p.

Gelman, A., Carlin, J.B., Stern, H.S., and D. B. Rubin. 1995. Bayesian data analysis. Chapman and Hall, London.

Gudmundsson, G. 1994. Time series analysis of catch-at-age observations. Applied Statistician 43:117-126.

Haist, V., and L. Rosenfeld. 1988. Definitions and codings of localities, sections and assessment regions for British Columbia herring data. Can. MS Rep. Fish. Aquat. Sci. 1994: 123p.

Haist, V., and J. Schweigert. 2006. Catch-age models for Pacific herring: Evaluation of alternative assumptions about fishery and stock dynamics and alternative error distributions. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/064: 55p.

Hall, D. L., Hilborn, R., Stocker, M., and C. J. Walters. 1988. Alternative harvest strategies for Pacific herring (*Clupea harengus pallasi*). Can. J. Fish. Aquat. Sci. 45: 888-897.

Mace, P. M., and I. J. Doonan. 1988. A generalized bioeconomic simulation model for fish population dynamics. New Zealand Fisheries Assessment Research Document Number 88/4, Wellington, New Zealand.

Myers, R.A., Barrowman, N.J., Hilborn, R., and D.G. Kehler. 2002. Inferring Bayesian priors with limited direct data: applications to risk analysis. N. Am. J. Fish. Manag. 22: 351-364.

Otter Research Limited. 2000. An introduction to AD model builder, version 4: For use in nonlinear modelling and statistics. Otter Research Limited. Sydney, B.C. Canada. 127p.

Schweigert, J. and V. Haist. 2007. Stock assessment for British Columbia herring in 2006 and forecasts of the potential catch in 2007. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/002: 67p.

Schweigert, J. 2005. An assessment framework for Pacific herring (*Clupea pallasi*) in British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/083: 35p.

Schweigert, J. 2004. Stock assessment for British Columbia herring in 2004 and forecasts of the potential catch in 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/081: 95p.

Shields, T.L., Jamieson, G.S., and P.E. Sprout. 1985. Spawn-on-kelp fisheries in the Queen Charlotte Islands and the northern British Columbia coast – 1982 and 1983. Can. Tech. Rep. Fish. Aquat. Sci. 1372: 53p.

Starr, P. J., Bentley, N., and M.N. Maunder. 1999. Stock assessment of two New Zealand rock lobster substocks. New Zealand Fisheries Assessment Research Document 99/34. pp 44.

Zheng, J., F. C. Funk, G. H. Kruse, and R. Fagen. 1993. Threshold management strategies for Pacific herring in Alaska. In: Proc. Int. Symp. on Management Strategies for Exploited Fish Populations. Alaska Sea Grant Report 93-02. Univ. Alaska Fairbanks.

APPENDICES

Appendix 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	PERCENT AT AGE 0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	(millions)
19501	Seine	Jan-Apr	0.00	0.07	15.31	52.91	15.31	11.52	4.20	0.61	0.07	0.00	89.7	1,476	2,847	31.744
19512	Seine	Jan-Apr	1.92	24.77	20.96	29.67	17.98	3.71	0.93	0.07	0.00	0.00	78.4	2,251	10,147	122.347
19534	Seine	Jan-Apr	0.06	2.90	29.02	21.28	33.66	10.19	1.93	0.71	0.19	0.06	77.1	0 *	1,786	23.168
19545	Seine	Oct-Dec	0.00	8.74	14.08	39.42	18.06	14.85	4.37	0.29	0.10	0.10	94.1	0 *	99	1.047
	Seine	Jan-Apr	0.00	8.74	14.08	39.42	18.06	14.85	4.37	0.29	0.10	0.10	94.1	0 *	1,136	12.066
19556	Seine	Jan-Apr	0.00	0.15	16.02	9.64	62.17	8.38	2.74	0.74	0.00	0.15	118.2	1,348	77,681	657.044
19567	Seine	Jan-Apr	0.07	20.71	24.66	15.96	9.38	26.29	2.37	0.44	0.11	0.00	103.3	4,423	23,711	227.806
19578	Seine	Oct-Dec	0.00	81.58	16.68	1.26	0.18	0.14	0.14	0.00	0.00	0.00	52.1	2,769 +	721	13.844
	Seine	Jan-Apr	0.00	81.98	16.24	1.29	0.20	0.16	0.12	0.00	0.00	0.00	51.8	2,475	10,426	201.343
	Seine	May-Sep	0.00	81.58	16.68	1.26	0.18	0.14	0.14	0.00	0.00	0.00	52.1	2,769 +	19	0.357
19589	Seine	Oct-Dec	0.00	1.05	63.16	28.42	7.37	0.00	0.00	0.00	0.00	0.00	92.8	95 +	199	2.140
	Seine	Jan-Apr	0.00	1.05	63.16	28.42	7.37	0.00	0.00	0.00	0.00	0.00	92.8	95 +	6,828	73.560
19601	Seine	Jan-Apr	0.00	4.21	32.63	36.00	24.84	1.26	0.42	0.21	0.42	0.00	97.7	0 *	576	5.901
	Seine	May-Sep	0.00	4.21	32.63	36.00	24.84	1.26	0.42	0.21	0.42	0.00	97.7	0 *	77	0.789
19612	Seine	Jan-Apr	0.00	2.57	38.97	44.12	5.88	7.35	0.74	0.37	0.00	0.00	114.0	272 +	7,632	66.952
19623	Seine	Jan-Apr	0.00	0.37	50.00	27.11	18.16	2.11	1.99	0.00	0.12	0.12	109.5	804	14,705	134.232
	Seine	May-Sep	0.00	0.37	50.00	27.11	18.16	2.11	1.99	0.00	0.12	0.12	109.5	804 +	275	2.508
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490	28,600	251.046
	Seine	May-Sep	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	131	1.154
	Trawl	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	46	0.401
19645	Seine	Jan-Apr	0.00	1.71	82.31	10.25	3.63	1.34	0.55	0.20	0.00	0.00	101.5	1,019	35,304	348.556
	Seine	May-Sep	0.00	1.67	81.75	10.30	4.02	1.47	0.59	0.20	0.00	0.00	102.0	1,019 +	145	1.419
19656	Seine	Jan-Apr	0.00	18.36	32.77	16.38	10.40	7.45	5.89	4.92	2.07	1.75	130.7	0 *	2,746	21.016
19667	Seine	Jan-Apr	0.00	0.88	67.25	26.49	2.65	2.72	0.00	0.00	0.00	0.00	113.0	0 *	213	1.883
19678	Seine	Jan-Apr	0.00	29.95	50.57	17.23	2.25	0.00	0.00	0.00	0.00	0.00	94.9	0 *	80	0.843
19701	Seine	Jan-Apr	0.00	6.50	50.40	29.30	8.00	4.30	0.80	0.50	0.20	0.00	118.1	0 *	102	0.861
19712	Seine	Jan-Apr	0.00	3.59	34.24	40.98	12.30	5.57	2.14	0.77	0.35	0.06	142.1	1,184	3,972	27.954
19723	Seine	Jan-Apr	0.00	0.20	32.91	18.91	32.99	11.77	2.10	1.13	0.00	0.00	140.7	1,726	7,520	49.735
19734	Seine	Jan-Apr	0.00	0.12	27.40	41.39	17.67	10.64	2.32	0.40	0.06	0.00	126.8	1,215	6,191	47.881
	Gillnet	Jan-Apr	0.00	0.00	5.73	48.41	25.48	16.56	3.18	0.00	0.00	0.64	153.8	157 +	127	0.824
19745	Seine	Jan-Apr	0.00	0.62	27.82	36.04	24.53	8.53	1.94	0.40	0.12	0.00	132.8	6,010	7,602	60.181
	Seine	May-Sep	0.00	0.13	33.28	45.41	13.55	5.29	1.72	0.46	0.17	0.00	116.3	3,026 +	17	0.147
	Gillnet	Jan-Apr	0.00	0.00	0.00	22.50	40.00	30.00	5.00	2.50	0.00	0.00	169.3	40 +	105	0.619
19756	Seine	Jan-Apr	0.00	0.30	2.98	44.51	31.53	15.24	4.61	0.76	0.06	0.00	155.4	4,055	11,939	82.499
	Seine	May-Sep	0.00	0.44	2.81	36.87	29.25	23.18	6.41	0.96	0.07	0.00	151.8	4,055 +	374	2.466
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.75	21.80	60.90	14.29	2.26	0.00	0.00	196.2	133 +	1,802	9.186
19767	Seine	Jan-Apr	0.00	0.05	18.42	9.26	36.66	22.74	9.92	2.64	0.31	0.00	159.1	3,178	11,125	73.628
	Seine	May-Sep	0.00	0.09	19.67	8.12	29.70	22.91	14.66	4.44	0.41	0.00	157.1	3,178 +	21	0.132
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.53	16.61	39.71	27.08	11.55	2.17	0.36	196.6	277 +	1,489	7.575
19778	Seine	Jan-Apr	0.00	0.16	22.75	17.10	11.34	33.12	13.29	2.03	0.17	0.05	146.4	1,172	9,172	62.947
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	11.81	20.14	38.89	20.14	4.17	0.69	196.9	144 +	2,553	12.967
19789	Seine	Oct-Dec	0.00	6.22	4.91	32.53	18.23	20.31	14.19	3.06	0.44	0.11	149.9	916 +	50	0.336
	Seine	Jan-Apr	0.00	7.06	5.39	32.35	18.23	20.80	12.45	3.08	0.51	0.13	148.9	779	5,817	39.078
	Gillnet	Jan-Apr	0.00	0.00	0.00	28.24	25.88	27.06	15.29	3.53	0.00	0.00	160.1	170 +	2,086	13.028
19790	Seine	Jan-Apr	0.00	0.69	83.10	4.49	5.44	2.58	1.79	1.22	0.60	0.09	97.1	2,986	2,106	22.050
	Gillnet	Jan-Apr	0.00	0.00	6.50	4.56	44.47	19.36	19.58	4.20	1.34	0.00	157.6	518	1,210	7.739
19801	Seine	Jan-Apr	0.00	0.42	3.05	85.37	5.13	3.08	1.92	0.68	0.21	0.14	116.3	5,551	3,888	32.912
	Seine	May-Sep	0.00	1.33	3.92	88.65	2.94	1.73	0.69	0.35	0.23	0.17	112.7	1,735 +	39	0.342
	Gillnet	Jan-Apr	0.00	0.00	0.30	72.00	8.55	9.84	5.88	2.84	0.60	0.00	141.9	790	1,705	11.930
19812	Seine	Jan-Apr	0.00	0.45	3.26	3.50	87.61	2.19	1.34	0.95	0.57	0.12	127.2	3,526	2,353	18.420
	Seine	May-Sep	0.00	0.85	4.68	4.48	84.32	2.47	1.53	0.99	0.54	0.14	128.0	3,526 +	18	0.138
	Gillnet	Jan-Apr	0.00	0.00	0.21	3.35	89.10	3.35	2.31	1.05	0.42	0.21	141.9	477	1,407	9.918
19823	Seine	Jan-Apr	0.00	4.14	4.21	3.02	5.75	77.05	3.65	1.33	0.70	0.14	148.7	1,425	4,601	30.942
	Seine	May-Sep	0.00	4.88	5.23	3.51	6.86	72.87	3.91	1.58	0.91	0.25	146.9	1,968 +	67	0.457
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.19	2.38	90.32	2.72	2.38	0.51	0.51	158.5	589	929	5.860
19834	Seine	Jan-Apr	0.00	2.09	36.57	4.17	2.64	9.56	43.33	1.11	0.35	0.17	126.1	3,484	4,054	31.997
	Seine	May-Sep	0.00	2.70	36.39	4.54	2.87	10.10	41.76	1.12	0.34	0.17	125.5	3,484 +	58	0.459
	Gillnet	Jan-Apr	0.00	0.00	2.81	1.28	4.60	8.95	80.05	1.79	0.26	0.26	154.6	391 +	535	3.459
19845	Seine	Jan-Apr	0.00	0.12	8.63	25.14	3.52	3.93	12.79	45.24	0.53	0.10	146.4	3,099	4,581	27.888
	Seine	May-Sep	0.00	0.10	8.15	24.49	3.51	3.95	12.94	46.22	0.54	0.10	165.5	2,025 +	35	0.209
	Gillnet	Jan-Apr	0.00	0.00	8.30	24.48	2.90	4.56	12.45	46.89	0.41	0.00	155.0	241 +	1,493	9.632
19856	Seine	Jan-Apr	0.00	0.16	2.00	21.05	37.46	3.69	3.28	8.88	23.03	0.43	165.5	4,462	2,613	15.278
	Trawl	Jan-Apr	0.00	0.31	2.80	10.56	37.58	8.70	9.63	11.18	17.70	1.55	163.5	322	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	12.73	53.42	4.04	5.28	9.01	15.22	0.31	159.7	322 +	890	5.576
19867	Seine	Jan-Apr	0.00	1.78	9.60	4.90	24.93	38.44	3.88	4.36	5.86	6.24	158.6	2,916	2,028	12.787
	Seine	May-Sep	0.00	1.74	10.42	5.85	24.35	37.76	3.84	4.33	5.79	5.91	157.2	3,281 +	33	0.210
19878	Seine	Jan-Apr	0.00	3.64	51.01	7.52	4.77	11.75	14.86	1.37	1.67	3.40	123.6	1,676	0	0.000 ~
	Seine	May-Sep	0.00	1.34	41.98	5.34	3.24	14.50	22.71	1.91	1.72	7.25	136.5	524 +	32	0.232
	Trawl	Jan-Apr	0.00	1.33	68.11	11.63	1.66	6.98	6.64	1.33	1.66	0.66	105.4	301	0	0.000 ~
19889	Seine	Jan-Apr	0.00	3.43	5.12	85.99	3.74	0.18	0.77	0.47	0.08	0.22	119.2	2,996	1,449	11.972
	Seine	May-Sep	0.00	1.27	31.75	45.90	4.03	2.55	7.00	4.81	1.06	1.63	117.4	1,414 +	13	0.108
19890	Seine	Jan-Apr	0.00	0.14	10.61	6.53	78.55	2.43	0.33	0.85	0.34	0.23	133.9	4,769	5,542	39.649
	Gillnet	Jan-Apr	0.00	0.00	0.51	8.18	44.50	9.97	8.44	17.39	8.44	2.56	149.6	391 +	1,170	7.821
19901	Seine	Jan-Apr	0.00	5.60	4.25	10.74	33.21	33.99	3.68	2.00	4.70	1.84	127.8	2,448	3,899	30.506
	Trawl	Jan-Apr	0.00	1.06	4.26	8.51	21.28	46.81	4.26	6.38	4.26	3.19	143.0	94	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.27	22.44	43.47	9.66	7.10	10.23	4.83	151.9	352 +	543	3.576
19912	Seine	Jan-Apr	0.00	1.05	30.50	4.25	8.27	4.46	48.40	2.42	0.14	0.52	143.2	3,228	2,524	16.695
	Trawl	Jan-Apr	0.00	1.08	54.84	9.68	2.15	15.05	11.83	3.23	2.15	0.00	115.6	93	0	0.000 ~

Appendix 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH		
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged		(tonnes)	(millions)
19923	Seine	Jan-Apr	0.00	0.04	2.79	67.33	4.25	4.68	9.73	9.95	0.87	0.36	124.2	2,755		2,699	21.742
	Trawl	Jan-Apr	0.00	1.75	4.68	59.65	5.85	6.43	11.70	7.02	2.34	0.58	125.9	171		0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.27	22.44	43.47	9.66	7.10	10.23	4.83	151.9	352	+	0	0.002
19934	Seine	Jan-Apr	0.00	5.50	5.50	5.63	40.75	12.87	14.48	11.13	3.49	0.67	130.5	746		299	2.291
	Trawl	Jan-Apr	0.00	7.08	2.36	5.42	53.30	8.49	6.60	8.49	7.31	0.94	133.0	424		0	0.000 ~
19945	Seine	Jan-Apr	0.00	14.35	15.82	2.32	4.43	37.55	9.70	8.02	5.27	2.53	134.8	474		0	0.000 ~
19956	Seine	Jan-Apr	0.10	10.76	53.81	9.30	3.24	3.34	15.57	2.40	1.15	0.31	102.8	957		0	0.000 ~
19967	Seine	Jan-Apr	0.00	22.64	26.17	33.41	5.23	1.52	4.44	5.36	0.85	0.37	97.5	1,643		0	0.000 ~
19978	Seine	Jan-Apr	0.00	0.16	58.12	27.55	9.74	2.53	0.48	0.40	0.63	0.40	87.9	1,263		1,372	15.597
19989	Seine	Jan-Apr	0.00	3.71	2.16	65.00	16.83	8.03	2.78	0.67	0.41	0.41	105.9	1,943		2,500	23.604
	Gillnet	Jan-Apr	0.00	0.00	0.67	30.78	22.80	29.12	9.98	2.66	1.33	2.66	131.4	601		473	3.596
19990	Seine	Jan-Apr	0.00	3.63	17.30	3.71	60.69	8.26	5.25	0.39	0.62	0.15	106.9	1,295		1,764	16.500
20001	Seine	Jan-Apr	0.00	15.26	31.65	22.32	5.06	20.92	3.05	1.39	0.26	0.09	97.0	1,147		0	0.000 ~
20012	Seine	Jan-Apr	0.00	20.84	22.90	25.47	12.99	3.11	12.83	1.36	0.43	0.08	93.6	2,572		706	7.543
20023	Seine	Jan-Apr	0.00	0.08	68.16	18.33	6.43	3.24	1.13	2.10	0.40	0.12	96.7	2,472		0	0.000 ~
20034	Seine	Jan-Apr	0.00	29.35	2.37	50.65	8.76	4.02	2.60	1.42	0.59	0.24	91.5	845		0	0.000 ~
20045	Seine	Jan-Apr	0.00	1.30	46.29	15.66	28.57	3.90	2.37	1.22	0.46	0.23	93.9	1,309		0	0.000 ~
20056	Seine	Jan-Apr	0.00	19.07	10.10	42.78	9.40	15.15	2.81	0.42	0.00	0.28	83.3	713		0	0.000 ~
20067	Seine	Jan-Apr	0.00	1.10	45.24	14.29	20.88	5.86	10.26	2.20	0.18	0.00	93.5	546		0	0.000 ~
20078	Seine	Jan-Apr	0.00	9.35	7.39	63.37	7.61	8.59	1.85	1.63	0.00	0.22	87.5	920		0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Oct-Dec	0.03	5.19	18.96	57.83	10.05	5.42	2.27	0.20	0.06	0.00	91.5	3,524	27,192	297.109
	Seine	Jan-Apr	0.09	1.72	15.86	60.43	11.38	6.21	3.79	0.43	0.00	0.09	95.8	1,160	18,674	195.022
19512	Seine	Oct-Dec	0.09	5.32	9.32	33.19	45.08	5.66	0.91	0.40	0.03	0.00	121.7	3,498	42,613	350.112
	Seine	Jan-Apr	0.00	3.96	8.08	34.32	45.41	6.84	1.19	0.16	0.04	0.00	115.7	2,427	9,650	83.415
	Seine	May-Sep	0.05	4.76	8.81	33.65	45.22	6.14	1.03	0.30	0.03	0.00	119.2	5,925 +	116	0.976
19523	Seine	Oct-Dec	0.00	1.46	38.05	28.90	26.40	4.99	0.21	0.00	0.00	0.00	114.7	481	401	3.491
	Seine	Jan-Apr	0.00	1.07	38.17	20.04	24.95	14.29	1.39	0.11	0.00	0.00	107.7	938	1,465	13.601
19534	Seine	Oct-Dec	0.00	0.38	22.98	31.95	27.13	14.48	2.52	0.56	0.01	0.00	114.3	2,138	26,692	232.215
	Seine	Jan-Apr	0.00	8.88	47.88	19.11	13.51	6.76	3.28	0.58	0.00	0.00	83.9	518	584	6.969
19545	Seine	Jan-Apr	0.00	2.25	4.08	70.30	15.80	6.01	1.34	0.22	0.00	0.00	105.2	1,131	17,806	167.544
19556	Seine	Oct-Dec	0.00	10.04	58.11	9.51	18.95	2.55	0.53	0.18	0.12	0.00	83.6	1,683 +	1,602	19.164
	Seine	Jan-Apr	0.00	8.99	59.62	9.14	18.79	2.65	0.66	0.07	0.07	0.00	84.6	1,357	8,580	101.455
19567	Seine	Oct-Dec	0.00	18.02	19.80	35.57	12.24	13.25	0.90	0.22	0.00	0.00	93.8	3,172 +	820	9.056
	Seine	Jan-Apr	0.00	3.83	19.26	42.33	13.46	19.05	1.61	0.41	0.05	0.00	104.8	2,784	19,753	182.450
	Seine	May-Sep	0.00	0.00	7.11	44.95	37.16	9.17	1.38	0.23	0.00	0.00	106.7	436	7,461	69.921
	Trawl	Jan-Apr	0.00	4.08	21.43	52.04	12.24	10.20	0.00	0.00	0.00	0.00	88.3	98	0	0.000 ~
19578	Seine	Oct-Dec	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	1,270	20.260
	Seine	Jan-Apr	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	667	10.640
	Seine	May-Sep	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	2,586	41.259
19589	Seine	Oct-Dec	0.00	1.64	62.11	19.52	5.96	7.16	2.05	1.54	0.01	0.00	98.0	1,592 +	1,629	16.406
	Seine	Jan-Apr	0.00	2.88	61.03	19.34	5.06	7.96	1.81	1.85	0.06	0.00	97.5	1,454	5,629	57.722
	Seine	May-Sep	0.00	1.17	62.96	19.29	6.19	6.74	2.21	1.44	0.56	0.00	98.7	1,592 +	2,899	29.047
	Trawl	Jan-Apr	0.00	3.39	58.98	20.35	5.15	8.73	1.44	1.88	0.06	0.00	97.5	1,592 +	66	0.674
19590	Seine	Oct-Dec	0.00	62.74	8.21	20.55	5.57	1.63	1.10	0.08	0.12	0.00	64.7	1,549	3,125	49.715
	Seine	Jan-Apr	0.00	66.74	7.43	18.52	4.46	1.48	0.94	0.22	0.22	0.00	61.5	1,617	12,513	218.740
	Seine	May-Sep	0.00	5.00	3.26	51.30	20.22	10.65	7.39	1.96	0.22	0.00	115.5	460	2,297	19.897
	Trawl	Oct-Dec	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166 +	72	1.110
	Trawl	Jan-Apr	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166 +	468	7.238
19601	Seine	Oct-Dec	0.00	13.33	69.22	4.76	9.50	2.44	0.44	0.25	0.06	0.00	80.6	1,729	14,879	183.842
	Seine	Jan-Apr	0.00	8.10	60.17	6.91	18.06	4.38	1.74	0.43	0.20	0.00	93.8	2,174	24,244	278.906
	Seine	May-Sep	0.00	10.08	59.51	7.23	17.13	4.07	1.43	0.42	0.13	0.00	93.9	3,903 +	350	4.012
	Trawl	Jan-Apr	0.00	10.25	60.16	7.07	16.63	3.97	1.38	0.41	0.13	0.00	86.7	3,903 +	3,273	37.756
19612	Seine	Oct-Dec	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	633	5.938
	Seine	Jan-Apr	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	25,352	237.877
	Seine	May-Sep	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	346	3.243
	Trawl	Oct-Dec	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496 +	296	2.714
	Trawl	Jan-Apr	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496 +	1,033	9.474
19623	Seine	Oct-Dec	0.00	76.33	15.42	4.46	3.10	0.28	0.35	0.06	0.00	0.00	55.5	1,267	9,769	199.178
	Seine	Jan-Apr	0.00	38.55	15.20	21.58	17.43	3.27	3.61	0.21	0.06	0.10	96.9	1,921	29,142	350.900
	Seine	May-Sep	0.00	60.74	16.33	12.62	7.12	1.42	1.69	0.01	0.00	0.07	74.6	3,188 +	736	11.819
	Trawl	Oct-Dec	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188 +	123	1.526
	Trawl	Jan-Apr	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188 +	457	5.653
19634	Seine	Oct-Dec	0.00	2.51	71.43	11.94	7.88	5.04	0.85	0.35	0.00	0.00	84.2	1,644	14,887	170.573
	Seine	Jan-Apr	0.00	1.29	48.47	10.21	19.65	17.00	1.48	1.38	0.40	0.11	89.9	1,697	13,180	135.777
	Seine	May-Sep	0.00	2.89	67.52	11.86	10.20	6.38	0.60	0.43	0.11	0.02	80.8	3,341 +	1,282	14.960
	Trawl	Oct-Dec	0.00	3.26	65.07	10.15	11.10	8.98	0.69	0.60	0.12	0.03	85.8	3,341 +	44	0.519
	Trawl	Jan-Apr	0.00	3.26	65.07	10.15	11.10	8.98	0.69	0.60	0.12	0.03	85.8	3,341 +	537	6.254
19645	Seine	Oct-Dec	0.00	9.22	19.05	45.55	10.13	10.34	4.75	0.71	0.22	0.03	127.7	805	5,435	40.840
	Seine	Jan-Apr	0.00	4.99	13.41	53.55	9.70	9.66	7.23	1.03	0.37	0.06	118.0	2,088	12,851	99.593
	Seine	May-Sep	0.00	6.54	15.87	50.81	10.48	9.83	5.18	0.95	0.34	0.77	124.0	2,893 +	25,924	191.386
19656	Seine	Oct-Dec	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	3,312	24.120
	Seine	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	9,151	66.643
	Seine	May-Sep	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	4,831	35.181
	Trawl	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	1	0.007
19667	Seine	Oct-Dec	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	4,379	66.650
	Seine	Jan-Apr	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	2,338	35.588
	Seine	May-Sep	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	1,280	19.484
19678	Seine	Oct-Dec	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	53	0.678
	Seine	Jan-Apr	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	1,084	13.902
	Seine	May-Sep	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	932	11.953
19690	Seine	Jan-Apr	0.00	18.67	62.91	15.11	3.12	0.03	0.08	0.08	0.00	0.00	81.6	0 *	1,330	16.304
19701	Seine	Jan-Apr	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673	3,418	37.076
	Seine	May-Sep	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673 +	82	0.894
19712	Seine	Jan-Apr	0.00	0.00	5.32	17.93	64.43	5.88	3.78	2.38	0.14	0.14	161.3	714	4,490	27.842
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104 +	4	0.023
19723	Seine	Oct-Dec	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950 +	16	0.123
	Seine	Jan-Apr	0.00	0.61	33.23	4.45	30.09	26.25	3.38	1.26	0.74	0.00	137.9	950	1,524	10.454
	Seine	May-Sep	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950 +	67	0.499
19734	Seine	Jan-Apr	0.00	0.16	17.88	53.16	7.44	16.46	4.43	0.32	0.16	0.00	132.2	632	2,300	17.401
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104 +	1,519	9.034
19745	Seine	Jan-Apr	0.20	0.35	4.42	26.83	51.39	9.06	6.31	1.26	0.18	0.00	124.1	1,704	1,691	12.357
	Gillnet	Jan-Apr	0.00	0.00	0.00	31.91	59.57	8.51	0.00	0.00	0.00	0.00	140.9	47 +	11	0.076
19756	Seine	Oct-Dec	0.00	0.00	1.60	6.86	27.66	43.89	9.26	8.46	2.29	0.00	172.2	875 +	564	3.278
	Seine	Jan-Apr	0.00	0.00	0.90	7.22	32.25	49.73	7.47	1.74	0.70	0.00	169.6	713	3,466	20.451
	Gillnet	Jan-Apr	0.00	0.00	0.00	15.79	57.89	22.81	3.51	0.00	0.00	0.00	154.0	57 +	276	1.793
19767	Seine	Oct-Dec	0.00	0.08	13.52	6.40	24.30	35.92	14.53	4.01	0.80	0.43	154.2	1,821 +	296	1.895
	Seine	Jan-Apr	0.00	0.13	21.43	3.97	20.78	34.28	14.49	3.18	1.29	0.45	151.9	1,765	6,309	41.462
	Seine	May-Sep	0.00	0.16	18.12	7.08	22.73	31.85	13.84	4.45	1.32	0.44	149.8	1,821 +	31	0.204
	Gillnet	Jan-Apr	0.00	0.00	1.07	2.14	19.93	54.09	14.59	6.76	1.42	0.00	166.9	281 +	1,494	8.948

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	CATCH (millions)
			PERCENT AT AGE													
	Gillnet	May-Sep	0.00	0.00	1.07	2.14	19.93	54.09	14.59	6.76	1.42	0.00	166.9	281 +	12	0.072
19778	Seine	Oct-Dec	0.00	1.66	7.66	32.30	17.60	16.98	13.46	6.21	2.48	1.66	151.1	483	2,263	14.977
	Seine	Jan-Apr	0.00	1.35	12.58	34.86	9.09	19.63	18.84	2.66	0.67	0.32	147.2	812	2,202	14.957
	Seine	May-Sep	0.00	1.73	12.50	38.39	9.35	18.12	15.88	2.73	0.92	0.38	147.1	1,295 +	68	0.469
	Trawl	Oct-Dec	0.00	1.36	10.03	31.95	13.18	19.41	17.48	4.37	1.43	0.79	150.3	1,396 +	1,024	6.814
	Trawl	Jan-Apr	0.00	0.99	2.97	20.79	19.80	25.74	20.79	7.92	0.99	0.00	167.6	101	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	20.53	5.96	32.45	33.11	6.62	1.32	0.00	167.1	151 +	3,031	18.142
19789	Seine	Oct-Dec	0.00	1.42	9.81	10.85	25.36	19.39	17.10	8.63	4.73	2.71	152.3	777	971	6.314
	Seine	Jan-Apr	0.00	2.91	9.88	12.21	32.17	13.57	21.32	5.81	1.74	0.39	158.5	516	1,411	8.905
	Seine	May-Sep	0.00	2.19	14.84	11.37	28.12	14.72	17.26	6.93	2.94	1.62	151.3	1,732 +	10	0.063
	Trawl	Oct-Dec	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	690	4.664
	Trawl	Jan-Apr	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	8.25	41.24	18.56	22.68	7.56	1.72	0.00	168.4	291 +	1,236	7.338
19790	Seine	Oct-Dec	0.00	1.82	62.62	6.88	6.93	7.57	5.81	5.21	2.12	1.04	108.2	1,049	460	4.238
	Seine	Jan-Apr	0.00	1.69	85.42	4.98	2.89	2.29	1.69	0.70	0.30	0.05	90.0	2,010	1,641	18.223
	Trawl	Oct-Dec	0.00	1.59	73.25	7.18	5.79	4.99	3.78	2.12	0.91	0.39	99.0	4,389 +	278	2.806
	Trawl	Jan-Apr	0.00	0.00	47.95	12.33	10.96	16.44	1.37	5.48	4.11	1.37	123.9	73	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	4.98	7.66	35.25	19.92	19.54	8.43	3.45	0.77	162.2	261 +	1,046	6.449
19801	Seine	Oct-Dec	0.00	1.13	7.37	53.52	10.15	10.64	8.82	4.51	2.45	1.40	124.7	3,068	733	5.870
	Seine	Jan-Apr	0.03	0.57	10.08	82.32	3.36	1.46	1.55	0.32	0.19	0.13	98.7	3,156	1,051	10.652
	Trawl	Oct-Dec	0.00	1.07	7.67	56.82	8.62	9.09	9.02	3.68	2.37	1.66	119.0	3,095	949	7.928
	Trawl	Jan-Apr	0.00	1.07	7.21	55.35	8.89	9.56	9.66	4.17	2.36	1.74	121.0	3,095	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.37	39.18	16.42	23.13	14.55	4.48	1.87	0.00	149.7	268 +	356	2.378
19812	Seine	Oct-Dec	0.00	0.83	14.25	24.70	45.73	6.01	3.80	3.07	1.13	0.49	128.5	1,143	794	6.481
	Seine	Jan-Apr	0.00	4.57	11.84	7.15	71.51	2.93	1.41	0.35	0.23	0.00	106.5	853	170	1.593
	Trawl	Oct-Dec	0.00	2.34	11.99	19.03	39.60	10.11	6.80	6.60	2.13	1.39	132.6	1,283	1,021	7.686
	Trawl	Jan-Apr	0.00	2.34	11.85	18.08	40.14	10.37	6.94	6.24	2.42	1.64	132.6	1,283	0	0.000 ~
19823	Seine	Jan-Apr	0.00	1.35	20.82	17.74	5.26	49.16	3.73	1.13	0.59	0.22	117.7	4,583	0	0.000 ~
19834	Seine	Oct-Dec	0.00	1.83	34.08	15.42	15.21	10.14	19.68	3.04	0.20	0.41	97.1	493	87	0.900
	Seine	Jan-Apr	0.00	0.43	32.79	11.18	9.48	17.31	27.38	0.95	0.33	0.14	106.6	3,118	1,679	15.337
	Seine	May-Sep	0.00	0.72	36.17	14.18	10.77	13.79	22.65	1.27	0.28	0.17	102.7	3,611 +	6	0.055
	Trawl	Oct-Dec	0.00	0.93	36.45	14.29	10.74	13.57	21.95	1.30	0.42	0.34	102.3	3,772 +	54	0.529
	Trawl	Jan-Apr	0.00	5.59	42.86	16.77	9.94	8.70	6.21	1.86	3.73	4.35	93.4	161	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.99	1.98	12.87	21.39	57.43	3.37	1.19	0.79	147.7	505	1,880	12.731
19845	Seine	Oct-Dec	0.00	17.10	8.92	20.45	30.67	12.83	4.46	4.28	0.93	0.37	86.0	538	48	0.556
	Seine	Jan-Apr	0.00	0.33	7.91	50.78	11.15	6.74	12.95	9.81	0.19	0.16	108.4	4,214	3,070	27.724
	Seine	May-Sep	0.00	2.15	7.95	50.48	14.31	7.07	10.01	7.61	0.27	0.17	108.3	4,752 +	70	0.662
	Trawl	Oct-Dec	0.00	2.31	7.95	50.46	14.58	7.09	9.74	7.41	0.27	0.17	105.8	4,752 +	83	0.787
	Gillnet	Jan-Apr	0.00	0.00	0.36	16.36	14.91	15.82	21.82	29.82	0.36	0.55	147.9	550	3,476	23.500
19856	Seine	Oct-Dec	0.00	1.77	12.72	10.13	44.29	9.00	5.23	8.78	7.96	0.11	139.2	3,554 +	130	0.937
	Seine	Jan-Apr	0.00	1.75	12.79	10.09	44.41	9.10	5.23	8.69	7.83	0.11	133.1	5,655	3,823	27.523
	Seine	May-Sep	0.00	1.69	13.34	9.55	46.09	10.53	5.26	7.46	5.98	0.10	137.1	5,655 +	105	0.778
	Trawl	Oct-Dec	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	47	0.343
	Trawl	Jan-Apr	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.38	4.09	54.02	18.86	8.71	7.65	6.06	0.23	147.0	1,320	4,573	31.100
19867	Seine	Oct-Dec	0.00	0.60	38.78	9.59	7.26	29.94	5.84	3.59	3.09	1.33	117.1	2,977 +	47	0.398
	Seine	Jan-Apr	0.00	0.45	39.37	9.51	7.32	29.04	5.78	3.72	3.34	1.47	117.1	4,049	2,100	17.695
	Seine	May-Sep	0.00	1.06	36.99	9.81	7.06	32.66	6.01	3.21	2.31	0.89	117.1	2,977 +	52	0.448
	Gillnet	Jan-Apr	0.00	0.00	0.50	2.67	6.37	55.23	16.65	9.37	6.07	3.14	150.4	1,855	4,071	27.067
19878	Seine	Oct-Dec	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076 +	23	0.229
	Seine	Jan-Apr	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076	3,550	35.399
	Seine	May-Sep	0.00	0.45	30.98	38.94	5.97	8.35	11.53	1.95	1.45	0.38	102.6	4,206 +	56	0.542
	Trawl	Jan-Apr	0.00	0.26	13.73	41.19	11.92	11.14	11.92	4.40	4.15	1.30	109.5	386	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.24	4.97	4.59	20.02	48.56	13.52	5.31	2.78	157.2	710	4,340	27.459
19889	Seine	Oct-Dec	0.00	0.21	25.24	29.11	30.29	4.94	4.83	4.40	0.64	0.32	105.0	931 +	42	0.403
	Seine	Jan-Apr	0.00	0.70	19.15	41.92	25.84	4.00	4.19	3.39	0.46	0.36	104.1	2,893	3,686	35.672
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.11	30.02	13.98	22.91	21.87	3.66	2.46	149.3	476	4,745	31.739
19890	Seine	Jan-Apr	0.00	0.63	20.05	21.02	29.59	18.95	3.90	3.41	2.08	0.37	120.7	4,215	2,295	19.231
	Seine	May-Sep	0.00	0.14	14.00	25.59	26.19	24.51	3.85	3.58	1.99	0.14	120.9	5,068 +	32	0.263
	Gillnet	Jan-Apr	0.00	0.00	0.00	6.25	21.32	42.46	10.29	11.58	6.07	2.02	146.7	544	2,361	16.100
19901	Seine	Jan-Apr	0.00	1.07	51.92	9.89	11.11	15.82	7.04	1.23	0.91	1.03	98.8	2,529	1,348	13.642
	Seine	May-Sep	0.00	0.55	40.80	10.75	16.94	17.49	11.29	1.82	0.00	0.36	108.1	549 +	19	0.172
	Trawl	Jan-Apr	0.00	17.05	28.41	5.68	22.73	6.82	6.82	0.00	2.27	10.23	110.2	88	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.26	18.67	31.44	31.33	6.66	4.37	3.28	144.5	916	2,143	14.832
19912	Seine	Jan-Apr	0.00	0.19	45.84	29.44	6.36	5.42	7.73	3.60	0.74	0.67	96.6	4,265	1,377	14.161
	Seine	May-Sep	0.00	0.70	24.97	53.31	5.57	5.34	5.23	3.95	0.46	0.46	96.2	861 +	3	0.027
	Trawl	Jan-Apr	0.00	14.10	21.79	20.94	8.97	18.80	6.41	4.70	1.28	2.99	108.5	234	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.32	13.21	9.13	23.52	25.35	19.66	3.97	4.83	145.5	931	3,797	26.100
19923	Seine	Jan-Apr	0.00	0.04	6.28	56.22	21.93	4.18	4.46	4.86	1.59	0.44	103.4	3,262	2,204	20.895
	Seine	May-Sep	0.00	0.40	21.17	25.83	39.41	4.26	3.73	3.20	1.73	0.27	101.3	751 +	5	0.046
	Trawl	Jan-Apr	0.00	6.59	31.87	31.32	22.53	2.75	3.85	1.10	0.00	0.00	91.4	182	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	8.32	40.54	9.53	18.52	13.29	8.19	1.61	134.1	745	4,112	30.661
19934	Seine	Jan-Apr	0.00	0.47	3.34	10.44	54.82	20.19	4.55	4.05	1.50	0.64	108.9	6,643	2,364	21.475
	Trawl	Jan-Apr	0.00	3.61	4.64	27.84	38.66	20.10	2.58	1.55	1.03	0.00	106.1	194	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	3.15	18.85	48.99	11.78	11.14	4.86	1.24	132.6	899	2,324	17.614
19945	Seine	Jan-Apr	0.08	3.82	12.91	5.38	9.57	49.66	13.84	2.46	1.44	0.82	113.1	3,532	706	6.242
	Gillnet	Jan-Apr	0.00	0.00	0.12	1.18	16.98	34.79	39.39	4.13	1.89	1.53	131.4	848	1,355	10.311
19956	Seine	Jan-Apr	0.00	1.08	65.37	8.94	2.82	4.26	11.72	5.19	0.37	0.26	89.0	2,697	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.78	4.11	5.68	25.83	32.68	26.42	3.13	1.37	133.8	511	3,086	23.053

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	**Gear**	**Fishery**	**0+**	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9++**	**Weight**	**Aged**	**(tonnes)**	**(millions)**
19967	Seine	Jan-Apr	0.00	1.30	22.79	53.63	8.01	2.52	4.93	4.74	1.85	0.22	88.5	2,698	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.16	19.49	11.57	13.95	20.29	20.60	11.09	2.85	133.4	631	5,541	41.550
19978	Seine	Jan-Apr	0.00	0.19	33.18	21.98	36.29	4.44	1.42	1.09	1.28	0.14	83.2	2,116	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.65	3.05	43.07	20.52	9.89	11.28	7.02	4.53	127.9	1,082	3,217	25.158
19989	Seine	Jan-Apr	0.00	0.93	3.39	51.17	20.68	17.76	2.92	0.47	1.17	1.52	105.5	856	256	2.426
	Gillnet	Jan-Apr	0.00	0.00	0.00	11.18	16.22	48.98	13.23	4.72	2.20	3.46	126.1	721	1,858	14.716
19990	Seine	Jan-Apr	0.00	1.71	24.71	8.27	36.25	14.34	11.83	1.99	0.41	0.49	95.9	3,685	1,314	12.980
	Gillnet	Jan-Apr	0.00	0.00	0.12	2.10	23.06	20.47	42.17	9.37	1.11	1.60	133.7	811	3,001	22.441
20001	Seine	Jan-Apr	0.00	0.53	28.84	25.30	5.65	23.85	9.15	5.34	1.14	0.22	103.9	2,285	1,012	9.743
	Gillnet	Jan-Apr	0.00	0.00	0.29	5.58	9.33	32.40	20.67	25.58	5.29	0.87	134.3	1,040	1,905	14.183
20012	Seine	Oct-Dec	0.00	5.18	19.99	36.74	18.99	3.93	9.56	3.51	1.79	0.30	90.3	5,577 +	1	0.009
	Seine	Jan-Apr	0.00	7.21	19.39	32.03	20.34	4.16	11.12	3.83	1.60	0.33	93.0	3,678	2,061	22.159
	Gillnet	Jan-Apr	0.00	0.00	0.11	7.05	20.25	11.72	27.42	15.81	15.36	2.28	143.2	879	2,432	16.982
20023	Seine	Oct-Dec	0.00	0.79	67.83	13.49	11.10	3.13	1.52	1.15	0.48	0.51	85.1	659 +	5	0.068
	Seine	Jan-Apr	0.00	0.07	53.06	13.44	14.53	9.54	2.97	4.24	1.47	0.68	95.3	2,925	1,446	15.169
	Gillnet	Jan-Apr	0.00	0.00	0.34	4.60	37.13	25.98	10.57	12.30	5.29	3.79	136.6	870	2,562	18.760
20034	Seine	Oct-Dec	0.00	0.91	1.98	69.32	11.20	10.06	4.20	0.91	1.27	0.16	93.7	2,526 +	11	0.116
	Seine	Jan-Apr	0.00	0.88	1.76	69.88	10.58	9.88	4.45	0.97	1.39	0.19	96.0	2,155	1,908	19.885
	Gillnet	Jan-Apr	0.00	0.00	0.09	21.84	13.52	36.88	15.40	4.92	4.74	2.60	134.5	1,117	2,192	16.304
20045	Seine	Jan-Apr	0.00	0.75	26.59	8.92	45.51	9.21	6.06	2.02	0.52	0.42	92.8	2,129	1,750	18.855
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.80	46.42	18.04	25.86	5.84	1.33	1.72	134.5	754	2,050	15.239
20056	Seine	Jan-Apr	0.00	1.45	16.34	44.33	8.80	22.99	3.90	1.60	0.45	0.15	87.1	2,001	956	10.975
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.77	7.11	59.88	15.22	13.64	1.38	0.00	128.4	506	1,661	12.942
20067	Seine	Jan-Apr	0.00	3.69	48.50	21.99	10.66	3.01	9.84	1.23	0.96	0.14	71.6	732	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.08	0.90	3.26	16.94	8.79	51.30	12.21	5.29	1.22	127.5	1,228	968	7.594
20078	Seine	Jan-Apr	0.00	1.50	9.82	56.89	13.82	10.45	2.18	4.24	0.75	0.36	93.3	2,526	513	5.498
	Gillnet	Jan-Apr	0.00	0.00	0.08	10.53	8.52	18.71	9.02	43.36	6.43	3.34	128.3	1,197	1,148	8.951

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	PERCENT AT AGE 0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	CATCH (millions)
19501	Seine	Oct-Dec	0.00	2.68	28.09	50.52	12.28	5.17	1.20	0.06	0.00	0.00	109.2	3,175	15,508	141.986
	Seine	Jan-Apr	0.06	2.25	31.20	49.36	11.23	4.84	1.06	0.01	0.00	0.00	107.9	2,143	26,950	250.936
19512	Seine	Jan-Apr	0.25	4.61	20.10	29.98	38.50	4.56	1.55	0.40	0.04	0.02	112.7	5,214	33,072	290.690
	Seine	May-Sep	1.11	5.12	19.85	29.75	37.71	4.45	1.52	0.44	0.04	0.02	112.3	5,214 +	123	1.091
19523	Seine	Jan-Apr	0.43	7.65	28.02	24.49	27.28	10.25	1.40	0.48	0.00	0.00	104.9	2,939	768	7.304
19534	Seine	Oct-Dec	0.15	7.31	69.86	17.41	3.99	1.06	0.15	0.00	0.08	0.00	63.6	1,327	6,389	100.473
	Seine	Jan-Apr	0.00	1.72	72.02	21.04	3.91	1.10	0.15	0.00	0.06	0.00	76.2	1,739	18,119	243.703
	Seine	May-Sep	0.07	4.04	69.18	20.52	4.63	1.34	0.16	0.00	0.07	0.00	71.1	3,066 +	109	1.531
19545	Seine	Oct-Dec	0.29	9.94	6.32	77.40	5.10	0.48	0.48	0.00	0.00	0.00	85.4	826	2,559	28.033
	Seine	Jan-Apr	0.00	1.31	5.42	80.39	11.08	1.56	0.25	0.00	0.00	0.00	99.8	1,524	9,035	90.856
19556	Seine	Oct-Dec	0.10	13.79	13.63	11.05	58.24	2.85	0.25	0.10	0.00	0.00	91.4	2,408	22,335	208.767
	Seine	Jan-Apr	0.00	7.39	12.21	8.70	67.86	3.36	0.43	0.00	0.00	0.04	114.2	2,614	21,018	178.311
	Seine	May-Sep	0.04	16.97	13.60	9.12	56.99	2.89	0.34	0.04	0.00	0.02	105.4	5,022 +	275	2.606
19567	Seine	Oct-Dec	0.00	52.32	42.90	3.83	0.55	0.27	0.14	0.00	0.00	0.00	60.1	732	1,788	29.756
	Seine	Jan-Apr	0.00	3.59	52.30	13.98	8.33	20.79	0.98	0.03	0.00	0.00	93.9	3,890	21,002	211.756
	Seine	May-Sep	0.00	23.13	49.84	9.53	5.03	11.85	0.59	0.02	0.00	0.00	79.6	4,622 +	470	5.669
19578	Seine	Oct-Dec	0.00	40.38	49.69	8.01	1.33	0.17	0.42	0.00	0.00	0.00	61.5	2,106	4,928	79.258
	Seine	Jan-Apr	0.00	5.67	73.61	17.35	1.50	1.22	0.65	0.00	0.00	0.00	73.8	1,472	4,454	60.180
	Seine	May-Sep	0.00	47.57	42.11	7.27	2.01	0.42	0.62	0.00	0.00	0.00	64.8	3,578 +	467	8.141
19589	Seine	Oct-Dec	0.17	5.25	49.47	35.94	7.43	0.61	0.57	0.55	0.01	0.00	83.4	2,169	10,774	125.789
	Seine	Jan-Apr	0.00	0.74	47.39	40.66	9.62	0.72	0.52	0.35	0.00	0.00	88.2	2,594	17,096	192.788
19590	Seine	Oct-Dec	0.00	42.87	24.11	26.16	5.59	1.10	0.08	0.08	0.00	0.00	62.1	1,269	3,397	54.675
	Seine	Jan-Apr	0.00	41.51	23.53	27.72	5.86	1.22	0.08	0.08	0.00	0.00	63.7	1,313 +	640	10.054
19601	Seine	Oct-Dec	0.00	64.30	28.81	3.34	2.30	1.25	0.00	0.00	0.00	0.00	51.4	479	956	18.581
	Seine	Jan-Apr	0.00	4.30	32.64	12.80	36.63	12.48	0.94	0.16	0.05	0.00	100.6	2,302	30,641	302.709
	Seine	May-Sep	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2,781 +	104	1.136
	Trawl	May-Sep	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2,781 +	4	0.042
19612	Seine	Oct-Dec	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	94.1	562 +	677	7.197
	Seine	Jan-Apr	0.00	3.73	51.28	25.17	2.80	13.99	2.80	0.23	0.00	0.00	99.6	429	14,942	150.045
	Seine	May-Sep	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	94.1	562 +	90	0.954
19623	Seine	Oct-Dec	0.00	0.36	30.27	58.03	5.25	2.86	3.02	0.21	0.00	0.00	100.6	1,052 +	124	1.232
	Seine	Jan-Apr	0.00	0.35	30.14	58.19	5.18	2.86	3.07	0.21	0.00	0.00	100.6	1,052	43,930	436.570
19634	Seine	Oct-Dec	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	3,214	35.288
	Seine	Jan-Apr	0.00	4.88	43.06	35.48	14.65	1.80	0.13	0.00	0.00	0.00	103.4	778	28,288	273.620
	Seine	May-Sep	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	165	1.808
	Trawl	Jan-Apr	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	228	2.507
19645	Seine	Oct-Dec	0.00	14.07	37.58	31.01	12.10	5.03	0.18	0.03	0.00	0.00	114.4	1,750 +	1,562	14.266
	Seine	Jan-Apr	0.00	3.62	35.16	37.44	17.59	5.77	0.39	0.03	0.00	0.00	122.3	1,652	12,630	101.310
	Seine	May-Sep	0.00	8.49	36.46	33.62	15.63	5.41	0.33	0.06	0.00	0.00	111.9	1,750 +	1,477	12.553
19656	Seine	Oct-Dec	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	16,217	225.703
	Seine	Jan-Apr	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	19,101	265.835
	Seine	May-Sep	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	2,163	30.107
19667	Seine	Oct-Dec	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	2,910	33.432
	Seine	Jan-Apr	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	17,206	197.668
	Seine	May-Sep	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	1,774	20.378
19678	Seine	Oct-Dec	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	497	5.535
	Seine	Jan-Apr	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	309	3.439
	Seine	May-Sep	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	722	8.043
19690	Seine	Jan-Apr	0.00	54.02	44.42	1.16	0.40	0.00	0.00	0.00	0.00	0.00	73.9	0 *	209	2.832
19701	Seine	Jan-Apr	0.06	12.04	39.34	39.20	4.11	4.33	0.72	0.06	0.13	0.00	108.2	953	3,614	32.684
19712	Seine	Jan-Apr	0.00	3.54	28.25	27.13	27.01	7.57	5.17	1.26	0.08	0.00	120.5	1,763	9,143	74.425
	Gillnet	Jan-Apr	0.00	0.00	2.27	18.18	61.36	11.36	6.82	0.00	0.00	0.00	159.6	44 +	137	0.855
19723	Seine	Jan-Apr	0.00	0.97	48.51	18.90	16.23	12.72	2.02	0.47	0.19	0.00	125.2	1,239	6,664	52.842
	Seine	May-Sep	0.00	1.21	49.64	18.40	15.98	12.11	2.02	0.48	0.16	0.00	124.7	1,239 +	22	0.178
	Gillnet	Jan-Apr	0.00	0.00	4.04	28.28	43.43	21.21	2.02	1.01	0.00	0.00	152.8	99 +	1,113	7.288
19734	Seine	Jan-Apr	0.00	2.94	20.26	42.18	18.05	10.26	5.42	0.71	0.18	0.00	129.5	1,515	3,621	28.835
	Gillnet	Jan-Apr	0.00	0.00	0.42	22.36	38.82	24.47	12.24	1.69	0.00	0.00	158.5	474	5,267	33.230
19745	Seine	Jan-Apr	0.18	0.99	48.84	22.87	19.00	5.33	2.25	0.48	0.04	0.02	119.5	8,923	3,343	31.457
	Gillnet	Jan-Apr	0.00	0.00	4.27	26.40	45.60	15.73	5.60	2.40	0.00	0.00	152.8	375 +	5,395	35.308
19756	Seine	Jan-Apr	0.00	2.18	11.33	41.86	21.86	16.69	4.31	1.52	0.24	0.02	124.4	5,418	6,198	50.662
	Gillnet	Jan-Apr	0.00	0.00	0.86	18.72	30.18	35.12	11.56	3.02	0.44	0.09	162.0	1,222	6,213	38.357
19767	Seine	Jan-Apr	0.00	0.70	17.01	23.32	31.11	17.06	8.70	1.72	0.34	0.05	136.6	2,606	4,201	30.702
	Gillnet	Jan-Apr	0.00	0.00	1.10	13.02	35.54	31.57	13.47	3.97	1.32	0.00	167.7	453	6,904	41.171
19778	Seine	Jan-Apr	0.00	0.19	28.64	16.47	21.54	21.13	8.68	2.56	0.59	0.20	129.6	1,391	4,723	37.629
	Seine	May-Sep	0.00	0.18	29.21	16.70	21.83	20.76	8.28	2.38	0.50	0.17	124.6	1,391 +	46	0.369
	Gillnet	Jan-Apr	0.00	0.00	0.83	8.45	32.10	38.26	16.57	3.21	0.44	0.15	162.1	886	9,277	56.466
19789	Seine	Oct-Dec	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0 *	0	0.001
	Seine	May-Sep	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0 *	5	0.031
19790	Seine	Oct-Dec	0.06	5.59	69.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3,345 +	10	0.111
	Seine	Jan-Apr	0.06	5.59	69.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3,345	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	5.36	0.89	34.82	21.43	18.75	11.61	6.25	0.89	157.9	112 +	528	3.347
19801	Seine	Jan-Apr	0.00	1.88	14.92	68.45	7.06	4.98	1.95	0.44	0.29	0.04	101.3	5,210	263	2.570
	Seine	May-Sep	0.00	3.78	14.57	63.82	7.83	6.03	2.80	0.67	0.36	0.13	99.2	5,210 +	6	0.063
	Gillnet	Jan-Apr	0.00	0.28	1.47	47.46	12.43	15.35	12.78	6.94	2.48	0.82	142.5	1,418	2,304	15.892
19812	Seine	Jan-Apr	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2,300	2,258	17.116
	Seine	May-Sep	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2,300 +	0	0.003
	Gillnet	Jan-Apr	0.00	0.00	2.88	6.96	76.07	7.38	5.17	1.20	0.33	0.01	141.3	1,242	4,112	29.155

Appendix 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	**Gear**	**Fishery**	**0+**	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9++**	**Weight**	**Aged**	**(tonnes)**	**(millions)**
19823	Seine	Jan-Apr	0.00	0.58	7.06	13.65	11.15	58.16	5.32	3.13	0.64	0.31	134.7	5,445	2,061	15.154
	Gillnet	Jan-Apr	0.00	0.00	0.56	7.56	13.82	68.06	5.22	3.93	0.62	0.23	146.7	1,703	3,579	24.422
19834	Seine	Jan-Apr	0.00	2.29	5.47	7.67	17.73	17.04	47.03	1.93	0.69	0.14	128.0	6,294	3,589	28.383
	Gillnet	Jan-Apr	0.00	0.00	0.27	2.69	12.49	16.84	61.49	4.63	1.07	0.53	145.1	1,092	3,582	24.536
19845	Seine	Jan-Apr	0.00	0.61	28.72	8.11	9.89	17.28	14.48	20.15	0.49	0.26	136.5	3,690	2,915	20.337
	Gillnet	Jan-Apr	0.00	0.00	3.78	6.27	9.37	20.63	23.57	35.09	0.85	0.44	161.3	1,507	2,294	14.082
19856	Seine	Oct-Dec	0.00	4.00	16.21	39.67	8.61	6.41	6.74	6.12	11.63	0.62	135.0	5,995 +	30	0.224
	Seine	Jan-Apr	0.00	0.94	14.64	41.12	10.95	5.12	6.40	6.55	13.85	0.43	138.7	3,983	2,173	16.047
	Trawl	Jan-Apr	0.00	4.00	16.21	39.67	8.61	6.41	6.74	6.12	11.63	0.62	135.0	5,995 +	7	0.054
	Gillnet	Jan-Apr	0.00	0.00	2.01	21.83	14.45	7.98	14.53	14.47	24.18	0.56	155.5	1,020	1,176	7.676
19867	Seine	Jan-Apr	0.00	4.13	20.03	13.26	32.77	5.60	5.06	6.71	5.11	7.33	143.9	3,614	2,695	18.225
	Gillnet	Jan-Apr	0.00	0.00	0.82	7.75	44.85	11.72	7.85	9.89	8.15	8.97	165.2	981	920	5.571
19878	Seine	Jan-Apr	0.00	0.82	65.84	12.35	6.16	8.30	1.73	1.71	1.68	1.40	107.5	4,159	3,539	31.909
	Seine	May-Sep	0.00	0.81	65.96	12.42	6.14	8.29	1.66	1.73	1.66	1.34	110.9	2,835 +	18	0.162
	Gillnet	Jan-Apr	0.00	0.00	4.39	10.69	15.27	27.48	13.74	7.06	9.73	11.64	162.2	524	970	5.978
19889	Seine	Jan-Apr	0.00	0.84	3.72	79.59	8.59	2.79	2.28	0.60	0.87	0.71	112.1	4,321	6,531	61.253
	Gillnet	Jan-Apr	0.00	0.00	0.32	29.13	25.73	17.31	14.72	5.34	3.72	3.72	147.9	618	2,911	19.680
19890	Seine	Jan-Apr	0.00	0.81	3.55	5.07	74.01	7.47	3.93	3.48	0.81	0.85	131.1	6,843	5,305	39.561
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.03	68.15	16.46	5.46	6.48	1.10	1.32	144.7	806	3,046	20.978
19901	Seine	Jan-Apr	0.00	1.76	16.48	7.41	6.52	56.72	6.70	2.34	1.70	0.36	133.9	7,107	7,097	52.412
	Gillnet	Jan-Apr	0.00	0.00	0.56	2.41	6.30	69.81	9.44	7.04	3.52	0.93	154.7	540	1,806	11.673
19912	Seine	Jan-Apr	0.00	0.94	60.91	10.17	2.47	2.95	19.02	2.03	0.79	0.72	107.2	7,264	7,251	66.620
	Gillnet	Jan-Apr	0.00	0.00	6.87	6.96	4.42	6.98	60.93	9.67	2.99	1.19	155.5	1,119	1,111	6.991
19923	Seine	Jan-Apr	0.00	3.37	7.06	63.75	9.66	1.85	2.41	10.22	1.24	0.43	112.3	6,939	8,478	75.838
	Gillnet	Jan-Apr	0.00	0.00	0.20	45.74	14.12	5.43	5.88	25.47	2.48	0.67	138.9	781	2,038	14.682
19934	Seine	Jan-Apr	0.00	0.87	18.91	7.17	56.09	7.93	2.09	3.02	3.51	0.42	118.7	6,174	9,757	81.704
	Gillnet	Jan-Apr	0.00	0.00	1.73	5.09	66.34	12.30	3.27	4.00	6.51	0.77	133.8	1,951	2,122	15.809
19945	Seine	Jan-Apr	0.00	0.58	5.12	22.95	9.25	49.46	6.30	2.18	2.34	1.81	127.0	8,932	8,131	64.167
	Gillnet	Jan-Apr	0.00	0.00	0.23	8.93	8.00	64.84	10.67	1.79	2.23	3.31	137.4	1,267	1,451	10.565
19956	Seine	Jan-Apr	0.00	12.82	18.28	5.03	16.68	7.26	31.17	5.89	1.57	1.31	124.2	4,087	3,897	32.478
	Gillnet	Jan-Apr	0.00	0.00	0.39	1.55	18.33	11.88	53.07	10.48	1.97	2.33	146.4	566	402	2.743
19967	Seine	Jan-Apr	0.00	2.20	56.77	15.70	3.46	6.65	4.27	8.66	1.70	0.58	94.3	5,235	3,276	34.713
	Gillnet	Jan-Apr	0.00	0.00	1.36	2.92	6.23	22.76	19.26	38.33	7.20	1.95	143.5	514	344	2.401
19978	Seine	Jan-Apr	0.00	0.52	30.62	41.30	7.99	2.46	6.42	5.30	4.48	0.90	97.1	1,339	7,963	81.986
	Gillnet	Jan-Apr	0.00	0.00	0.44	13.09	12.55	8.50	18.31	16.51	22.13	8.46	140.4	1,031	639	4.483
19989	Seine	Jan-Apr	0.00	0.38	8.37	39.70	34.48	7.66	2.22	2.89	2.74	1.55	100.2	3,861	5,940	58.064
	Gillnet	Jan-Apr	0.00	0.00	0.13	15.27	45.02	17.80	6.24	5.31	5.44	4.78	128.8	753	1,524	11.833
19990	Seine	Jan-Apr	0.00	0.19	17.02	10.47	33.07	28.97	6.40	1.46	1.17	1.26	109.3	2,624	6,440	55.631
	Gillnet	Jan-Apr	0.00	0.00	0.44	2.04	40.44	41.61	10.36	1.61	0.88	2.63	133.0	685	926	6.963
20001	Seine	Jan-Apr	0.00	2.00	6.90	24.68	12.46	25.29	21.72	5.20	1.21	0.54	119.7	1,653	5,613	46.878
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.87	5.75	52.75	28.13	7.12	1.13	0.25	135.3	800	517	3.822
20012	Seine	Jan-Apr	0.00	4.71	33.86	9.81	15.67	6.41	19.55	8.17	1.56	0.26	98.5	3,164	2,894	29.155
	Gillnet	Jan-Apr	0.00	0.00	0.60	5.95	20.83	7.54	47.02	16.47	1.39	0.20	128.6	504	399	3.099
20023	Seine	Jan-Apr	0.00	0.09	30.97	24.46	9.95	12.93	5.79	11.12	3.98	0.72	104.9	2,212	2,299	21.911
	Gillnet	Jan-Apr	0.00	0.00	0.43	3.57	11.14	25.73	11.24	33.08	12.32	2.49	143.2	925	289	2.021
20034	Seine	Jan-Apr	0.00	1.27	6.44	65.95	16.06	2.98	3.46	1.74	1.67	0.43	96.1	2,094	2,987	30.986
20045	Seine	Jan-Apr	0.00	0.67	32.35	17.80	35.63	8.73	1.75	1.49	1.12	0.45	92.2	2,680	3,779	40.991
20056	Seine	Jan-Apr	0.00	0.72	9.80	53.87	10.52	20.03	3.38	0.97	0.68	0.04	89.8	2,367	3,072	34.226
20067	Seine	Jan-Apr	0.00	0.12	30.17	13.82	37.14	7.21	8.65	1.80	0.72	0.36	86.7	832	398	4.592
20078	Seine	Jan-Apr	0.00	10.12	10.20	44.83	12.51	15.91	2.82	2.89	0.58	0.14	79.3	1,383	0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	**Gear**	**Fishery**	**0+**	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9++**	**Weight**	**Aged**	**(tonnes)**	**(millions)**
19501	Seine	Oct-Dec	0.03	4.32	58.19	28.93	6.71	1.40	0.30	0.10	0.02	0.00	99.6	7,816	42,180	424.795
	Seine	Jan-Apr	0.06	4.40	32.64	48.59	10.65	2.76	0.62	0.23	0.06	0.00	103.6	1,774 +	1,226	11.828
	Seine	May-Sep	0.04	3.46	61.00	26.57	7.12	1.25	0.43	0.12	0.00	0.00	99.5	7,816 +	393	3.923
19512	Seine	Oct-Dec	0.11	14.85	55.11	21.73	6.50	1.32	0.28	0.08	0.01	0.00	93.0	8,839	44,896	492.871
	Seine	Jan-Apr	0.16	21.32	49.53	21.11	6.19	1.52	0.11	0.05	0.00	0.00	91.8	8,839 +	423	4.847
	Seine	May-Sep	0.03	5.73	55.51	29.95	7.19	1.34	0.20	0.05	0.00	0.00	97.0	8,839 +	527	5.222
	Trawl	Jan-Apr	0.00	0.00	50.26	36.79	9.84	2.59	0.52	0.00	0.00	0.00	115.6	193	0	0.000 ~
19523	Seine	Oct-Dec	0.10	1.72	54.76	38.77	3.97	0.52	0.07	0.10	0.00	0.00	87.1	3,810	3,750	41.452
	Seine	Jan-Apr	0.14	3.79	65.35	27.05	2.97	0.62	0.07	0.00	0.00	0.00	81.0	5,220	3,966	48.795
	Seine	May-Sep	0.17	2.60	55.66	37.08	3.71	0.63	0.09	0.07	0.00	0.00	84.6	9,030 +	442	5.059
	Trawl	Oct-Dec	0.00	1.58	63.29	30.79	3.68	0.66	0.00	0.00	0.00	0.00	88.4	760	29	0.326
	Trawl	Jan-Apr	0.00	5.91	67.27	23.62	2.60	0.60	0.00	0.00	0.00	0.00	78.0	999	225	2.888
19534	Seine	Oct-Dec	0.00	1.12	53.97	36.36	6.83	1.38	0.27	0.06	0.01	0.00	96.0	9,693	57,443	595.913
	Seine	Jan-Apr	0.00	2.17	43.19	41.52	8.91	3.32	0.70	0.18	0.01	0.00	94.5	3,618 +	619	6.600
	Seine	May-Sep	0.00	1.78	22.05	37.29	26.45	8.79	2.98	0.60	0.07	0.00	119.9	3,374	7,692	62.447
	Trawl	Jan-Apr	0.00	1.36	52.67	36.83	7.07	1.66	0.33	0.08	0.01	0.00	95.7	9,788 +	14	0.142
19545	Seine	Oct-Dec	0.00	3.92	56.38	33.92	5.18	0.52	0.09	0.00	0.00	0.00	98.5	4,028	50,604	503.361
	Seine	Jan-Apr	0.00	3.50	22.26	60.88	11.00	2.22	0.15	0.00	0.00	0.00	85.6	896	13,825	161.566
	Seine	May-Sep	0.00	4.65	49.87	38.62	5.95	0.82	0.10	0.00	0.00	0.00	94.5	4,924 +	4,207	43.919
	Trawl	Oct-Dec	0.00	4.65	50.12	38.35	5.99	0.80	0.10	0.00	0.00	0.00	95.8	4,994 +	5	0.054
	Trawl	Jan-Apr	0.00	8.57	57.14	25.71	8.57	0.00	0.00	0.00	0.00	0.00	84.7	70	0	0.000 ~
19556	Seine	Oct-Dec	0.00	4.07	52.03	30.65	11.30	1.65	0.29	0.00	0.00	0.00	97.4	3,783	44,043	451.810
	Seine	Jan-Apr	0.00	4.10	14.20	29.99	41.94	7.87	1.37	0.43	0.09	0.02	109.1	4,816	26,375	243.982
	Seine	May-Sep	0.00	0.13	9.76	43.52	26.32	17.07	2.44	0.64	0.00	0.13	125.5	779	1,462	11.648
	Trawl	Oct-Dec	0.00	5.52	58.00	26.95	8.19	1.05	0.29	0.00	0.00	0.00	93.7	1,050	182	1.944
	Trawl	Jan-Apr	0.00	18.62	44.38	24.62	10.24	1.91	0.23	0.00	0.00	0.00	85.7	2,197	0	0.000 ~
19567	Seine	Oct-Dec	0.00	0.73	64.78	20.31	9.37	4.25	0.51	0.04	0.00	0.00	96.2	4,691	44,241	460.767
	Seine	Jan-Apr	0.00	1.42	64.96	21.83	7.50	3.97	0.31	0.00	0.00	0.00	95.7	826	8,202	84.577
	Seine	May-Sep	0.00	3.46	18.92	40.97	25.30	9.95	1.08	0.11	0.11	0.11	129.9	925	7,165	55.146
	Trawl	Jan-Apr	0.12	2.24	71.93	14.15	4.60	5.66	0.94	0.24	0.00	0.12	91.7	848	0	0.000 ~
19578	Seine	Oct-Dec	0.00	10.67	60.24	20.45	3.60	3.20	1.64	0.15	0.04	0.00	88.8	3,085	11,745	133.517
	Seine	Jan-Apr	0.00	9.97	61.67	16.52	4.36	3.66	3.24	0.49	0.09	0.00	90.1	1,850	6,982	84.814
	Seine	May-Sep	0.00	9.00	60.10	21.06	3.99	3.20	2.30	0.30	0.05	0.00	88.9	4,935 +	1,206	13.597
	Trawl	Jan-Apr	0.00	12.72	73.29	11.64	1.88	0.45	0.01	0.01	0.00	0.00	74.8	527	695	9.491
	Gillnet	Jan-Apr	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49	0	0.000 ~
19589	Seine	Oct-Dec	0.74	13.95	66.31	15.95	2.34	0.39	0.21	0.10	0.01	0.00	83.5	7,169	47,601	575.751
	Seine	Jan-Apr	0.86	14.21	65.57	16.41	2.29	0.39	0.21	0.06	0.01	0.00	82.4	7,215 +	146	1.770
	Seine	May-Sep	0.00	25.55	57.59	10.98	3.72	1.52	0.27	0.29	0.09	0.00	79.4	1,506	1,897	23.636
	Trawl	Jan-Apr	1.52	19.81	59.43	18.10	1.14	0.00	0.00	0.00	0.00	0.00	70.9	525	0	0.000 ~
	Gillnet	Oct-Dec	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49 +	381	5.002
19590	Seine	Oct-Dec	0.00	6.80	54.12	35.60	2.93	0.36	0.09	0.07	0.00	0.02	98.1	3,323	67,866	685.617
	Seine	Jan-Apr	0.00	23.34	50.24	24.15	2.11	0.00	0.16	0.00	0.00	0.00	79.8	617	149	1.863
	Trawl	Oct-Dec	0.00	10.10	51.47	34.80	3.07	0.36	0.10	0.08	0.00	0.03	95.7	3,940 +	23	0.237
19601	Seine	Oct-Dec	0.00	40.17	30.91	22.59	5.84	0.50	0.00	0.00	0.00	0.00	88.0	2,248	25,847	303.907
	Seine	Jan-Apr	0.00	31.62	24.51	25.79	16.10	1.87	0.11	0.00	0.00	0.00	80.6	1,145	9,335	115.270
	Seine	May-Sep	0.00	0.16	28.79	22.54	26.29	19.56	2.35	0.31	0.00	0.00	114.2	639	9,119	79.855
	Trawl	Oct-Dec	0.00	38.75	35.27	19.59	6.24	0.15	0.00	0.00	0.00	0.00	85.8	689	1,328	15.472
	Trawl	Jan-Apr	0.00	38.75	35.27	19.59	6.24	0.15	0.00	0.00	0.00	0.00	85.8	689 +	586	6.822
19612	Seine	Oct-Dec	0.00	9.92	71.21	12.79	4.02	1.72	0.33	0.00	0.00	0.00	88.8	2,824	53,725	602.612
	Seine	Jan-Apr	0.00	13.01	67.90	10.71	5.23	2.56	0.60	0.00	0.00	0.00	87.8	2,824 +	36	0.412
	Seine	May-Sep	0.00	9.42	71.71	13.00	3.96	1.57	0.32	0.02	0.00	0.00	88.8	2,824 +	10,747	120.280
	Trawl	Oct-Dec	0.00	9.56	71.49	12.85	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2,824 +	785	8.818
	Trawl	Jan-Apr	0.00	9.56	71.49	12.85	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2,824 +	9	0.106
19623	Seine	Oct-Dec	0.00	13.94	52.76	29.55	3.49	0.19	0.04	0.04	0.00	0.00	86.6	1,596	56,900	651.147
	Seine	Jan-Apr	0.00	31.58	47.44	15.39	2.88	1.78	0.72	0.35	0.00	0.00	82.2	1,874 +	5,014	71.016
	Seine	May-Sep	0.00	16.74	51.99	27.11	3.19	1.26	0.49	0.10	0.00	0.00	83.3	1,874 +	6,685	78.835
	Trawl	Oct-Dec	0.00	16.73	53.03	26.51	2.73	0.65	0.25	0.10	0.00	0.00	84.5	2,014 +	200	2.372
	Trawl	Jan-Apr	0.00	16.73	53.03	26.51	2.73	0.65	0.25	0.10	0.00	0.00	84.5	2,014 +	47	0.562
19634	Seine	Oct-Dec	0.00	4.30	63.37	29.55	2.20	0.47	0.05	0.07	0.00	0.00	103.4	3,255	65,538	626.573
	Seine	Jan-Apr	0.06	5.19	60.54	31.14	2.58	0.40	0.03	0.06	0.00	0.00	105.7	3,255 +	878	8.440
	Seine	May-Sep	0.00	3.41	49.27	36.83	6.34	3.17	0.73	0.24	0.00	0.00	99.2	410	10,153	102.385
	Trawl	Oct-Dec	0.06	5.41	60.55	30.91	2.58	0.40	0.03	0.06	0.00	0.00	103.4	3,255 +	105	1.016
	Trawl	Jan-Apr	0.06	5.41	60.55	30.91	2.58	0.40	0.03	0.06	0.00	0.00	103.4	3,255 +	208	2.011
19645	Seine	Oct-Dec	0.00	20.04	54.60	22.98	2.07	0.28	0.00	0.03	0.00	0.00	103.0	2,555	39,050	388.413
	Seine	Jan-Apr	0.00	20.49	50.36	25.51	2.46	1.14	0.23	0.00	0.00	0.00	104.3	2,939 +	5,453	54.899
	Seine	May-Sep	0.00	16.35	55.51	25.09	2.26	0.77	0.67	0.04	0.00	0.00	104.0	2,939 +	3,266	31.893
	Trawl	Oct-Dec	0.00	14.53	56.86	25.79	2.14	0.61	0.03	0.03	0.00	0.00	104.3	2,939 +	36	0.349
	Trawl	Jan-Apr	0.00	14.53	56.86	25.79	2.14	0.61	0.03	0.03	0.00	0.00	104.3	2,939 +	14	0.132
19656	Seine	Oct-Dec	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529	27,909	231.771
	Seine	Jan-Apr	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	4,216	35.012
	Seine	May-Sep	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	1,165	9.673
	Trawl	Oct-Dec	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	25	0.211
	Trawl	Jan-Apr	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	18	0.146
19667	Seine	Oct-Dec	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	28,090	306.795
	Seine	Jan-Apr	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1,694	18.499
	Seine	May-Sep	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1,193	13.031
	Trawl	Oct-Dec	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1	0.008
	Trawl	Jan-Apr	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	65	0.707

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19678	Seine	Oct-Dec	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0 *	1,031	10.881
	Seine	Jan-Apr	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0 *	58	0.616
	Seine	May-Sep	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0 *	700	7.390
	Trawl	Jan-Apr	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0 *	101	1.061
19690	Seine	Oct-Dec	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0 *	1	0.007
	Seine	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0 *	220	2.299
	Trawl	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0 *	0	0.004
	Gillnet	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0 *	22	0.230
19701	Seine	Oct-Dec	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419	588	5.118
	Seine	Jan-Apr	0.43	13.36	41.17	34.74	7.01	2.58	0.67	0.04	0.00	0.00	113.9	1,419 +	857	7.672
	Seine	May-Sep	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419 +	66	0.577
	Trawl	Oct-Dec	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419 +	95	0.828
	Trawl	Jan-Apr	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419 +	4	0.032
	Gillnet	Oct-Dec	0.00	4.58	11.75	46.61	28.49	6.77	1.49	0.20	0.10	0.00	140.1	1,004 +	40	0.286
	Gillnet	Jan-Apr	0.00	4.58	11.75	46.61	28.49	6.77	1.49	0.20	0.10	0.00	140.1	1,004 +	44	0.311
19712	Seine	Oct-Dec	0.06	12.78	32.57	33.30	16.53	3.36	1.21	0.12	0.06	0.00	126.0	2,340	1,017	8.277
	Seine	Jan-Apr	0.00	5.69	32.75	36.27	19.69	4.21	1.29	0.09	0.01	0.00	113.1	7,062	7,240	63.276
	Seine	May-Sep	0.01	4.41	29.73	34.98	23.32	6.08	1.39	0.09	0.01	0.00	117.3	9,402 +	98	0.815
	Trawl	Jan-Apr	0.01	8.60	34.61	33.23	18.40	3.79	1.17	0.17	0.02	0.00	114.9	9,402 +	0	0.002
	Gillnet	Jan-Apr	0.00	5.92	11.45	45.25	28.69	6.90	1.65	0.14	0.00	0.00	139.8	1,004	456	3.275
19723	Seine	Oct-Dec	0.00	3.37	50.48	20.94	18.35	5.39	0.91	0.45	0.11	0.00	120.6	1,071	256	2.082
	Seine	Jan-Apr	0.08	1.98	36.48	29.31	20.75	10.01	1.24	0.14	0.01	0.00	130.3	4,643	5,161	41.003
	Seine	May-Sep	0.09	3.35	39.83	27.62	19.68	7.90	1.15	0.33	0.05	0.00	124.1	5,714 +	167	1.351
	Trawl	Oct-Dec	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777 +	1	0.008
	Trawl	Jan-Apr	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777 +	0	0.000
	Gillnet	Oct-Dec	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224 +	6	0.048
	Gillnet	Jan-Apr	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224 +	2,057	15.421
19734	Seine	Jan-Apr	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884 +	842	10.833
	Seine	May-Sep	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884 +	62	0.795
	Trawl	Jan-Apr	0.00	16.83	61.15	17.24	3.42	1.23	0.14	0.00	0.00	0.00	72.2	731	5	0.064
	Gillnet	Jan-Apr	0.00	0.00	3.74	43.04	32.01	17.56	3.21	0.43	0.00	0.00	157.1	924	3,095	19.692
19745	Seine	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685 +	218	2.243
	Seine	Jan-Apr	0.36	3.87	57.31	27.80	7.04	2.49	0.77	0.23	0.13	0.00	98.1	5,685	575	5.995
	Seine	May-Sep	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685 +	55	0.564
	Trawl	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685 +	1	0.006
	Gillnet	Jan-Apr	0.00	0.00	4.88	46.34	32.32	12.80	3.05	0.61	0.00	0.00	150.1	164 +	5,331	35.526
19756	Seine	Oct-Dec	0.06	7.34	23.01	40.08	20.31	5.57	2.38	0.79	0.43	0.04	122.7	3,494	4,313	35.358
	Seine	Jan-Apr	0.00	5.95	20.35	46.41	19.28	5.46	1.60	0.71	0.20	0.04	109.9	2,254	834	7.166
	Seine	May-Sep	0.03	7.45	21.69	41.20	20.01	5.53	2.57	1.04	0.40	0.07	119.8	5,748 +	28	0.238
	Trawl	Oct-Dec	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918 +	3	0.021
19756	Trawl	Jan-Apr	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918 +	86	0.711
	Gillnet	Jan-Apr	0.00	0.00	0.54	42.00	43.88	10.28	2.70	0.40	0.20	0.00	148.8	786	6,975	46.818
19767	Seine	Oct-Dec	0.62	6.52	56.39	19.55	12.05	3.06	0.95	0.66	0.19	0.01	107.2	1,828	616	5.836
	Seine	Jan-Apr	0.06	3.39	52.68	22.31	16.46	3.70	0.86	0.42	0.03	0.09	105.5	3,200	8,257	78.397
	Seine	May-Sep	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028 +	25	0.236
	Trawl	Oct-Dec	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028 +	73	0.683
	Trawl	Jan-Apr	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028 +	802	7.534
	Gillnet	Jan-Apr	0.00	0.00	3.50	27.75	47.32	16.68	4.08	0.54	0.15	0.00	150.3	1,658	7,736	51.507
19778	Seine	Oct-Dec	0.06	2.53	36.75	40.07	9.39	7.18	3.08	0.56	0.35	0.03	110.2	1,984	10,648	96.197
	Seine	Jan-Apr	0.00	0.42	34.65	42.60	13.62	7.09	1.22	0.32	0.00	0.08	105.6	3,516	3,919	36.641
	Seine	May-Sep	0.06	2.25	36.56	39.10	10.46	7.84	2.83	0.57	0.27	0.06	106.3	5,500 +	30	0.287
	Trawl	Oct-Dec	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891 +	1,792	16.618
	Trawl	Jan-Apr	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891 +	296	2.746
	Gillnet	Oct-Dec	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541 +	63	0.425
	Gillnet	Jan-Apr	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541	7,253	48.694
19789	Seine	Oct-Dec	0.00	1.62	17.91	38.42	27.23	8.82	4.77	1.01	0.15	0.08	126.5	2,433	10,046	79.075
	Seine	Jan-Apr	0.00	3.01	23.91	33.51	25.54	7.92	3.91	1.48	0.43	0.29	117.7	2,095	54	0.461
	Seine	May-Sep	0.00	2.25	20.19	36.76	25.68	8.39	4.95	1.27	0.31	0.20	120.8	4,528 +	71	0.587
	Trawl	Oct-Dec	0.00	1.04	17.08	39.67	29.98	8.28	2.76	1.04	0.07	0.07	125.5	1,341	2,734	21.790
	Trawl	Jan-Apr	0.00	2.34	21.31	33.82	29.30	8.39	3.55	0.56	0.48	0.24	121.0	1,239	607	5.018
	Gillnet	Oct-Dec	0.00	0.00	1.15	23.14	54.68	13.77	5.54	1.53	0.00	0.19	153.5	523 +	7	0.048
	Gillnet	Jan-Apr	0.00	0.00	1.25	22.00	55.02	14.11	5.74	1.66	0.00	0.21	153.8	523	6,818	44.171
19790	Seine	Oct-Dec	0.30	2.02	42.12	22.71	18.78	9.35	2.56	1.54	0.47	0.15	114.6	3,063	1,188	10.051
	Seine	Jan-Apr	0.00	4.54	41.60	20.45	20.27	9.00	2.55	1.29	0.25	0.05	100.2	7,664	903	9.224
	Seine	May-Sep	0.15	4.03	43.30	19.97	19.34	8.73	2.59	1.42	0.37	0.11	102.3	10,727 +	52	0.514
	Trawl	Oct-Dec	0.00	3.30	46.70	22.21	15.90	8.60	2.01	1.29	0.00	0.00	108.4	698	242	2.234
	Trawl	Jan-Apr	0.00	3.31	49.04	22.17	14.65	7.90	1.78	1.15	0.00	0.00	107.1	785 +	254	2.373
	Gillnet	Oct-Dec	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263 +	0	0.001
	Gillnet	Jan-Apr	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263 +	3,177	21.367
	Gillnet	May-Sep	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263 +	2	0.017
19801	Seine	Oct-Dec	0.00	4.38	33.94	34.26	14.82	8.57	3.14	0.66	0.21	0.02	116.5	6,355	4,152	34.800
	Seine	Jan-Apr	0.00	6.17	34.93	30.73	11.93	10.58	4.58	0.67	0.37	0.04	99.9	12,461	2,133	19.819
	Seine	May-Sep	0.00	4.80	38.21	36.28	10.06	7.77	2.22	0.46	0.15	0.03	96.4	18,816 +	79	0.813
	Trawl	Oct-Dec	0.26	4.36	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147	501	4.510
	Trawl	Jan-Apr	0.26	4.36	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147 +	121	1.087
	Gillnet	Jan-Apr	0.00	0.09	2.19	18.16	22.98	37.37	16.05	2.81	0.26	0.09	152.1	1,140	5,067	33.319

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	CATCH (millions)
			PERCENT AT AGE													
19812	Seine	Oct-Dec	0.00	5.36	39.98	31.38	14.07	4.96	3.31	0.83	0.06	0.06	121.1	3,876	3,337	27.503
	Seine	Jan-Apr	0.00	7.65	37.90	23.33	19.46	4.51	4.57	2.11	0.40	0.06	104.8	5,332	3,324	30.103
	Seine	May-Sep	0.00	3.86	35.45	28.47	21.36	4.56	4.30	1.74	0.22	0.04	106.8	9,208 +	74	0.690
	Trawl	Oct-Dec	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548	414	3.464
	Trawl	Jan-Apr	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548 +	101	0.843
	Gillnet	Jan-Apr	0.00	0.00	4.60	15.77	30.37	15.82	20.42	11.58	1.03	0.41	150.9	589	5,583	37.004
	Gillnet	May-Sep	0.00	0.00	4.58	15.96	30.56	15.11	20.88	11.71	0.85	0.34	151.6	589 +	0	0.001
19823	Seine	Oct-Dec	0.00	3.37	34.06	30.39	16.43	8.12	2.93	3.00	1.43	0.26	116.0	5,296	632	4.809
	Seine	Jan-Apr	0.00	3.36	31.41	28.72	17.68	11.49	3.16	2.78	1.16	0.24	113.5	13,007	7,798	69.556
	Seine	May-Sep	0.00	10.91	42.05	22.39	12.44	7.63	1.95	1.76	0.72	0.14	109.6	18,303 +	57	0.568
	Trawl	Oct-Dec	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	115	0.797
	Trawl	Jan-Apr	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	0	0.000 ~
	Trawl	May-Sep	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439 +	2	0.017
	Gillnet	Jan-Apr	0.00	0.00	0.49	27.76	29.48	23.59	9.34	7.37	1.72	0.25	152.8	407	8,613	56.381
19834	Seine	Oct-Dec	0.21	19.24	36.34	21.19	13.02	6.01	2.80	0.64	0.34	0.22	108.4	3,634	444	3.882
	Seine	Jan-Apr	0.00	4.70	40.35	31.85	11.86	6.31	3.10	1.27	0.44	0.11	103.8	7,318	4,137	41.098
	Seine	May-Sep	0.15	10.57	39.21	27.00	12.16	6.30	3.13	0.95	0.39	0.14	105.9	10,952 +	88	0.843
	Trawl	Oct-Dec	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952 +	113	1.056
	Trawl	Jan-Apr	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952 +	214	2.011
	Gillnet	Jan-Apr	0.00	0.00	7.14	30.29	30.95	19.05	9.39	1.59	0.66	0.93	142.9	756	6,039	42.246
19845	Seine	Oct-Dec	0.00	32.93	37.34	18.72	6.75	2.89	0.91	0.34	0.11	0.00	101.9	2,528	409	3.904
	Seine	Jan-Apr	0.00	23.09	43.51	19.33	8.62	3.55	1.27	0.55	0.07	0.00	90.8	8,187	2,770	29.011
	Seine	May-Sep	0.00	24.05	45.04	18.72	7.69	2.83	1.19	0.42	0.05	0.01	90.3	10,715 +	88	0.975
19845	Trawl	Oct-Dec	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799 +	20	0.218
	Trawl	Jan-Apr	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799 +	246	2.630
	Gillnet	Oct-Dec	0.00	0.09	3.10	26.09	32.48	23.63	9.22	3.74	0.82	0.82	147.4	1,096 +	0	0.002
	Gillnet	Jan-Apr	0.00	0.09	3.10	26.09	32.48	23.63	9.22	3.74	0.82	0.82	147.4	1,096	3,495	23.718
19856	Seine	Oct-Dec	0.00	14.33	62.24	17.57	4.40	1.27	0.17	0.02	0.00	0.00	103.3	1,390	209	2.004
	Seine	Jan-Apr	0.01	9.76	55.76	24.98	6.45	2.06	0.80	0.12	0.08	0.00	94.7	6,773	178	1.844
	Seine	May-Sep	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	40	0.426
	Trawl	Oct-Dec	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	46	0.481
	Trawl	Jan-Apr	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	120	1.257
	Gillnet	Oct-Dec	0.00	0.00	2.50	35.62	33.44	16.51	8.49	2.60	0.57	0.26	145.1	1,920 +	0	0.000
19867	Seine	Oct-Dec	0.10	23.34	34.77	30.50	8.84	1.75	0.46	0.23	0.00	0.00	104.8	1,148	104	0.984
	Seine	Jan-Apr	0.03	2.73	32.98	38.23	19.76	4.32	1.22	0.45	0.19	0.10	97.6	7,957	3,133	32.258
	Seine	May-Sep	0.03	11.92	35.91	34.11	13.52	3.16	0.96	0.27	0.08	0.05	94.2	9,105 +	41	0.431
	Trawl	Jan-Apr	0.03	11.82	33.27	35.95	14.21	3.23	0.99	0.34	0.11	0.05	98.6	9,105 +	76	0.768
	Gillnet	Jan-Apr	0.00	0.00	3.01	38.33	32.48	15.47	7.35	2.55	0.60	0.21	145.3	1,920	5,998	41.166
19878	Seine	Oct-Dec	0.41	6.52	64.47	14.59	11.38	1.81	0.55	0.15	0.11	0.00	106.4	1,632	357	3.386
	Seine	Jan-Apr	0.00	2.35	52.89	17.58	20.29	5.27	1.31	0.21	0.10	0.00	104.0	6,338	1,475	13.516
	Seine	May-Sep	0.07	4.82	61.90	14.59	13.99	3.51	0.87	0.18	0.06	0.00	99.7	7,970 +	33	0.333
	Trawl	Oct-Dec	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970 +	83	0.826
	Trawl	Jan-Apr	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970 +	279	2.773
	Gillnet	Jan-Apr	0.00	0.00	9.20	14.81	47.81	20.09	5.27	2.24	0.34	0.22	144.4	891	5,988	41.461
19889	Seine	Oct-Dec	0.00	26.15	17.44	42.75	6.77	5.90	0.82	0.16	0.00	0.00	109.1	1,252	728	6.660
	Seine	Jan-Apr	0.00	12.31	15.17	51.91	10.87	7.93	1.48	0.27	0.04	0.03	104.6	6,517	1,446	13.339
	Seine	May-Sep	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	56	0.547
	Trawl	Oct-Dec	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	134	1.308
	Trawl	Jan-Apr	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	86	0.844
	Gillnet	Jan-Apr	0.00	0.00	1.60	40.43	21.42	26.02	7.99	2.26	0.28	0.00	140.3	823	5,919	42.236
19890	Seine	Oct-Dec	0.00	6.68	58.62	12.72	17.67	2.26	2.05	0.00	0.00	0.00	101.3	928	75	0.736
	Seine	Jan-Apr	0.00	10.09	57.87	8.23	17.43	3.59	2.27	0.40	0.07	0.06	100.2	5,915	96	0.936
	Seine	May-Sep	0.00	7.51	56.71	11.25	19.33	2.97	1.81	0.34	0.06	0.01	97.4	6,843 +	62	0.632
	Gillnet	Jan-Apr	0.00	0.00	8.93	11.71	56.04	12.10	9.44	1.41	0.30	0.06	141.6	1,371	7,886	55.630
19901	Seine	Oct-Dec	0.00	13.89	31.24	38.58	7.67	7.42	1.04	0.16	0.00	0.00	107.5	698	371	3.440
	Seine	Jan-Apr	0.00	3.82	21.09	44.52	10.27	16.08	2.48	1.47	0.24	0.03	109.4	5,291	1,141	10.217
	Seine	May-Sep	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	108.1	5,989 +	58	0.541
	Trawl	Oct-Dec	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	108.1	5,989 +	122	1.133
	Gillnet	Jan-Apr	0.00	0.00	1.29	28.15	17.20	40.11	7.27	4.69	1.20	0.09	146.0	1,087	9,410	64.461
19912	Seine	Oct-Dec	0.00	3.96	67.09	17.24	9.27	1.31	0.56	0.56	0.00	0.00	103.6	641	639	6.140
	Seine	Jan-Apr	0.00	3.62	53.63	14.96	17.44	4.04	5.34	0.59	0.38	0.00	105.6	5,036	3,725	34.318
	Seine	May-Sep	0.00	4.95	56.44	14.07	15.80	3.22	4.63	0.58	0.28	0.02	104.1	5,677 +	57	0.550
	Trawl	Oct-Dec	0.00	4.95	56.44	14.07	15.80	3.22	4.63	0.58	0.28	0.02	104.1	5,677 +	128	1.229
	Gillnet	Jan-Apr	0.00	0.00	6.33	14.88	43.63	11.72	18.91	2.65	1.45	0.43	147.6	1,169	8,870	60.081
19923	Seine	Oct-Dec	0.00	26.95	31.11	31.47	6.97	2.56	0.26	0.58	0.11	0.00	98.6	973	516	5.272
	Seine	Jan-Apr	0.00	11.22	39.18	33.15	7.57	5.77	1.37	1.63	0.06	0.06	101.3	5,445	4,396	42.070
	Seine	May-Sep	0.00	16.80	36.80	31.55	6.87	5.28	1.20	1.32	0.14	0.03	99.6	6,418 +	96	0.968
	Gillnet	Jan-Apr	0.00	0.00	11.47	40.02	16.98	21.61	4.08	5.40	0.22	0.22	137.9	907	8,733	63.326
19934	Seine	Oct-Dec	0.00	5.65	50.00	25.43	16.30	1.52	1.09	0.00	0.00	0.00	101.3	460	866	8.549
	Seine	Jan-Apr	0.02	3.72	42.96	26.98	19.34	3.70	2.65	0.53	0.13	0.00	97.2	5,969	5,138	52.868
	Seine	May-Sep	0.02	4.74	42.74	26.61	18.59	3.81	2.69	0.65	0.14	0.00	97.4	6,429 +	71	0.730
	Gillnet	Jan-Apr	0.00	0.07	3.65	25.26	44.78	15.21	7.83	2.42	0.62	0.16	133.7	1,201	11,572	86.661
19945	Seine	Oct-Dec	0.00	20.87	27.81	36.05	10.01	4.44	0.68	0.11	0.00	0.02	102.9	1,130	604	5.865
	Seine	Jan-Apr	0.00	7.09	21.21	37.04	18.67	11.51	2.92	1.13	0.35	0.08	110.4	5,754	4,362	38.990
	Seine	May-Sep	0.00	11.65	22.69	35.69	16.39	9.89	2.37	0.93	0.29	0.10	107.9	6,884 +	33	0.306
	Gillnet	Jan-Apr	0.00	0.00	2.10	27.82	38.15	24.14	5.10	2.10	0.30	0.30	139.6	927	8,190	58.655
19956	Seine	Oct-Dec	0.49	29.31	46.92	11.70	8.84	1.78	0.87	0.08	0.00	0.00	85.9	1,662	397	4.650
	Seine	Jan-Apr	0.06	9.29	47.72	15.20	15.88	6.74	3.87	0.86	0.27	0.11	98.2	8,243	7,434	73.620
	Seine	May-Sep	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905 +	10	0.106

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
	Trawl	Oct-Dec	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905 +	39	0.406
	Gillnet	Jan-Apr	0.00	0.00	4.05	15.87	44.53	22.08	10.30	2.11	0.84	0.21	138.2	544	6,233	45.214
19967	Seine	Oct-Dec	3.29	9.71	54.01	21.40	5.31	5.27	2.24	1.24	0.14	0.16	88.1	7,667 +	279	3.120
	Seine	Jan-Apr	0.00	5.52	51.35	24.45	6.54	7.43	2.84	1.70	0.12	0.04	88.8	7,297	9,390	96.287
	Seine	May-Sep	0.65	8.74	52.26	22.45	5.78	6.09	2.41	1.42	0.13	0.07	91.7	7,667 +	7	0.071
	Gillnet	Jan-Apr	0.00	0.00	4.74	17.85	16.43	31.91	17.06	8.53	2.53	0.95	136.7	633	6,148	44.974
19978	Seine	Oct-Dec	0.00	3.96	48.07	40.23	6.40	0.91	0.34	0.08	0.00	0.00	86.1	1,288	954	11.072
	Seine	Jan-Apr	0.02	2.93	47.03	31.80	12.25	2.90	2.14	0.70	0.21	0.03	86.8	5,837	5,755	66.260
	Trawl	Jan-Apr	0.00	7.01	45.19	37.03	8.16	1.14	0.98	0.16	0.33	0.00	74.3	613	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	1.54	26.20	28.32	15.61	18.69	7.13	1.54	0.96	130.4	519	6,895	52.858
19989	Seine	Oct-Dec	0.17	12.30	27.77	43.17	13.35	2.74	0.37	0.13	0.00	0.00	91.3	1,297	1,471	16.123
	Seine	Jan-Apr	0.00	4.23	22.78	45.02	18.55	6.58	1.88	0.78	0.13	0.06	100.0	3,192	4,976	49.748
	Trawl	Jan-Apr	0.00	5.49	31.87	30.77	21.98	7.69	1.10	0.00	1.10	0.00	92.3	91	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	2.15	29.31	36.72	21.05	6.70	3.35	0.60	0.12	130.8	836	6,837	52.248
19990	Seine	Oct-Dec	0.00	21.12	50.16	16.69	8.74	2.39	0.89	0.00	0.00	0.00	75.0	1,077	1,156	15.363
	Seine	Jan-Apr	0.10	9.62	35.44	19.34	23.92	8.81	2.12	0.36	0.28	0.02	92.2	5,042	6,454	69.966
	Gillnet	Jan-Apr	0.00	0.00	1.07	13.75	44.56	28.68	9.59	1.92	0.43	0.00	135.1	938	7,593	56.219
20001	Seine	Oct-Dec	0.00	9.66	51.94	27.98	5.52	3.51	1.25	0.00	0.13	0.00	95.6	797	1,423	14.897
	Seine	Jan-Apr	0.00	4.80	42.65	30.65	9.52	9.19	2.52	0.55	0.09	0.02	97.3	4,558	7,275	74.770
	Gillnet	Jan-Apr	0.00	0.00	3.55	17.75	25.59	35.06	15.09	2.37	0.30	0.30	133.4	676	7,682	57.589
20012	Seine	Oct-Dec	0.00	4.96	61.42	26.19	5.93	0.97	0.32	0.11	0.00	0.11	87.0	928	1,328	15.265
	Seine	Jan-Apr	0.00	6.59	49.18	27.04	12.45	2.35	1.99	0.40	0.00	0.00	87.7	4,475	9,299	106.015
	Gillnet	Jan-Apr	0.00	0.00	5.83	20.78	30.42	17.69	21.01	3.54	0.49	0.24	131.8	915	7,986	60.800
20023	Seine	Oct-Dec	0.00	2.80	44.16	42.29	8.41	2.10	0.23	0.00	0.00	0.00	91.9	428	1,696	18.466
	Seine	Jan-Apr	0.01	2.67	42.62	36.58	12.64	4.03	0.93	0.41	0.10	0.00	87.2	7,293	10,670	122.311
	Gillnet	Jan-Apr	0.00	0.00	2.29	22.38	31.05	23.83	9.87	7.34	2.65	0.60	131.6	831	8,010	60.889
20034	Seine	Oct-Dec	0.00	11.24	30.77	40.04	14.00	3.55	0.39	0.00	0.00	0.00	83.1	507	1,356	16.316
	Seine	Jan-Apr	0.00	2.90	25.39	41.55	22.29	5.65	1.54	0.43	0.25	0.00	83.1	1,707	7,019	79.437
	Gillnet	Jan-Apr	0.00	0.00	1.74	21.39	37.02	23.98	11.72	2.51	1.49	0.14	124.0	1,185	5,226	41.630
20045	Seine	Oct-Dec	0.05	9.02	31.32	28.33	20.85	7.92	1.94	0.44	0.10	0.03	87.7	5,135 +	1,332	15.157
	Seine	Jan-Apr	0.00	4.00	23.82	31.66	28.26	8.73	2.30	0.85	0.28	0.09	95.6	3,174	7,929	82.942
	Gillnet	Jan-Apr	0.00	0.00	0.88	12.91	46.61	24.07	10.28	3.72	1.31	0.22	130.6	457	8,954	68.542
20056	Seine	Oct-Dec	0.33	23.95	30.75	23.55	11.93	7.30	1.88	0.83	0.31	0.01	79.5	4,891 +	1,371	17.913
	Seine	Jan-Apr	0.07	16.89	24.93	24.50	18.98	11.05	2.44	0.89	0.21	0.04	84.5	2,824	9,308	110.102
	Gillnet	Jan-Apr	0.00	0.00	0.62	12.22	35.80	33.54	14.70	2.49	0.62	0.00	129.8	810	7,277	56.028
20067	Seine	Oct-Dec	0.00	2.66	48.04	26.57	12.82	5.96	3.01	0.68	0.23	0.03	84.9	6,122 +	672	7.770
	Seine	Jan-Apr	0.00	1.76	48.73	27.86	11.85	5.53	3.43	0.78	0.05	0.00	81.3	2,042	3,865	47.559
	Gillnet	Jan-Apr	0.00	0.00	3.46	13.42	28.95	27.51	18.90	5.82	1.69	0.25	126.7	1,185	5,285	41.722
20078	Seine	Oct-Dec	0.12	15.45	10.56	55.62	14.50	2.89	0.61	0.12	0.12	0.00	74.8	933	1,136	14.517
	Seine	Jan-Apr	0.00	0.25	7.14	65.12	16.73	6.27	3.01	1.20	0.25	0.04	88.0	2,761	6,046	68.731
	Gillnet	Jan-Apr	0.00	0.01	1.24	41.78	23.94	17.99	10.43	3.29	1.28	0.05	111.0	1,866	2,752	24.624

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Oct-Dec	0.10	15.78	39.08	37.78	5.35	1.56	0.26	0.05	0.05	0.00	96.8	1,927	7,670	79.266
	Seine	Jan-Apr	0.00	10.19	36.69	43.89	7.69	1.25	0.30	0.00	0.00	0.00	99.3	2,112	14,151	143.353
19512	Seine	Oct-Dec	0.11	6.62	61.99	20.85	9.27	0.89	0.27	0.00	0.00	0.00	98.9	996	8,251	83.215
	Seine	Jan-Apr	0.00	0.33	12.08	27.32	50.77	6.88	2.08	0.48	0.06	0.00	123.8	3,897	18,757	146.019
19523	Seine	Jan-Apr	0.16	11.77	57.76	28.08	1.67	0.50	0.05	0.00	0.00	0.00	82.4	3,764	20	0.242
19534	Seine	Oct-Dec	0.05	1.61	61.40	29.42	6.70	0.59	0.12	0.12	0.00	0.00	95.6	3,655	23,534	245.938
	Seine	Jan-Apr	0.00	4.43	65.53	24.81	4.06	0.83	0.21	0.04	0.04	0.04	87.2	2,439	9,675	109.814
19545	Seine	Oct-Dec	0.06	19.64	57.81	18.59	3.27	0.64	0.00	0.00	0.00	0.00	87.6	1,723	4,650	53.117
	Seine	Jan-Apr	0.00	10.86	65.09	20.01	3.47	0.52	0.05	0.00	0.00	0.00	80.9	754	1,473	18.369
19556	Seine	Oct-Dec	0.00	13.43	67.98	14.82	3.09	0.50	0.16	0.02	0.00	0.00	87.4	3,730	15,310	175.972
	Seine	Jan-Apr	0.00	9.21	49.51	19.28	17.88	3.68	0.11	0.11	0.22	0.00	87.2	923	1,787	20.496
19567	Seine	Oct-Dec	0.00	2.86	71.84	24.69	0.41	0.20	0.00	0.00	0.00	0.00	86.4	490 +	1,690	19.549
	Seine	Jan-Apr	0.00	2.74	71.92	24.81	0.35	0.18	0.00	0.00	0.00	0.00	86.4	588 +	915	10.586
	Seine	May-Sep	0.00	2.72	71.94	24.83	0.34	0.17	0.00	0.00	0.00	0.00	86.4	588 +	8	0.088
19578	Seine	Jan-Apr	0.00	15.18	54.28	25.87	3.98	0.47	0.17	0.04	0.01	0.00	76.8	1,480	513	6.766
	Seine	May-Sep	0.00	13.04	52.03	25.41	5.47	2.30	1.35	0.34	0.07	0.00	78.3	1,480 +	43	0.551
19589	Seine	Oct-Dec	0.00	3.26	45.21	29.96	14.51	3.46	1.82	1.45	0.33	0.00	92.2	2,843	55,196	588.911
	Seine	Jan-Apr	0.00	3.28	19.68	23.88	26.94	9.15	7.94	6.52	1.99	0.62	99.6	751	13,845	136.204
	Gillnet	Jan-Apr	0.00	10.00	58.10	9.50	19.00	2.60	0.50	0.20	0.10	0.00	97.6	0 *	182	1.868
19590	Seine	Oct-Dec	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2,846	53,911	563.328
	Seine	Jan-Apr	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2,846	0	0.000 ~
19601	Seine	Oct-Dec	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	16,711	195.384
	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	9,679	113.162
	Seine	May-Sep	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	44	0.520
19612	Seine	Oct-Dec	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163 +	5,951	63.821
	Seine	Jan-Apr	0.00	5.32	80.46	10.07	3.10	1.05	0.00	0.00	0.00	0.00	92.8	1,117	17,710	190.890
	Trawl	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163 +	24	0.253
19623	Seine	Oct-Dec	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1,862 +	3,184	31.449
	Seine	Jan-Apr	0.00	2.47	41.39	49.75	5.41	0.71	0.27	0.00	0.00	0.00	101.0	1,633	15,022	148.723
19634	Seine	Oct-Dec	0.00	1.64	60.61	25.86	10.83	0.77	0.29	0.00	0.00	0.00	103.4	1,107 +	2,952	28.550
	Seine	Jan-Apr	0.00	0.95	65.05	22.91	10.00	0.85	0.25	0.00	0.00	0.00	101.0	769	18,313	182.208
19645	Seine	Oct-Dec	0.00	2.78	34.38	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576 +	68	0.553
	Seine	Jan-Apr	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576	10,397	84.858
	Seine	May-Sep	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576 +	5,582	45.559
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	4,299	31.377
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	6,471	47.228
	Seine	May-Sep	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	73	0.535
19667	Seine	Oct-Dec	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	2,965	25.811
	Seine	Jan-Apr	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	9,794	85.253
	Seine	May-Sep	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	2,385	20.760
19701	Seine	Jan-Apr	0.00	5.77	44.57	36.95	7.85	2.77	1.62	0.46	0.00	0.00	132.8	433	0	0.000 ~
19712	Seine	Jan-Apr	0.00	3.66	19.01	50.10	21.81	3.39	1.23	0.79	0.03	0.00	135.3	1,482	6,894	51.001
19723	Seine	Jan-Apr	0.00	0.21	25.15	23.05	35.64	13.81	1.89	0.17	0.08	0.00	139.1	2,556	16,766	117.326
	Gillnet	Jan-Apr	0.00	0.00	8.81	23.56	51.44	12.23	3.06	0.72	0.18	0.00	159.4	556	1,537	9.642
19734	Seine	Jan-Apr	0.00	5.71	43.66	22.09	15.14	10.96	2.32	0.12	0.00	0.00	114.9	5,221	12,394	109.083
	Gillnet	Jan-Apr	0.00	0.00	29.87	27.92	27.92	10.39	3.90	0.00	0.00	0.00	133.5	154 +	3,940	29.517
19745	Seine	Jan-Apr	0.02	0.44	51.61	19.95	12.00	8.70	5.71	1.38	0.18	0.00	124.6	10,038	17,798	142.327
	Trawl	Jan-Apr	0.02	0.60	53.85	19.75	11.36	8.01	4.96	1.28	0.17	0.01	122.5	10,038 +	0	0.004
	Gillnet	Jan-Apr	0.00	0.00	2.90	32.37	36.51	19.92	7.88	0.41	0.00	0.00	169.0	241 +	8,310	49.159
19756	Seine	Jan-Apr	0.00	0.20	8.31	48.06	19.79	12.97	7.65	2.57	0.43	0.00	140.0	9,230	22,820	162.893
	Trawl	Jan-Apr	0.00	0.47	14.55	54.46	18.78	6.10	5.16	0.47	0.00	0.00	131.6	213	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.68	41.72	34.00	14.77	5.92	2.50	0.33	0.08	150.2	1,199	16,005	106.418
19767	Seine	Jan-Apr	0.00	0.39	11.51	32.16	38.00	12.43	3.89	1.42	0.16	0.03	136.7	6,684	17,463	126.700
	Gillnet	Jan-Apr	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332 +	12,556	81.452
	Gillnet	May-Sep	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332 +	24	0.154
19778	Seine	Oct-Dec	0.00	0.00	31.00	23.75	15.00	22.50	4.25	1.50	1.00	1.00	127.3	400	303	2.379
	Seine	Jan-Apr	0.00	0.77	39.43	18.78	16.78	18.80	4.14	1.10	0.17	0.04	109.2	7,454	7,615	67.761
	Seine	May-Sep	0.00	0.80	41.49	19.07	15.66	17.60	3.85	1.18	0.23	0.11	111.9	7,854 +	7	0.066
	Trawl	Oct-Dec	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898 +	51	0.456
19778	Trawl	Jan-Apr	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898 +	3	0.023
	Trawl	May-Sep	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898 +	11	0.101
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422	14,755	93.615
19789	Seine	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689 +	70	0.563
	Seine	Jan-Apr	0.00	1.07	14.94	51.51	13.82	9.87	7.04	1.43	0.26	0.06	123.1	3,689	10,473	86.211
	Seine	May-Sep	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689 +	4	0.032
	Trawl	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689 +	9	0.073
	Gillnet	Jan-Apr	0.00	0.00	1.05	24.79	28.57	23.74	18.07	3.15	0.42	0.21	161.5	476	8,138	50.388
19790	Seine	Jan-Apr	0.00	7.13	37.93	13.75	20.24	8.99	8.11	3.14	0.48	0.23	110.8	3,735	1,682	14.641
	Seine	May-Sep	0.00	6.21	43.91	15.58	20.00	6.37	5.30	2.20	0.35	0.08	108.2	3,735 +	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.31	52.51	22.35	12.01	7.26	0.28	0.28	163.6	358 +	2,300	14.061
19801	Seine	Jan-Apr	0.00	3.89	32.52	33.31	10.62	13.65	4.07	1.51	0.37	0.05	116.1	5,026	5,008	44.277
	Seine	May-Sep	0.00	2.83	27.39	22.26	14.13	17.84	8.83	4.77	1.41	0.53	133.6	566	2	0.015
	Gillnet	Jan-Apr	0.00	0.00	1.78	21.00	14.95	36.30	18.86	7.12	0.00	0.00	148.6	281 +	3,079	20.725
19812	Seine	Jan-Apr	0.00	4.32	24.84	28.55	22.53	5.50	7.92	3.73	2.04	0.58	120.4	4,775	2,370	19.713
	Seine	May-Sep	0.00	3.27	23.96	27.41	26.05	5.45	9.51	2.72	1.36	0.27	115.9	4,775 +	2	0.013
	Gillnet	Jan-Apr	0.00	0.00	0.70	12.02	44.25	11.67	27.53	3.31	0.35	0.17	137.0	574	3,115	22.741

Appendix 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	PERCENT AT AGE 0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	(millions)
19823	Seine	Jan-Apr	0.00	3.83	19.37	23.62	23.39	16.69	4.60	5.45	1.50	1.55	131.3	3,188	6,141	45.840
	Gillnet	Jan-Apr	0.00	0.00	0.35	14.19	23.82	44.83	6.48	9.81	0.35	0.18	137.8	571	2,434	17.662
19834	Seine	Jan-Apr	0.00	23.09	37.97	13.00	8.86	9.48	5.52	0.88	1.00	0.19	114.9	3,079	5,718	49.965
	Gillnet	Jan-Apr	0.00	0.00	1.68	6.72	17.98	32.61	31.93	5.38	3.36	0.34	154.9	595	858	5.540
19845	Seine	Jan-Apr	0.00	6.28	48.74	22.86	6.40	5.12	6.21	3.47	0.37	0.55	120.1	2,995	177	1.352
	Seine	May-Sep	0.00	20.47	53.62	14.22	3.71	2.74	3.17	1.70	0.13	0.23	109.0	2,995 +	1	0.008
19856	Seine	Oct-Dec	0.00	3.78	50.45	29.70	8.29	3.13	2.24	1.76	0.58	0.07	121.5	4,151 +	1	0.005
	Seine	Jan-Apr	0.00	3.86	48.16	27.50	10.68	3.83	2.92	2.21	0.74	0.11	124.3	2,847	203	1.633
19867	Seine	Jan-Apr	0.00	16.21	16.21	36.29	18.16	7.70	2.56	1.38	1.15	0.34	130.8	3,480	13,463	102.956
	Trawl	Jan-Apr	0.00	26.98	26.03	28.57	13.65	1.59	0.95	1.90	0.32	0.00	93.9	315	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	1.82	24.55	61.82	5.45	2.18	2.91	0.91	0.36	171.3	550	2,471	14.431
19878	Seine	Jan-Apr	0.00	1.60	63.80	7.41	14.70	8.38	2.75	0.65	0.48	0.23	127.5	4,883	8,276	67.129
	Trawl	Jan-Apr	0.00	3.03	59.09	19.70	15.15	3.03	0.00	0.00	0.00	0.00	92.9	66	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	5.38	7.10	41.29	28.60	12.90	3.01	1.29	0.43	166.9	465	1,448	8.674
19889	Seine	Jan-Apr	0.00	3.06	14.96	61.92	7.11	8.47	3.45	0.79	0.17	0.07	126.4	4,178	9,774	77.304
	Trawl	Jan-Apr	0.00	0.00	14.29	63.10	10.71	9.52	2.38	0.00	0.00	0.00	127.4	84	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.20	54.50	11.00	22.30	9.40	1.60	1.00	0.00	151.0	382 +	3,515	23.274
19890	Seine	Jan-Apr	0.00	0.46	26.32	11.72	48.79	4.89	5.99	1.53	0.27	0.03	139.4	3,720	7,890	56.611
	Gillnet	Jan-Apr	0.00	0.00	1.35	7.87	68.99	8.31	10.34	2.47	0.67	0.00	155.6	445	1,959	12.593
19901	Seine	Jan-Apr	0.00	6.15	19.13	22.02	10.60	35.06	2.99	3.39	0.64	0.02	130.8	5,715	6,299	47.096
	Gillnet	Jan-Apr	0.00	0.00	3.26	6.84	12.70	64.50	6.84	8.14	6.52	0.00	175.5	307 +	2,336	13.308
19912	Seine	Jan-Apr	0.00	1.47	43.29	10.77	14.97	6.62	18.95	2.42	1.26	0.26	132.2	4,290	3,086	23.337
	Trawl	Jan-Apr	0.00	3.45	31.03	20.69	26.44	2.30	10.34	2.30	2.30	1.15	105.6	87	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	6.29	13.49	30.76	13.85	29.86	2.88	2.52	0.36	154.2	556	627	4.066
19923	Seine	Jan-Apr	0.00	3.46	26.25	39.83	7.14	8.29	4.57	8.71	1.08	0.66	126.9	4,705	5,612	44.244
19934	Seine	Jan-Apr	0.00	3.85	18.47	22.30	31.82	8.69	6.19	6.58	1.84	0.27	125.3	6,196	5,332	42.481
	Trawl	Oct-Dec	0.00	3.00	22.74	24.13	30.04	8.00	5.00	5.26	1.58	0.24	124.7	6,274 +	0	0.001
	Trawl	Jan-Apr	0.00	6.41	25.64	37.18	12.82	12.82	3.85	0.00	1.28	0.00	92.4	78	0	0.000 ~
	Trawl	May-Sep	0.00	0.79	26.11	29.11	26.58	7.91	5.38	2.85	1.11	0.16	97.1	632	1	0.008
	Gillnet	Jan-Apr	0.00	0.16	5.65	32.10	54.84	5.32	1.13	0.65	0.16	0.00	131.1	620	706	5.381
19945	Seine	Jan-Apr	0.00	1.02	13.98	21.55	19.83	27.32	7.46	4.66	3.26	0.93	139.0	5,392	1,947	14.006
	Trawl	Oct-Dec	0.00	1.17	13.32	25.60	20.52	25.29	6.44	4.02	2.89	0.75	135.6	7,086 +	1	0.005
	Trawl	May-Sep	0.00	2.57	34.57	29.07	10.02	13.75	4.52	3.93	1.57	0.00	105.9	574	3	0.029
19956	Seine	Jan-Apr	0.00	17.06	22.43	12.83	15.22	12.76	14.03	3.39	1.42	0.86	119.3	5,394	790	6.607
	Trawl	Oct-Dec	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	1	0.006
	Trawl	May-Sep	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	0	0.000
19967	Seine	Jan-Apr	0.00	3.65	70.44	8.47	4.17	5.11	4.02	3.18	0.63	0.32	98.6	6,539	6,656	67.506
19978	Seine	Jan-Apr	0.00	2.40	21.91	61.07	6.56	2.75	2.40	1.65	0.98	0.29	99.1	6,098	5,449	55.784
	Gillnet	Jan-Apr	0.00	0.00	0.86	41.37	10.51	10.55	14.67	12.41	6.33	3.29	138.6	899	1,550	11.177
19989	Seine	Jan-Apr	0.00	1.39	21.95	23.61	39.60	8.41	2.67	1.29	0.73	0.33	110.5	4,341	3,407	31.759
	Gillnet	Jan-Apr	0.00	0.00	0.82	9.98	60.36	18.46	5.32	3.35	1.48	0.24	135.7	1,043	963	7.098
19990	Seine	Jan-Apr	0.00	7.85	24.06	19.88	17.32	25.46	3.65	1.07	0.58	0.13	115.1	6,613	926	8.308
	Gillnet	Jan-Apr	0.00	0.00	1.28	7.52	27.04	52.80	6.24	2.56	2.24	0.32	145.2	625	700	4.823
20001	Seine	Jan-Apr	0.00	7.02	45.66	20.20	8.38	7.57	9.44	1.32	0.21	0.21	105.3	2,352	0	0.000 ~
20012	Seine	Jan-Apr	0.00	4.14	51.73	22.77	9.91	3.00	4.36	3.73	0.36	0.00	103.0	2,200	433	4.204
	Gillnet	Jan-Apr	0.00	0.00	0.00	10.28	28.79	15.33	20.56	22.43	2.24	0.37	152.3	535	388	2.550
20023	Seine	Jan-Apr	0.00	1.13	38.66	39.14	14.95	2.87	1.45	0.88	0.79	0.11	105.7	4,309	2,571	24.345
	Gillnet	Jan-Apr	0.00	0.00	2.61	17.43	31.86	19.84	9.82	12.83	5.01	0.60	146.7	499	945	6.444
20034	Seine	Jan-Apr	0.00	1.32	13.73	52.30	22.60	7.34	1.89	0.51	0.27	0.03	104.1	2,956	3,861	37.106
	Gillnet	Jan-Apr	0.00	0.00	0.79	28.37	24.41	25.04	14.58	3.80	2.22	0.79	137.2	631	593	4.324
20045	Seine	Jan-Apr	0.00	1.09	33.21	23.84	27.65	9.92	3.45	0.60	0.12	0.12	100.5	1,653	3,373	33.573
	Gillnet	Jan-Apr	0.00	0.00	0.80	10.80	49.80	23.80	10.60	3.80	0.20	0.20	127.5	500	896	7.032
20056	Seine	Jan-Apr	0.00	15.08	37.26	33.54	7.89	5.37	0.78	0.09	0.00	0.00	78.8	1,154	0	0.000 ~
20067	Seine	Jan-Apr	0.00	1.16	50.33	35.05	10.96	1.83	0.66	0.00	0.00	0.00	78.3	602	0	0.000 ~
20078	Seine	Jan-Apr	0.00	5.22	24.64	54.01	11.50	3.09	0.77	0.58	0.10	0.10	82.8	1,035	0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.6. Age composition and catch by season, fishery and gear type for the Area 27 stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	PERCENT AT AGE 0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (tonnes)	CATCH (millions)
19534	Seine	Jan-Apr	0.03	2.56	62.55	28.12	5.74	0.69	0.19	0.08	0.02	0.02	92.9	6,361 +	1,920	20.667
19545	Seine	Oct-Dec	0.00	2.77	35.29	52.50	7.55	1.48	0.33	0.08	0.00	0.00	99.0	1,412	5,939	58.757
	Seine	Jan-Apr	0.00	6.80	34.77	49.72	6.94	1.42	0.28	0.07	0.00	0.00	96.7	1,412	0	0.000 ~
19589	Seine	Jan-Apr	0.00	4.12	44.71	27.63	14.44	3.90	2.45	2.06	0.58	0.11	93.3	3,594 +	407	4.366
19601	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	1,149	13.434
19612	Seine	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163 +	173	1.856
19623	Seine	Jan-Apr	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1,862 +	31	0.304
19634	Seine	Jan-Apr	0.00	1.33	59.98	26.04	11.56	0.83	0.25	0.00	0.00	0.00	103.7	1,202 +	323	3.110
19645	Seine	Jan-Apr	0.00	2.51	31.20	46.10	14.62	4.60	0.42	0.28	0.28	0.00	125.8	718 +	769	6.113
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	125	0.913
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	826	6.032
19667	Seine	Jan-Apr	2.43	20.71	55.46	16.68	3.43	0.80	0.26	0.19	0.04	0.00	106.7	0 *	51	0.482
19701	Seine	Jan-Apr	0.00	19.86	30.14	40.41	4.79	2.05	1.37	0.68	0.68	0.00	131.8	146	0	0.000 ~
19734	Seine	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	508	4.562
	Gillnet	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	18	0.165
19756	Gillnet	Jan-Apr	0.00	0.00	1.03	41.48	32.92	15.35	6.05	2.80	0.30	0.07	149.7	1,355 +	79	0.525
19778	Seine	Jan-Apr	0.00	0.81	41.60	18.95	15.70	17.59	3.84	1.17	0.23	0.11	111.8	7,925 +	75	0.670
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422 +	75	0.477
19789	Seine	Jan-Apr	0.00	0.82	13.88	50.49	14.19	10.61	7.80	1.59	0.50	0.11	124.1	3,769 +	422	3.401
	Gillnet	Jan-Apr	0.00	0.00	0.93	27.43	27.61	23.32	17.35	2.80	0.37	0.19	159.6	536 +	270	1.695
19790	Seine	Jan-Apr	0.00	7.17	82.08	8.96	1.43	0.00	0.00	0.36	0.00	0.00	84.3	279	0	0.000 ~
	Gillnet	Jan-Apr	0.00	6.28	46.56	15.12	18.71	5.93	4.93	2.07	0.32	0.07	106.6	4,014 +	519	4.873
19801	Seine	Jan-Apr	0.00	2.08	13.73	60.33	8.74	13.59	1.53	0.00	0.00	0.00	113.6	721	0	0.000 ~
	Gillnet	Jan-Apr	0.00	4.30	34.23	32.33	9.78	12.20	4.73	1.79	0.50	0.14	114.0	5,747 +	671	5.884
19812	Seine	Jan-Apr	0.00	0.60	30.57	8.73	47.59	4.07	7.53	0.75	0.15	0.00	118.6	664	238	2.011
	Gillnet	Jan-Apr	0.00	0.00	0.63	11.62	44.58	11.77	27.63	3.30	0.31	0.16	137.7	637 +	332	2.411
19823	Seine	Jan-Apr	0.00	3.96	20.79	31.68	10.89	28.71	0.00	3.96	0.00	0.00	108.4	101	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.31	13.52	22.73	47.00	5.99	9.98	0.31	0.15	138.0	651 +	163	1.181
19834	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	42.13	16.67	33.33	2.55	1.16	0.00	154.2	432	171	1.107
19856	Seine	Jan-Apr	0.00	2.21	23.62	63.47	2.58	1.48	1.85	2.58	2.21	0.00	136.5	271	0	0.000 ~
19867	Seine	Jan-Apr	0.00	17.02	27.66	15.96	35.46	1.06	0.00	1.06	0.35	1.42	131.2	282	0	0.000 ~
19878	Seine	Jan-Apr	0.00	2.16	62.53	11.05	6.20	15.36	1.62	0.81	0.00	0.27	121.3	371	0	0.000 ~
19889	Seine	Jan-Apr	0.00	0.21	12.66	57.51	8.15	8.37	11.37	1.29	0.43	0.00	151.3	466	0	0.000 ~
19890	Seine	Jan-Apr	0.00	1.84	22.68	14.25	39.63	5.83	7.13	7.78	0.65	0.22	158.0	926	0	0.000 ~
19901	Seine	Oct-Dec	0.01	6.71	22.27	20.52	10.65	32.59	2.99	3.50	0.73	0.03	131.8	7,680 +	0	0.001
	Seine	Jan-Apr	0.27	8.94	39.30	8.94	10.30	22.49	2.71	4.88	2.17	0.00	128.4	369	0	0.000 ~
19912	Seine	Jan-Apr	0.00	1.30	66.59	13.39	4.27	3.20	7.11	1.42	1.90	0.83	130.0	844	335	2.580
19923	Seine	Jan-Apr	0.00	11.30	35.79	38.93	5.02	1.57	1.41	5.02	0.31	0.63	108.5	637	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	3.28	53.28	14.09	7.92	7.53	11.58	0.97	1.35	146.6	518	367	2.502
19934	Seine	Jan-Apr	0.00	1.48	31.75	24.55	30.90	5.50	2.12	2.86	0.53	0.32	119.5	945	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	1.28	19.40	61.19	9.81	3.41	3.84	0.43	0.64	140.4	469	345	2.455
19945	Seine	Jan-Apr	0.00	1.29	6.83	30.93	27.19	25.26	5.28	1.55	1.29	0.39	130.6	776	88	0.670
	Trawl	May-Sep	0.00	1.68	6.37	35.29	24.37	24.65	4.13	1.33	1.61	0.56	131.3	1,428 +	0	0.000
19956	Seine	Jan-Apr	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569	0	0.000 ~
	Trawl	May-Sep	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569 +	0	0.000
19967	Seine	Jan-Apr	0.00	4.01	76.83	7.32	1.57	4.01	4.70	1.57	0.00	0.00	89.9	574	0	0.000 ~
19978	Seine	Jan-Apr	0.00	1.39	38.89	48.61	4.86	0.35	2.78	2.43	0.69	0.00	90.8	288	0	0.000 ~
19989	Seine	Jan-Apr	0.00	7.76	28.03	33.82	24.87	4.08	0.53	0.53	0.26	0.13	86.9	760	0	0.000 ~
19990	Seine	Jan-Apr	0.00	2.30	54.36	24.20	9.65	7.50	1.23	0.15	0.46	0.15	89.9	653	0	0.000 ~
20001	Seine	Jan-Apr	0.00	6.63	20.92	35.71	12.76	12.24	9.69	1.02	0.51	0.51	91.7	196	0	0.000 ~
20012	Seine	Jan-Apr	0.00	7.49	62.74	15.63	10.06	0.64	2.36	0.86	0.21	0.00	96.7	467	0	0.000 ~
20023	Seine	Jan-Apr	0.00	0.52	51.13	37.09	6.24	3.99	0.17	0.69	0.17	0.00	104.9	577	0	0.000 ~
20034	Seine	Jan-Apr	0.00	1.30	21.50	54.15	19.69	1.04	1.55	0.78	0.00	0.00	98.1	386	0	0.000 ~
20045	Seine	Jan-Apr	0.00	0.56	54.19	24.02	12.85	7.26	0.56	0.56	0.00	0.00	81.1	179	0	0.000 ~
20056	Seine	Jan-Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0	0.000 ~
20067	Seine	Jan-Apr	0.00	1.10	46.14	30.91	15.89	3.53	2.21	0.22	0.00	0.00	75.5	453	0	0.000 ~
20078	Seine	Jan-Apr	0.00	1.64	3.28	59.56	21.86	12.02	1.37	0.27	0.00	0.00	82.7	366	0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.7. Age composition and catch by season, fishery and gear type for the Area 2W stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	**Gear**	**Fishery**	**0+**	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9++**	**Weight**	**Aged**	**(tonnes)**	**(millions)**
19567	Seine	Jan-Apr	0.07	20.00	25.34	16.22	9.41	25.92	2.46	0.47	0.11	0.00	104.2	4,506 +	106	1.016
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	312	2.743
19645	Seine	Jan-Apr	0.00	1.59	80.07	10.20	5.14	1.78	0.84	0.37	0.00	0.00	104.0	1,069 +	1,251	12.030
19656	Seine	Jan-Apr	1.67	18.05	32.22	16.11	10.23	7.33	5.79	4.84	2.04	1.72	128.8	0 *	172	1.338
19723	Seine	Jan-Apr	0.00	0.16	38.08	21.42	26.62	10.93	1.93	0.80	0.05	0.00	144.7	1,867 +	706	4.878
19734	Seine	Jan-Apr	0.00	0.61	31.47	38.54	17.89	8.36	2.58	0.49	0.06	0.00	126.9	1,627 +	403	3.178
	Gillnet	Jan-Apr	0.00	50.98	11.11	5.88	15.69	5.88	9.15	1.31	0.00	0.00	101.0	153	0	0.000 ~
19745	Seine	Jan-Apr	0.00	0.63	26.50	34.13	27.01	9.18	2.05	0.41	0.09	0.00	130.8	6,384 +	449	3.436
19756	Seine	Jan-Apr	0.00	23.71	6.70	41.24	23.71	4.64	0.00	0.00	0.00	0.00	139.8	194	0	0.000 ~
19778	Seine	Jan-Apr	0.00	0.15	23.63	18.15	9.48	28.96	13.11	5.04	1.26	0.22	150.5	1,350 +	575	3.819
19789	Seine	Jan-Apr	0.00	1.49	18.84	22.95	16.23	22.95	13.81	1.87	1.12	0.75	151.9	536	691	4.546
19790	Seine	Jan-Apr	0.00	0.37	76.03	13.11	4.49	3.37	1.87	0.00	0.75	0.00	108.8	267	0	0.000 ~
19801	Seine	Jan-Apr	0.00	4.98	1.87	66.92	11.97	6.35	5.02	1.79	0.84	0.26	132.9	1,232	770	5.808
19812	Seine	Jan-Apr	0.00	0.02	53.90	2.31	34.93	3.91	2.55	2.02	0.23	0.13	139.5	1,654	1,225	9.099
19823	Seine	Jan-Apr	0.00	0.50	1.52	68.64	3.59	20.49	2.37	1.43	0.83	0.64	151.9	3,356	2,518	16.808
19834	Seine	Jan-Apr	0.00	6.45	1.61	0.60	35.28	2.42	51.01	1.81	0.60	0.20	166.2	496	0	0.000 ~
19845	Seine	Jan-Apr	0.00	0.40	0.67	5.80	2.56	13.75	1.62	74.39	0.67	0.13	212.3	742	199	0.940
19856	Seine	Jan-Apr	0.00	0.82	0.27	11.48	11.75	5.46	20.77	7.38	41.53	0.55	205.2	366	0	0.000 ~
19867	Seine	Jan-Apr	0.00	22.14	61.32	0.25	1.27	1.27	1.27	8.14	1.02	3.31	112.0	393	0	0.000 ~
19878	Seine	Jan-Apr	0.00	1.79	74.01	19.31	0.26	0.53	0.66	0.79	1.65	0.99	114.1	1,512	0	0.000 ~
19889	Seine	Jan-Apr	0.00	0.49	3.42	76.06	15.88	0.49	0.49	0.98	0.81	1.38	137.6	1,228	0	0.000 ~
19890	Seine	Jan-Apr	0.00	0.19	1.71	2.28	80.41	13.18	0.46	0.18	0.70	0.90	168.1	2,353	2,272	13.608
19901	Seine	Jan-Apr	0.00	0.50	6.46	0.89	1.84	68.91	19.83	0.72	0.45	0.39	173.3	1,795	2,558	14.762
19912	Seine	Jan-Apr	0.00	1.48	6.34	13.44	1.37	2.79	60.55	12.46	0.55	1.04	183.5	1,830	1,284	6.994
19923	Seine	Jan-Apr	0.00	0.76	11.71	16.46	13.53	1.91	4.57	44.54	5.67	0.84	156.7	2,574	1,306	7.985
19934	Seine	Jan-Apr	0.00	5.32	12.23	43.62	14.89	9.57	2.13	5.85	5.32	1.06	145.6	188	0	0.000 ~
19978	Seine	Jan-Apr	0.00	18.50	34.75	23.10	18.68	2.62	0.63	1.53	0.18	0.00	120.8	1,108	180	1.487
19989	Seine	Jan-Apr	0.00	15.60	32.38	28.09	14.30	7.28	1.56	0.52	0.26	0.00	116.8	769	0	0.000 ~
19990	Seine	Jan-Apr	0.00	14.77	63.64	18.18	0.00	2.27	0.00	1.14	0.00	0.00	85.0	88	0	0.000 ~
20001	Seine	Jan-Apr	0.00	4.37	8.48	40.62	24.42	12.08	6.94	2.06	0.51	0.51	153.2	389	0	0.000 ~
20012	Seine	Jan-Apr	0.00	28.69	23.83	4.77	21.64	9.72	6.86	2.67	1.53	0.29	130.5	1,049	0	0.000 ~
20023	Seine	Jan-Apr	0.00	1.03	73.49	15.31	3.39	3.69	1.15	1.33	0.36	0.24	111.3	1,652	0	0.000 ~
20034	Seine	Jan-Apr	0.00	7.24	9.74	71.71	7.50	1.71	1.58	0.26	0.00	0.26	124.5	760	0	0.000 ~
20045	Seine	Jan-Apr	0.00	0.36	26.68	8.63	58.76	4.04	0.54	0.81	0.00	0.18	122.7	1,113	0	0.000 ~
20056	Seine	Jan-Apr	0.00	10.75	13.98	17.63	6.88	44.95	3.44	1.72	0.65	0.00	132.4	465	0	0.000 ~
20067	Seine	Jan-Apr	0.00	0.31	57.89	11.30	6.50	3.25	18.58	1.55	0.46	0.15	102.9	646	0	0.000 ~
20078	Seine	Jan-Apr	0.00	34.08	1.68	41.90	8.38	2.79	2.23	8.38	0.00	0.56	99.6	179	0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix table 2.1. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Queen Charlotte Is. stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	1632	1261	1433	358	216	72	19	8	7	18062	4213	-0.14
1951/52	4012	1106	790	868	215	129	43	11	9	16390	2578	-0.53
1952/53	15124	2640	562	357	379	92	55	18	9	35162	7555	-0.22
1953/54	2871	10536	1839	391	248	264	64	39	19	49965	12408	-0.08
1954/55	3035	1979	7121	1232	262	166	176	43	38	66442	6437	-1.02
1955/56	1592	2054	1327	4758	822	174	111	118	54	17222	6042	0.27
1956/57	2487	902	515	212	682	113	24	15	23	2883	1592	0.72
1957/58	11420	1278	150	42	15	45	7	2	2	6658	815	-0.78
1958/59	2750	5852	335	28	7	2	7	1	1	25325	8981	0.28
1959/60	8441	1486	2765	149	12	3	1	3	1	23518	6599	0.05
1960/61	6980	4577	806	1499	81	7	2	1	2	35414	8981	-0.06
1961/62	9273	3747	2436	427	794	43	3	1	1	45429	5730	-0.75
1962/63	2400	4944	1852	1164	202	374	20	2	1	39395	7297	-0.37
1963/64	6549	1274	2249	786	485	84	154	8	1	16855	4104	-0.10
1964/65	1072	3240	382	527	172	104	18	33	2	3851	1378	0.29
1965/66	1273	461	436	24	28	9	5	1	2	4542	2824	0.84
1966/67	1051	588	170	145	8	9	3	2	1	5339	710	-0.70
1967/68	1653	480	264	76	64	3	4	1	1	5989	833	-0.66
1968/69	2827	768	222	122	35	30	2	2	1	8487	2075	-0.09
1969/70	4936	1377	374	108	59	17	14	1	1	14466	5552	0.36
1970/71	5225	2519	703	191	55	30	9	7	1	23845	13291	0.73
1971/72	10352	2773	1334	372	101	29	16	5	4	36159	9542	-0.02
1972/73	8167	5701	1455	650	166	42	12	6	4	53373	7960	-0.59
1973/74	6105	4761	3125	713	277	63	15	4	4	63609	14510	-0.16
1974/75	2492	3772	2834	1736	362	130	29	7	3	59450	9686	-0.50
1975/76	2216	1588	2322	1637	923	180	63	14	5	47233	16374	0.26
1976/77	2872	1418	963	1275	771	372	68	23	7	33814	16408	0.59
1977/78	1439	1802	836	502	563	288	127	23	10	22582	18371	1.11
1978/79	31681	874	1012	393	175	154	66	27	6	41587	13649	0.20
1979/80	3294	18866	483	469	123	43	31	12	6	95872	31904	0.22
1980/81	1585	1992	11253	280	234	49	15	11	6	89880	20294	-0.17
1981/82	1628	964	1191	6496	150	103	19	6	6	65068	23593	0.30
1982/83	13451	986	578	698	3706	82	51	9	5	58721	21391	0.31
1983/84	6182	7914	571	324	375	1912	41	25	7	64486	23439	0.31
1984/85	1790	3448	4333	302	163	182	903	19	14	55250	18625	0.23
1985/86	2459	932	1755	2101	136	68	74	350	12	38672	6847	-0.41
1986/87	15166	1214	453	822	937	58	29	31	149	35686	12289	0.25
1987/88	5446	7491	590	214	374	414	25	12	78	48149	15245	-1.15
1988/89	1901	2766	3804	300	108	190	210	13	46	44420	25201	-0.57
1989/90	896	1012	1458	1968	151	54	93	103	29	27392	27058	-0.01
1990/91	5193	485	525	698	826	56	18	29	39	17384	17998	0.04
1991/92	535	2752	245	243	287	301	18	6	20	18530	12376	-0.40
1992/93	629	271	1344	112	101	111	113	7	9	10165	8152	-0.22
1993/94	1846	305	124	549	40	32	34	34	5	7317	14293	0.67
1994/95	3352	862	141	56	244	17	14	14	16	9130	4701	-0.66
1995/96	3929	1510	388	64	25	110	8	6	14	11544	7377	-0.45
1996/97	8727	1805	694	178	29	12	50	4	9	18080	11215	-0.48
1997/98	562	4124	853	328	84	14	6	24	6	19026	21649	0.13
1998/99	2129	264	1873	366	130	32	5	2	11	11045	10610	-0.04
1999/00	2509	945	110	686	114	31	6	1	1	7181	6698	-0.07
2000/01	2444	1019	358	37	196	29	7	1	0	6710	15195	0.82
2001/02	5959	910	379	133	14	73	11	3	1	6638	3257	-0.71
2002/03	2692	2002	291	110	35	3	17	2	1	8060	8801	0.09
2003/04	1882	906	674	98	37	12	1	6	1	5383	5668	0.05
2004/05	1964	626	301	224	33	12	4	0	2	4252	3614	-0.16
2005/06	5031	650	207	100	74	11	4	1	1	4762	4097	-0.15
2006/07	2669	1699	219	70	34	25	4	1	1	6590	9436	0.36
2007/08	2032	912	581	75	24	12	9	1	1	4872	4213	-0.15

Estimated average availability at age (Si):

0.25 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries:

0.01 0.06 0.24 0.501 0.71 0.87 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.27

Appendix table 2.2. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Prince Rupert District stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	3424	4781	6253	962	363	167	51	28	36	45473	27149	0.16
1951/52	3664	2398	2492	2493	282	71	20	4	2	22235	24047	0.76
1952/53	5883	2480	1001	661	397	23	3	0	0	34801	28468	0.48
1953/54	1671	4307	1779	705	456	266	15	2	0	26759	13535	0.00
1954/55	5846	1151	2219	704	206	90	33	1	0	21761	14482	0.27
1955/56	2696	4012	618	956	235	49	15	4	0	27735	14533	0.03
1956/57	5354	1845	2414	332	449	93	16	4	1	15174	27518	1.27
1957/58	13944	3340	762	681	61	47	5	0	0	32087	9882	-0.50
1958/59	4264	8826	1994	432	363	30	21	2	0	56571	40961	0.36
1959/60	35008	2581	4963	1051	211	161	12	7	1	57060	16545	-0.56
1960/61	18495	20281	1334	2319	436	75	48	3	2	89081	12059	-1.32
1961/62	10470	10327	9538	538	783	117	15	7	0	99968	26329	-0.66
1962/63	33446	5807	5229	4457	229	294	38	4	2	74964	16981	-0.81
1963/64	5560	17512	2639	2096	1542	65	67	7	1	76507	26919	-0.37
1964/65	1957	2673	7552	1034	733	466	17	14	1	39049	6055	-1.19
1965/66	2722	804	897	2114	234	126	58	1	1	11132	7105	0.23
1966/67	4222	1021	241	219	408	33	13	4	0	5100	3386	0.27
1967/68	2466	1549	280	51	34	43	2	1	0	6598	5197	0.44
1968/69	6197	975	554	92	15	9	9	0	0	9764	965	-1.64
1969/70	3834	2750	433	246	41	7	4	4	0	16244	8814	0.07
1970/71	1324	1942	1348	206	113	18	3	2	2	15955	8480	0.05
1971/72	3567	732	998	650	92	46	6	1	1	18892	8774	-0.09
1972/73	2767	2139	402	482	296	41	20	3	1	22435	10959	-0.04
1973/74	1592	1772	1327	237	279	171	24	12	2	27006	9244	-0.40
1974/75	834	1069	1149	793	124	142	86	12	7	24403	10949	-0.12
1975/76	1136	582	727	754	512	80	91	55	12	25653	15587	0.18
1976/77	497	813	396	458	457	306	47	53	39	17530	11589	0.26
1977/78	448	361	532	217	217	205	134	20	39	10820	6164	0.12
1978/79	3756	329	238	282	88	73	62	37	15	11323	9195	0.47
1979/80	1283	2788	223	133	133	37	28	22	17	20169	11937	0.15
1980/81	1520	964	1975	139	68	60	16	12	16	22311	14087	0.22
1981/82	2311	1142	692	1338	87	38	32	8	13	25661	17186	0.28
1982/83	6171	1733	835	494	932	58	25	20	12	37457	25247	0.28
1983/84	2002	4602	1292	623	368	695	44	18	24	45704	27041	0.15
1984/85	2047	1465	3309	902	415	231	402	22	19	42988	41028	0.63
1985/86	6094	1464	1020	2179	562	236	115	164	14	46880	26638	0.11
1986/87	4558	4222	982	629	1222	298	120	56	86	49446	39905	0.46
1987/88	2978	3054	2774	615	359	637	146	57	65	42324	35444	-0.18
1988/89	1633	1931	1918	1638	332	163	242	55	41	33499	16379	-0.72
1989/90	6483	1038	1182	1091	829	128	52	63	25	32640	22679	-0.36
1990/91	5766	4126	641	688	596	414	59	23	37	39625	25811	-0.43
1991/92	2248	3718	2616	388	390	320	202	27	26	41425	40145	-0.03
1992/93	1003	1469	2395	1631	209	176	130	73	15	33821	25071	-0.30
1993/94	2013	660	943	1442	897	88	58	37	20	24511	16589	-0.39
1994/95	5476	1337	425	569	815	465	34	21	18	26914	18516	-0.37
1995/96	2559	3699	893	278	358	494	265	17	18	34210	24854	-0.32
1996/97	3435	1749	2526	601	177	195	251	120	14	30921	25037	-0.21
1997/98	1193	2348	1194	1695	356	75	50	46	16	28452	19420	-0.38
1998/99	3038	801	1570	783	1038	190	18	5	1	28979	29745	0.03
1999/00	5054	1972	516	987	477	581	102	7	2	25089	19694	-0.24
2000/01	3230	3187	1217	305	521	233	238	29	2	28183	36684	0.26
2001/02	10506	1995	1937	714	171	251	110	97	12	29687	22449	-0.28
2002/03	1458	6346	1168	1071	358	72	82	31	20	38234	34007	-0.12
2003/04	4448	863	3686	654	536	139	20	20	10	29336	30493	0.04
2004/05	2443	2561	485	1963	324	220	36	3	4	22472	27956	0.22
2005/06	6230	1360	1384	251	905	138	68	5	1	19788	10251	-0.66
2006/07	2400	3381	723	709	124	378	44	15	1	19435	15562	-0.22
2007/08	2552	1295	1823	389	368	55	159	14	4	17360	13553	-0.25

Estimated average availability at age (Si): 0.25 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries:

0.01 0.08 0.27 0.47 0.64 0.84 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.51

Appendix table 2.3. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Central Coast stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	3771	4757	4859	820	311	89	31	16	18	40254	15390	0.33
1951/52	4662	2265	2169	1654	191	43	7	1	1	20726	10295	0.59
1952/53	19510	2755	945	624	295	18	2	0	0	37465	18237	0.57
1953/54	2611	12170	1705	580	378	176	10	1	0	43061	13967	0.16
1954/55	2904	1563	5941	672	173	77	23	1	0	41793	13564	0.16
1955/56	6328	1755	871	3047	309	69	25	6	0	14565	6626	0.50
1956/57	9184	3521	637	199	386	17	1	0	0	12487	4607	0.29
1957/58	11539	4919	1107	111	17	12	0	0	0	24865	3549	-0.66
1958/59	3899	6495	2322	435	34	4	2	0	0	24268	3904	-0.54
1959/60	10992	2128	2470	599	68	3	0	0	0	26827	12615	0.53
1960/61	16835	6277	1150	1260	284	29	1	0	0	29363	4265	-0.64
1961/62	9623	8911	2435	320	229	29	1	0	0	49496	11948	-0.13
1962/63	8450	5165	4241	1023	114	65	6	0	0	28863	6485	-0.21
1963/64	5757	4257	1761	950	134	7	2	0	0	17251	6464	0.31
1964/65	4763	2777	1341	350	105	7	0	0	0	17203	2097	-0.82
1965/66	12386	2199	992	365	67	12	0	0	0	4890	1863	0.32
1966/67	6762	4665	272	29	2	0	0	0	0	9698	5434	0.71
1967/68	4078	2460	914	27	1	0	0	0	0	14030	5790	0.40
1968/69	11809	1535	891	318	9	0	0	0	0	17770	1837	-0.98
1969/70	8504	4644	604	350	125	3	0	0	0	30170	8230	-0.01
1970/71	6258	3808	2074	269	155	55	2	0	0	35351	4156	-0.85
1971/72	7668	3165	1860	978	121	66	22	1	0	36001	3572	-1.02
1972/73	5092	4331	1607	814	382	45	24	8	0	47013	12434	-0.04
1973/74	5981	3137	2502	829	381	172	20	10	3	45800	8852	-0.36
1974/75	2855	3873	1964	1382	377	144	62	7	5	48751	8037	-0.51
1975/76	1979	1895	2504	1157	676	162	59	25	5	37409	13849	0.30
1976/77	2715	1314	1196	1421	507	235	50	17	9	30216	14613	0.56
1977/78	1889	1769	821	662	627	172	74	15	8	17824	7747	0.46
1978/79	15706	1200	1047	373	180	78	16	6	2	43626	5779	-0.73
1979/80	3787	10001	764	666	238	115	49	10	5	64184	13012	-0.31
1980/81	3408	2440	6440	490	418	143	67	28	9	62311	15919	-0.08
1981/82	1518	2228	1591	4130	299	224	66	27	15	59902	16333	-0.01
1982/83	1400	1001	1449	999	2402	165	116	32	20	46152	18482	0.37
1983/84	4138	918	647	906	589	1339	90	61	27	32687	14185	0.45
1984/85	2089	2660	570	377	489	292	631	39	36	34504	8850	-0.07
1985/86	3197	1311	1617	322	198	246	142	303	35	32257	20342	0.83
1986/87	14485	1970	786	917	174	104	127	73	172	41306	12827	0.12
1987/88	1294	8842	1166	441	483	89	52	64	123	59518	26916	-0.79
1988/89	949	802	5317	666	237	245	45	26	94	43479	21561	-0.70
1989/90	2431	609	489	2985	319	98	88	16	42	32075	28980	-0.10
1990/91	9872	1620	387	288	1576	146	41	36	23	33590	19183	-0.56
1991/92	1522	6736	1023	218	144	721	62	17	24	49518	43274	-0.14
1992/93	1934	1059	4373	600	116	72	339	28	18	40849	32392	-0.23
1993/94	769	1353	689	2537	309	54	31	132	17	28794	29432	0.02
1994/95	2150	534	856	377	1203	132	20	11	52	18018	22348	0.22
1995/96	6997	1465	324	436	163	467	48	7	21	23011	21646	-0.06
1996/97	7233	4713	917	183	224	80	222	22	13	35920	28255	-0.24
1997/98	1588	4847	3005	545	103	119	41	112	17	38614	31503	-0.20
1998/99	2752	1055	2945	1610	265	46	45	15	43	31923	31813	0.00
1999/00	1306	1820	656	1660	815	123	17	11	12	26534	32652	0.21
2000/01	3198	847	1096	356	815	368	52	7	8	19281	25109	0.26
2001/02	6998	2004	486	554	164	349	150	20	6	21177	23147	0.09
2002/03	2016	4215	1138	254	269	76	154	64	11	27742	25679	-0.08
2003/04	6218	1158	2327	594	126	128	35	70	33	22607	29407	0.26
2004/05	1848	3379	596	1112	270	56	56	15	45	18800	24158	0.25
2005/06	2831	936	1580	250	431	101	21	21	22	11071	12051	0.09
2006/07	1168	1336	401	592	85	141	33	7	14	9017	9857	0.09
2007/08	2148	523	588	173	251	36	59	14	9	6534	3971	-0.50

Estimated average availability at age (Si): 0.25 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries:

0.01 0.09 0.30 0.56 0.76 0.90 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.28

Appendix table 2.4. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Strait of Georgia stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	10964	6788	2776	634	155	54	19	6	3	40840	66143	0.46
1951/52	12862	7104	2720	942	213	52	18	6	3	46279	72376	0.42
1952/53	17431	8393	2939	963	331	75	18	6	3	76168	111307	0.35
1953/54	13111	12060	5426	1862	609	209	47	12	6	86495	82141	-0.08
1954/55	7972	8720	5562	2218	755	247	85	19	7	73637	69854	-0.08
1955/56	8902	5292	3841	2135	844	287	94	32	10	37971	25667	-0.42
1956/57	6768	5725	1741	983	539	213	72	24	11	20959	24126	0.12
1957/58	14286	4251	1520	324	180	98	39	13	6	33061	16149	-0.74
1958/59	13146	9529	2013	644	136	76	41	16	8	45067	47864	0.04
1959/60	7449	8487	3780	672	202	41	22	12	7	38956	55082	0.32
1960/61	20788	4591	2795	989	173	52	10	6	5	35473	42864	0.16
1961/62	17117	12435	1530	754	264	46	14	3	3	44496	31078	-0.38
1962/63	17816	9861	3932	389	189	66	12	3	1	38343	35135	-0.11
1963/64	10302	9809	2822	882	86	42	15	3	1	31951	33117	0.01
1964/65	5959	5304	2393	515	159	15	8	3	1	21352	37116	0.53
1965/66	8638	2856	1302	457	97	30	3	1	1	11575	7153	-0.51
1966/67	4848	3706	547	181	62	13	4	0	0	5684	9619	0.50
1967/68	4831	1855	493	45	14	5	1	0	0	11578	9128	-0.26
1968/69	11204	1943	690	179	16	5	2	0	0	18307	14644	-0.25
1969/70	9599	4541	783	278	72	7	2	1	0	29915	33970	0.10
1970/71	6579	4065	1916	329	117	30	3	1	0	35292	38180	0.05
1971/72	5590	2955	1785	833	143	51	13	1	1	26889	25165	-0.09
1972/73	7978	2671	1192	642	290	49	17	4	1	28979	16191	-0.61
1973/74	10270	4203	1261	499	242	107	18	6	2	44284	40354	-0.12
1974/75	5981	5964	2403	626	233	111	49	8	4	51521	70211	0.28
1975/76	11660	3659	3600	1328	252	81	37	17	4	60286	60642	-0.02
1976/77	9178	7290	2180	1879	598	105	33	15	8	71113	78562	0.07
1977/78	4636	5831	4272	1125	807	228	38	12	9	62542	102115	0.47
1978/79	7963	2936	3236	2108	447	270	71	12	6	56754	64266	0.10
1979/80	7080	5013	1645	1621	912	179	105	28	7	60663	85991	0.32
1980/81	7359	4450	3075	983	897	479	93	54	18	60924	55121	-0.13
1981/82	6204	4454	2529	1655	465	389	203	39	30	56144	100987	0.56
1982/83	5952	3574	2378	1233	735	180	147	76	26	37812	64575	0.51
1983/84	9001	3204	1706	904	359	192	41	32	21	32470	26227	-0.24
1984/85	16187	4621	1514	673	251	83	44	9	11	41868	25247	-0.53
1985/86	8989	8175	2192	629	223	69	22	11	5	60328	41575	-0.40
1986/87	21848	4596	4155	1112	319	113	35	11	8	61703	41737	-0.42
1987/88	6434	11368	2279	1864	396	86	24	7	4	77074	24976	-1.13
1988/89	16421	3411	5872	1069	746	140	28	8	3	70043	66052	-0.06
1989/90	8383	9008	1825	2947	448	274	48	9	3	76104	67152	-0.13
1990/91	21492	4663	4976	962	1291	164	94	16	4	79494	45830	-0.55
1991/92	15749	11930	2530	2483	397	447	51	28	6	95889	82656	-0.15
1992/93	20523	8716	6354	1232	998	136	146	16	11	101437	90198	-0.12
1993/94	9635	11259	4585	3055	507	359	45	47	9	87096	67144	-0.26
1994/95	20010	5159	5765	2104	1114	136	86	9	10	82326	64899	-0.24
1995/96	30226	10394	2574	2651	816	386	43	27	6	91060	71326	-0.24
1996/97	30346	15332	4960	1140	1017	266	120	13	10	104142	58232	-0.58
1997/98	14042	15225	7196	2153	423	297	69	29	5	98537	74616	-0.28
1998/99	22495	7121	7388	3246	821	123	53	9	3	90977	85095	-0.07
1999/00	25883	11598	3510	3409	1320	273	35	13	3	92392	72639	-0.24
2000/01	32496	13590	5780	1647	1413	398	68	7	3	122365	100248	-0.20
2001/02	32016	17275	6849	2761	670	478	113	18	3	129073	117864	-0.09
2002/03	18720	16967	8633	3185	1157	196	116	22	3	123559	141651	0.14
2003/04	16282	9713	8239	3872	1258	404	39	15	5	96351	113689	0.17
2004/05	13602	8232	4655	3729	1628	456	135	9	5	71998	95851	0.29
2005/06	23310	6694	3771	1979	1355	453	96	24	3	54430	46752	-0.15
2006/07	6588	11172	2860	1438	616	314	63	8	1	55977	35446	-0.46
2007/08	16340	3141	5029	1227	521	125	39	5	0	34383	32103	-0.07

Estimated average availability at age (Si): 0.25 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries:

0.02 0.17 0.46 0.70 0.84 0.93 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 1.03

Appendix table 2.5. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the west coast of Vancouver Island stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	6984	3591	3700	539	147	51	20	9	6	29661	19597	0.03
1951/52	7799	3303	1285	1117	160	44	15	6	4	16695	13310	0.22
1952/53	11839	3602	867	234	197	28	8	3	2	25608	39571	0.88
1953/54	8150	5603	1704	410	110	93	13	4	2	16634	20648	0.66
1954/55	15215	3597	1266	246	57	15	13	2	1	26399	15112	-0.11
1955/56	19406	6835	1409	457	88	20	5	5	1	36389	27183	0.15
1956/57	17456	8728	2386	422	135	26	6	2	2	52104	44114	0.28
1957/58	19231	8080	3928	1056	186	60	11	3	1	59699	18986	-0.70
1958/59	12597	9067	3791	1837	494	87	28	5	2	28440	12979	-0.34
1959/60	6794	5807	2067	534	244	63	11	3	1	11467	6015	-0.20
1960/61	20300	3069	910	144	35	16	4	1	0	16810	10556	-0.02
1961/62	8282	9238	603	99	15	4	2	0	0	30918	34470	0.55
1962/63	10680	3858	3013	158	25	4	1	0	0	27143	11245	-0.44
1963/64	4072	5005	1337	868	45	7	1	0	0	23456	22761	0.42
1964/65	2745	1934	1661	355	226	12	2	0	0	15796	11891	0.16
1965/66	3069	1308	639	437	92	58	3	0	0	9791	3722	-0.52
1966/67	3174	1474	420	159	106	22	14	1	0	5830	4813	0.25
1967/68	2317	1512	314	51	18	12	3	2	0	12476	11029	0.32
1968/69	6607	1173	765	159	26	9	6	1	1	18416	10465	-0.12
1969/70	11273	3425	608	397	82	13	5	3	1	36748	26912	0.13
1970/71	7164	6106	1855	329	215	45	7	3	2	64898	36206	-0.14
1971/72	8912	4086	3483	1058	188	123	25	4	3	68005	41857	-0.04
1972/73	11237	5354	2325	1877	558	98	64	13	4	73440	19481	-0.88
1973/74	16538	7096	3005	1137	852	247	43	28	7	88295	25540	-0.80
1974/75	6421	11032	4388	1660	557	393	112	20	16	116927	49149	-0.42
1975/76	4803	4402	7014	2435	772	249	174	50	16	91453	64222	0.09
1976/77	9162	3294	2745	3676	922	251	79	55	20	73797	58679	0.22
1977/78	3238	6200	2033	1404	1565	333	88	27	26	59779	45607	0.17
1978/79	10153	2147	3891	1151	572	446	78	19	11	53162	66397	0.67
1979/80	7375	6477	1259	2013	435	169	124	21	8	65457	62308	0.40
1980/81	4417	4502	3897	740	1115	220	83	60	14	61458	52063	0.28
1981/82	3027	2525	2472	2030	347	490	91	34	31	44783	33047	0.14
1982/83	5591	1625	1322	1238	949	145	194	33	23	31212	16771	-0.18
1983/84	13867	2840	760	554	465	335	50	66	19	36216	23872	0.03
1984/85	12493	6900	1286	306	207	170	121	18	30	59262	30010	-0.24
1985/86	4083	6320	3484	648	154	104	85	61	24	67295	39514	-0.09
1986/87	18730	2123	3281	1805	336	80	54	44	44	59071	16858	-0.81
1987/88	3261	10021	1012	1339	672	122	29	19	32	75040	46242	-0.48
1988/89	3667	1831	5281	492	611	301	54	13	23	53685	47718	-0.12
1989/90	2392	2122	979	2503	210	245	118	21	14	41077	46464	0.12
1990/91	7639	1401	1148	478	1135	93	107	52	15	32171	30456	-0.06
1991/92	4610	4463	748	541	204	451	36	41	26	42849	42687	0.00
1992/93	3668	2692	2498	398	276	103	225	18	33	39367	34728	-0.13
1993/94	1770	2116	1446	1250	193	133	49	108	24	30551	25625	-0.18
1994/95	2860	1007	1113	695	568	85	57	21	57	26579	28057	0.05
1995/96	12308	1608	548	585	360	293	44	30	40	32608	33986	0.04
1996/97	4396	6779	872	293	311	191	155	23	37	40360	46490	0.14
1997/98	2452	2325	3252	380	122	128	79	64	25	26306	41556	0.46
1998/99	2998	1247	1077	1330	143	37	32	18	18	17260	20390	0.17
1999/00	4461	1471	561	440	486	49	10	8	9	16857	13267	-0.24
2000/01	6602	2154	689	253	186	191	19	4	6	21610	13955	-0.44
2001/02	6461	3194	1042	334	123	90	93	9	5	25396	22086	-0.14
2002/03	3222	3110	1520	488	151	52	37	37	6	23098	29750	0.25
2003/04	4093	1487	1345	612	179	47	14	9	10	13484	15844	0.16
2004/05	1676	1723	546	418	174	43	10	2	2	6074	9075	0.40
2005/06	1415	618	506	122	56	15	1	0	0	4038	2705	-0.40
2006/07	1726	464	203	166	40	19	5	0	0	2857	2089	-0.31
2007/08	2347	532	143	62	51	12	6	2	0	2730	2548	-0.07

Estimated average availability at age (Si): 0.25 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries:

0.01 0.16 0.46 0.71 0.86 0.94 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.64