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 2008/011 / **Document de recherche 2008/011**

Not to be cited without permission of the authors *

Ne pas citer sans autorisation des auteurs *

Stock Assessment for British Columbia Herring in 2007 and Forecasts of the Potential Catch in 2008

Évaluation des stocks de harengs de la Colombie-Britannique en 2007 et prévisions des prises potentielles en 2008

J. Schweigert[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

* This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

* La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au Secrétariat.

This document is available on the Internet at:

Ce document est disponible sur l'Internet à:

http://www.dfo-mpo.gc.ca/csas/

ISSN 1499-3848 (Printed / Imprimé)

Canada

ABSTRACT

Herring stock abundance in British Columbia waters was assessed for 2007 and forecasts were made for 2008 using the new age structured assessment model (HCAM) 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 2007 season represented the first year of post-Larocque assessment and resulted in a substantially reduced data collection program. Reduced biological sample collection occurred in all areas and dive survey coverage was reduced. Additionally, unusually late spawning in most areas presented logistical difficulties and some deep spawning on the west coast of Vancouver Island 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 2007. The estimated pre-fishery biomass was 117,400 metric tonnes (t), which represents a 13% decrease from the 2006 stock level (135,100 t). The recruitment of the 2004-year class in 2007 was poor for the Central Coast and west coast of Vancouver Island. The Queen Charlotte Islands and Strait of Georgia had average recruitment while Prince Rupert had poor to average recruitment. Abundance decreased slightly in all areas except the Queen Charlotte Islands where there was a moderate increase. The stock projections for 2008 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 2008 (20% of the 2008 forecast spawning stock biomass), in the two remaining areas is 4,014 tonnes in the Prince Rupert area and 13,470 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 2007 et à l’établissement de prévisions pour 2008 à l’aide du nouveau modèle d’évaluation structuré selon l’âge pour les principales zones d’évaluation des stocks et pour les stocks moins importants des zones 2W et 27. On s’est servi de toutes les données biologiques disponibles sur les prélèvements totaux, la ponte ainsi que la composition selon l’âge et la taille des reproducteurs en migration pour déterminer les niveaux d’abondance actuels. La saison 2007, qui fait directement suite à l’évaluation post-Larocque, a été marquée par un programme de collecte de données fortement réduit. La collecte d’échantillons biologiques a été réduite toutes les zones, tout comme la couverture des relevés effectués en plongée. En outre, le frai anormalement tardif observé dans la plupart des zones a créé des difficultés logistiques, et certains reproducteurs des eaux profondes de la côte ouest de l’île de Vancouver n’ont pas fait l’objet d’un relevé adéquat. Néanmoins, toutes les données disponibles ont 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 2007. La biomasse estimée avant la pêche était de 117 400 tonnes métriques (t), une diminution de 13 % par rapport au niveau de stock de 2006 (135 100 t). Le recrutement de la classe d’âge de 2004 a été médiocre en 2007 sur la côte centrale ainsi que sur la côte ouest de l’île de Vancouver. Dans les îles de la Reine-Charlotte et le détroit de Georgia, le recrutement a été moyen, tandis que la zone de Prince Rupert, il a été de médiocre à moyen. L’abondance a diminué légèrement dans toutes les zones à l’exception des îles de la Reine-Charlotte, où on a observé une augmentation modérée. Les projections relatives aux stocks pour 2008 indiquent que l’abondance ne pourra soutenir la pêche dans trois zones d’évaluation – îles de la Reine-Charlotte, côte ouest de l’île de Vancouver et côte centrale. L’estimation de l’excédant récoltable de harengs en Colombie-Britannique pour 2008 (20 % de la biomasse prévue du stock reproducteur de 2008), dans les deux autres zones, s’établit à 4 014 tonnes pour la zone de Prince Rupert et de 13 470 tonnes pour le détroit de Georgia.

INTRODUCTION

The stock assessment for Pacific herring presented here follows on the methodology adopted last year and applies the recently developed Herring Catch Age Model (HCAM). A full description of the model is provided in a Canadian Science Advice (CSA) research document (Haist and Schweigert, 2006). Additional model development and analysis with this implementation were conducted last year and the results presented in that assessment (Schweigert and Haist (2007). 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, 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.

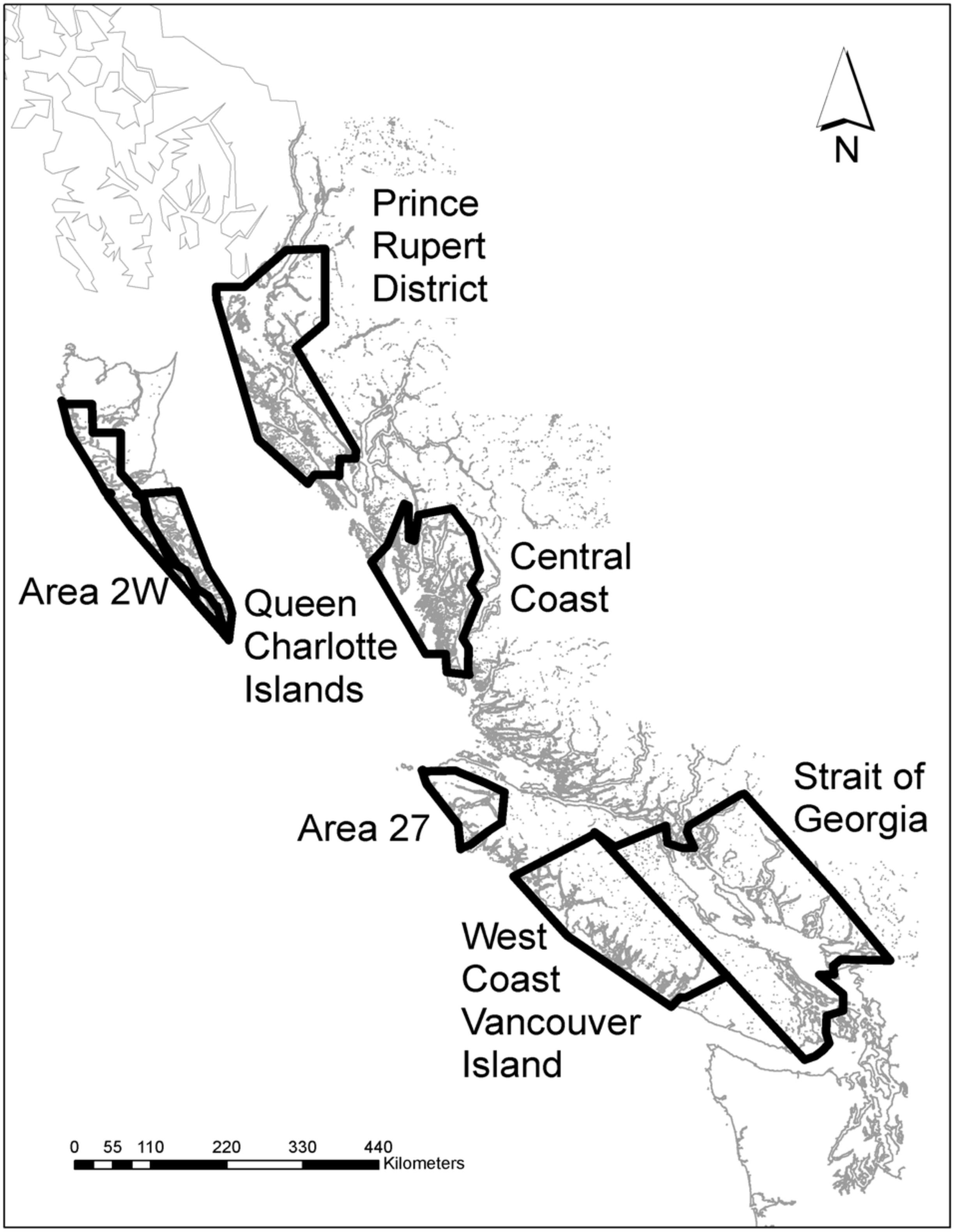


Figure 1. The five major British Columbia herring stock assessment regions: Prince Rupert District (PRD), Queen Charlotte Islands (QCI), Central Coast (CC), west coast Vancouver Island (WCVI), the Strait of Georgia (SOG) and minor stocks in Areas 2W and 27.

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 2007. This time span includes the reduction fishery period to 1968 and the subsequent roe fishery period that began in 1972.

As a result of the recent Larocque court ruling, the policy for use of fish to fund resource assessment was reversed and funding for stock assessment activities was provided by DFO. The available funds were substantially less than had been provided in recent years through the Herring Conservation and Research Society via the use of the resource to fund assessment surveys. Dive surveys were conducted in all areas of the coast with the exception of Areas 2W and 27 and some limited dive coverage occurred in Area 2E. These areas were surveyed using a combination of snorkelling and surface survey techniques. Unlike previous years, no minor spawning beds outside the main assessment areas were surveyed by SCUBA or surface methods in 2007. Additionally, unusually deep spawning was noted in a number of areas on the WCVI through raking or spot dives but it was not possible to develop a supportable assessment of the egg deposition for these spawning 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.

In contrast to recent assessments, 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 2006/07 season a total of 198 herring samples (92 roe, 15 food and bait, 80 test fishery, 6 SOK, and 5 research samples) were collected and processed compared to 212 in 2006 and 274 in 2005. Of the roe, test fishery and SOK samples, none were collected in non-assessment areas, 6 were taken in the Queen Charlotte Islands assessment area (another 6 from Area 2W), 24 in the Prince Rupert area, 26 in the Central Coast, 104 in the Strait of Georgia, and only 12 on the west coast of Vancouver Island of which 5 came from Area 27. The age composition estimates for each major assessment region for 1951-2007 are presented in Figure 3 and Appendix Table 1.1-1.7.

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.

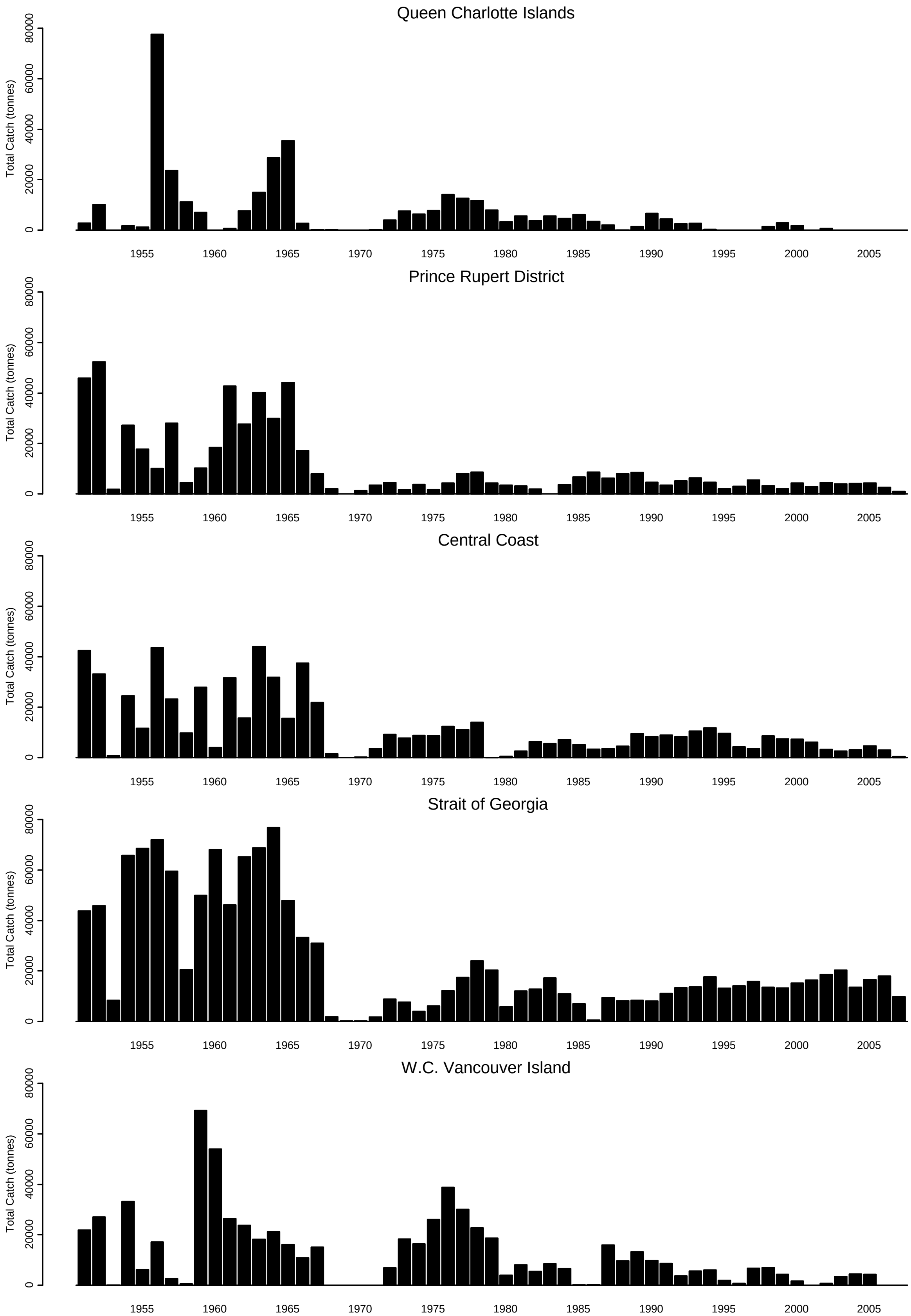


Figure 2. Estimated total catch from all fisheries except spawn-on-kelp for each assessment region from 1951-2007.

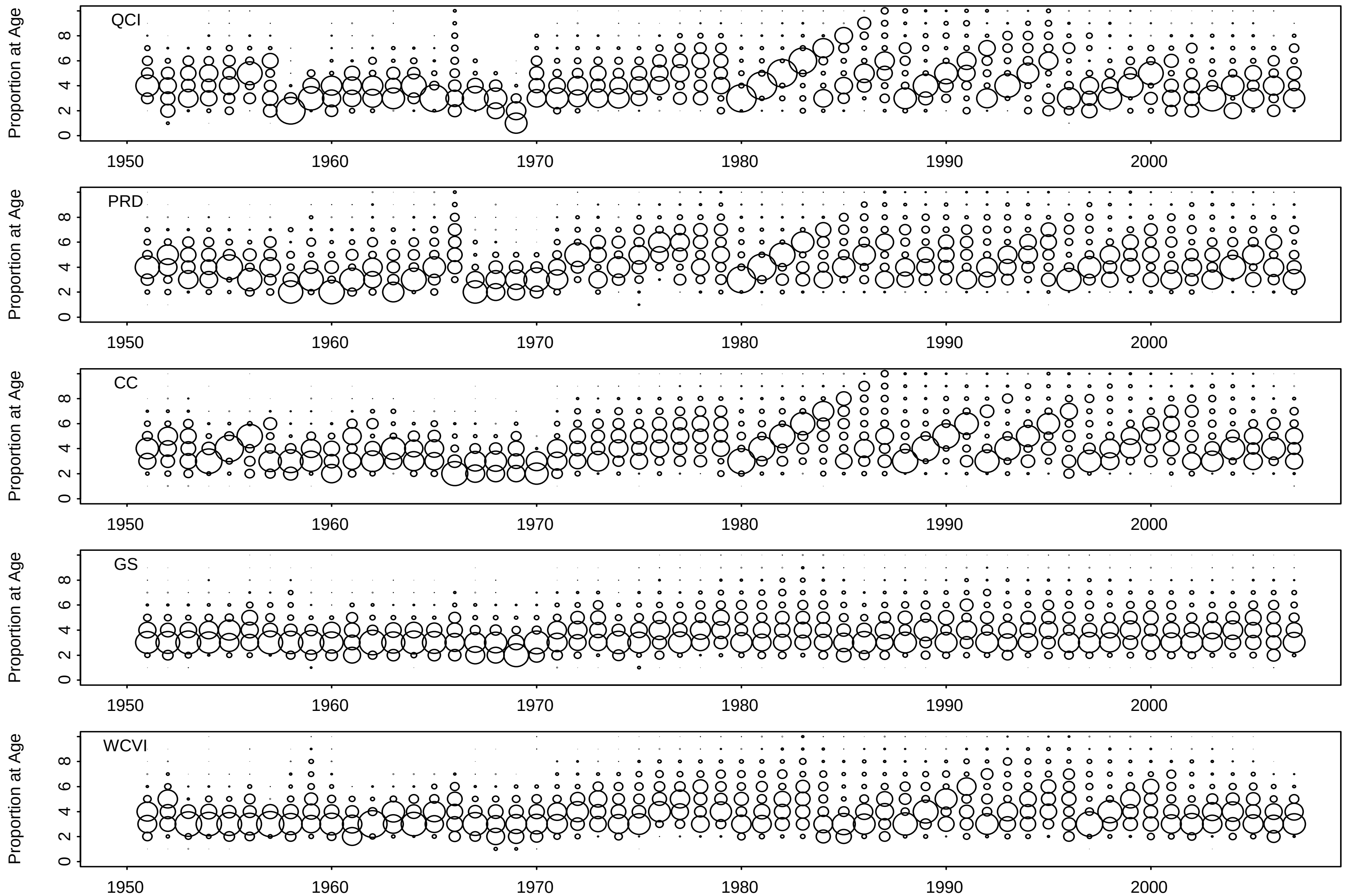


Figure 3. Age composition estimates for five major assessment regions from 1951-2006 from biological sampling. These data are used in the catch-age analysis.

GENERALIZED HERRING CATCH-AGE MODEL

In this section we provide a brief overview of the generalized herring catch-age model (HCAM), including descriptions of the options for population and fishery dynamics and the likelihoods used in fitting to 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 HCAM 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 modelled 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.

A number of options are available for the parameterization of age-specific fishery selectivity and age-specific availability. These include: fixed at 1; age-based logistic functions; a size-based logistic function; and free-at-age.

Deviations from the prescribed availability-at-age or selectivity-at-age can be estimated. For availability deviations this adds an additional parameter for each year and for selectivity deviations this adds an additional parameter for each fishery. The methods for including deviations are different for the alternative parameterizations of availability and selectivity (see Haist and Schweigert 2006, Appendix A).

Fishery Dynamics and the Catch Equations

The fishery dynamics can be modelled using either the instantaneous (Baranov) form of catch equations where fishing and natural mortality are simultaneous or a discrete form of catch equations 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 the first case the implied assumption is that there is no error in the catch data while the second case acknowledges error in the catch data.

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).

Stock-Recruitment Assumptions

A Beverton-Holt type stock-recruitment relationship is implemented in HCAM, using the "steepness" parameterization (Mace and Doonan 1988, Francis 1992). Estimated parameters of the stock-recruitment relationship are: R_0, the average recruitment at the unfished equilibrium biomass level (B_0); steepness (h), the fraction of R_0 that is expected at 20% of B_0; and the variance of the residuals from the stock-recruitment relationship (σ_r).

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 current implementation initializes the populations in the first year of the analysis.

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 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 current 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. These are the multinomial distribution and a robust-normal distribution (Fournier et al. 1990, Starr et al. 1999).

For fitting the spawn index data, HCAM only models the lognormal distribution.

Priors

The priors implemented in HCAM include uniform, normal, and lognormal distributions (Haist and Schweigert 2006, Appendix A).

Residuals

To assess deviations from model assumptions we examine two types of residuals; Pearson residuals which express the residual relative to the variability of the observation and normalized residuals which express the residual on a standard normal scale (see Haist and Schweigert 2006, Appendix A for descriptions). For the normalized residuals we calculate two statistics; the standard deviation of the normalized residuals (SNDR) which has an expected value of 1, and a potentially more robust statistic, the median of the absolute residuals (MAR) which has an expected value of 0.67.

FORMULATION OF THE HCAM MODEL

The herring catch-age analysis (HCAM) 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 computer 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 selected the R13 HCAM formulation for future assessments because it combined features of: only minor retrospective patterns; no obvious patterns in model residuals; consistency between the assumed and empirical error structure; and model parsimony.

The suite of HCAM model runs presented by Haist and Schweigert (2006) was not comprehensive, and prior to conducting analyses for the 2006 herring stock assessment some additional runs were compared to assess whether better formulations of the model were possible. A description of the options included in the different runs is presented in Schweigert and Haist (2007) and version 20 of the model was adopted for the assessment in 2006 and again for 2007.

STOCK TRENDS AND ABUNDANCE FORECASTS

Estimates of the spawn index, spawning biomass, and pre-fishery stock biomass over the period 1951 to 2007 from the HCAM implementation are presented in Figures 4 and 5 for the northern and southern migratory herring stocks. The three southern stocks, west coast of Vancouver Island, Strait of Georgia, and Central Coast all show a slight decline following the sharp decrease from 2005 to 2006. The stocks in Prince Rupert and the Queen Charlotte Islands show a small increase in 2007. However, all stocks except the Strait of Georgia remain near or below the Cutoff level.

Residual and Retrospective Analysis

An examination of residuals provides the basis for assessing the fit of the model to the available data. The model estimate of the population egg production can be compared to the observed egg deposition and residuals reviewed for lack of 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 over time in all areas since the inception of diving surveys in 1988. The standardized residuals presented here differ from those in assessments prior to 2006 but are in the expected range of variation. The residuals for all areas except the SG in 2007 are insignificant. The SG residual suggests that the model estimated more based on the age composition information than was observed during the spawn assessment.

The normalized residuals from the age-composition fit are presented for the three fishing periods over time for the five major stocks in Figures 8 to 12. Based on the large residuals in the 2006 assessment, some suspect age composition samples were removed from the assessment for this year. In the QCI, the fall samples from 1966/67 and 1982/83, in the CC the 1979/80 fall sample, in the SG the two 1972/73 gillnet samples, and on the WCVI the two 1973/74 gillnet samples was removed from the dataset. As a result the residuals are substantially improved relative to recent assessments. A few larger residuals remain but there are no clear patterns or trends in residuals evident over time or age in any area.

The estimates of natural and fishing mortality over the time period from 1951-2007 are presented in Figure 13. The average natural mortality rate estimates range widely between stocks and over time with the highest levels in the QCI and WCVI. 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 WCVI stock. All stocks show a peak in natural mortality during the stock collapse of the late 1960s. Fishing mortality rates have decreased significantly in all stocks following the high levels during the reduction period and the subsequent collapse. Fishing mortality rates have been low and stable in all stocks since the early 1980s.

A retrospective analysis for the HCAM model version R20 is presented for each of the major herring stocks in Figures 14. The plots show the stock trajectory determined for each year since 1996 demonstrating the effect of additional data on model performance relative to the estimates from the stock trajectory in the current year. The 95% confidence bands from the posterior distribution from the Bayesian analysis are also shown. In general, the retrospective patterns are very stable for all stocks with some minor exceptions for the Strait of Georgia and west coast of Vancouver Island since the 1970s. The retrospective patterns are much improved from recent assessments and suggest consistency in the interpretation of the data over time.

Trace plots from the sub-sampling of the MCMC posterior distribution for estimated 2007 spawning stock biomass are presented in Figure 15. The plots show a substantial amount of variation but there is no evidence of trends over the course of the simulations. A total of 2000 samples were retained over the course of the 1 million simulations.

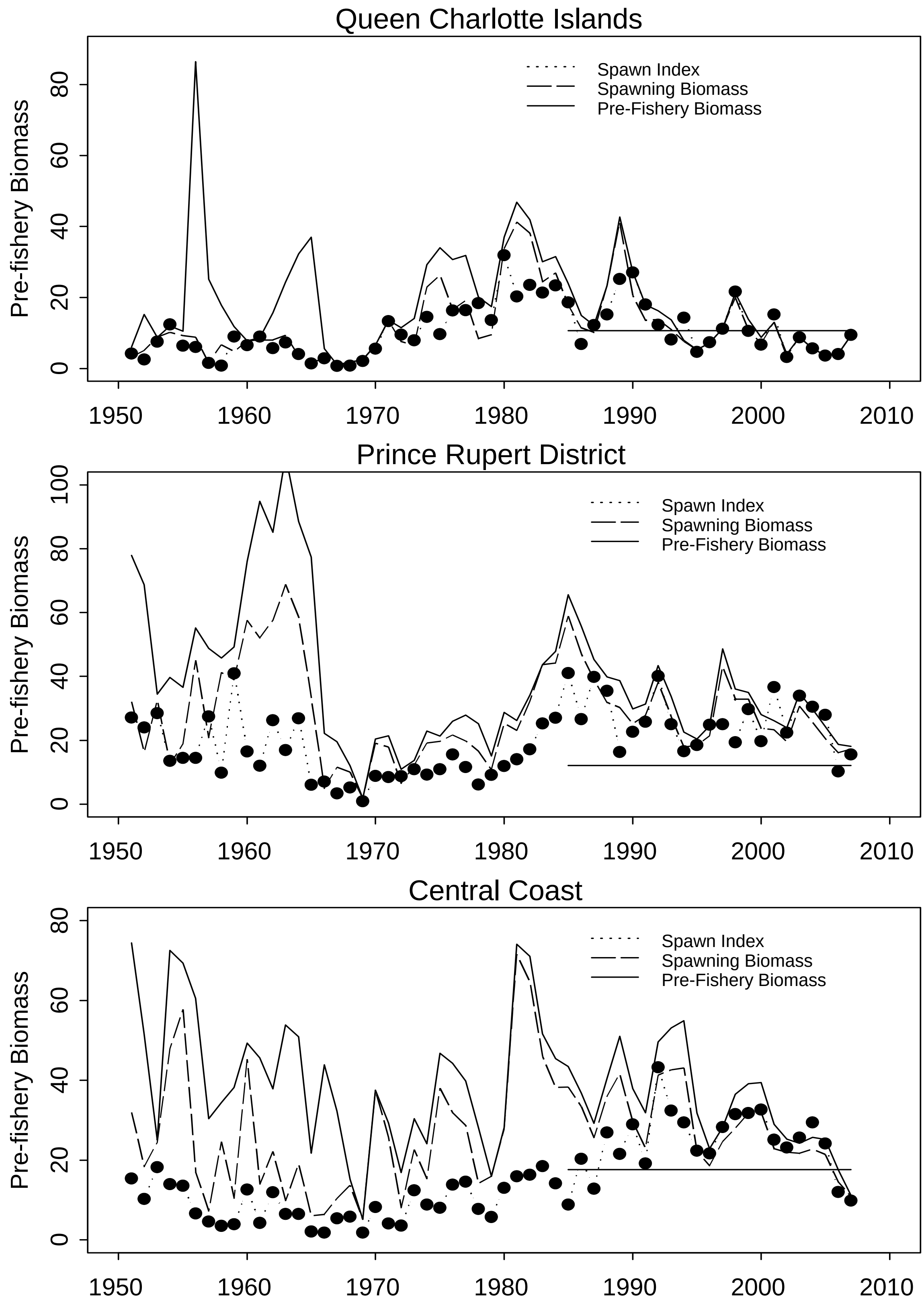
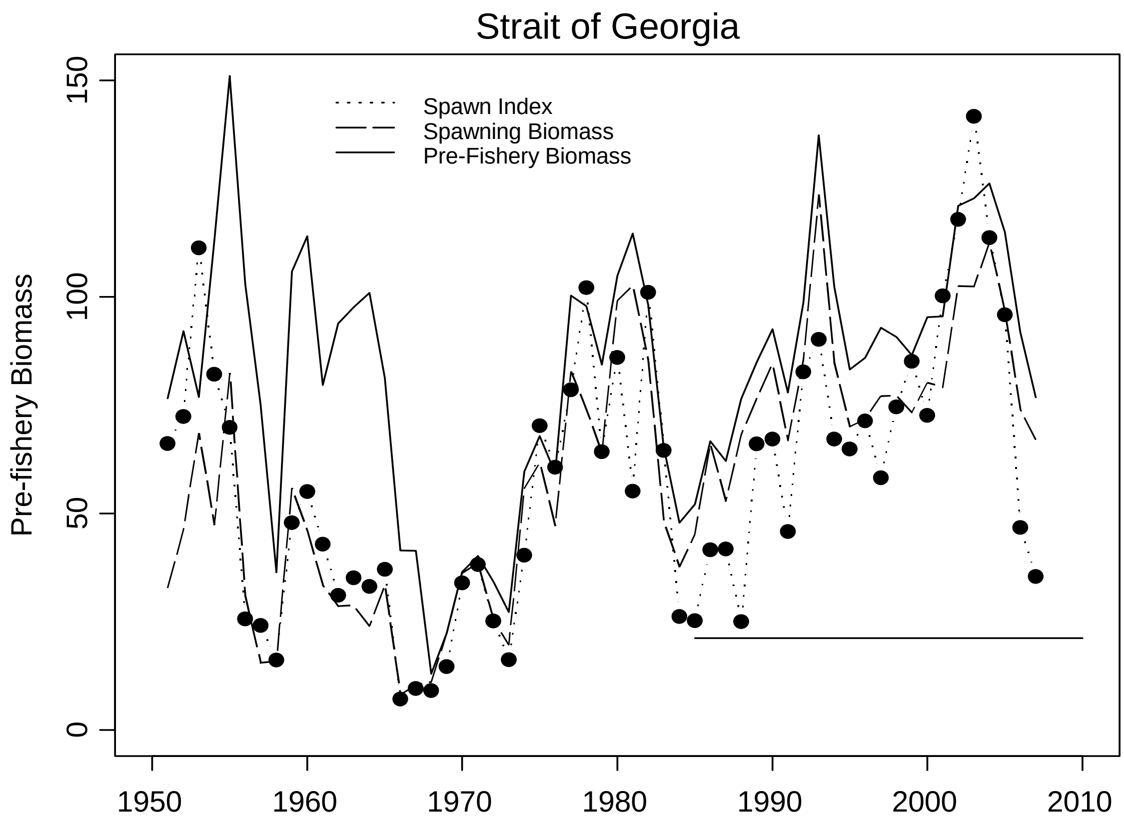


Figure 4. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAM) analyses for northern B.C. herring stock assessment regions, 1951-2007. Horizontal line indicates the Cutoff level.



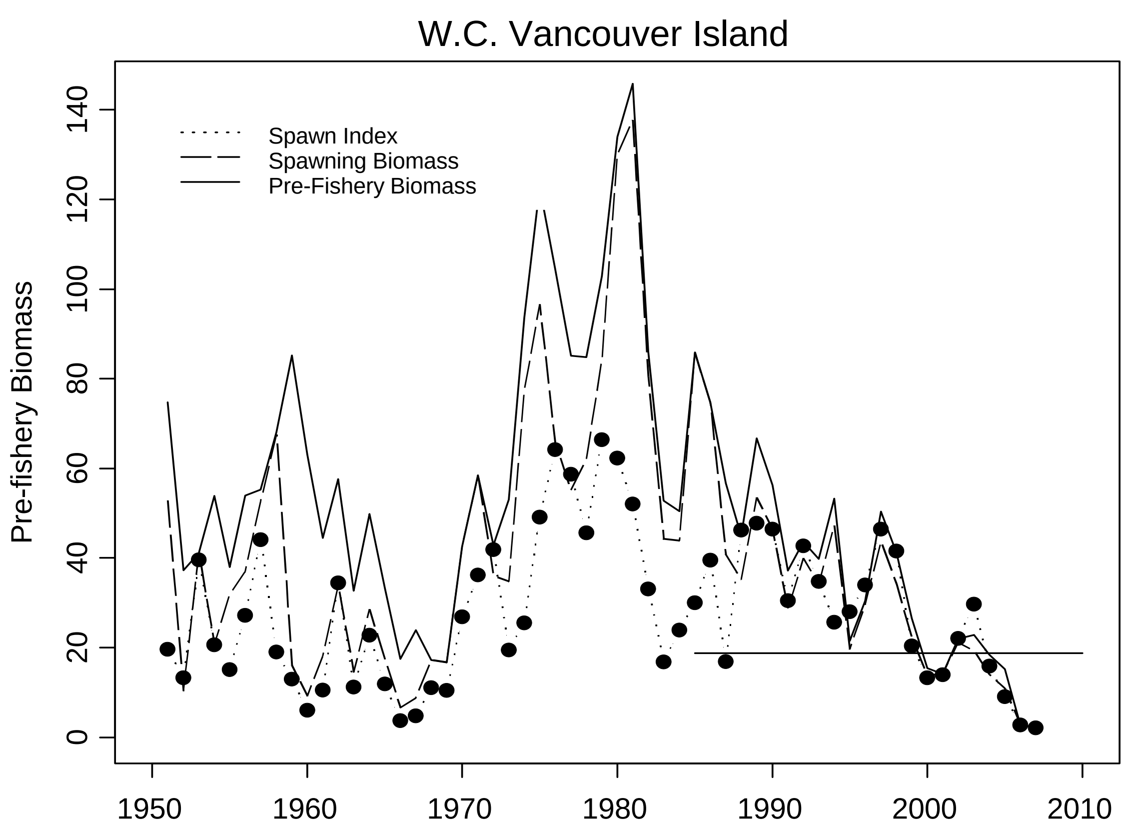


Figure 5. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAM) analyses for southern B.C. herring stock assessment regions, 1951-2007. Horizontal line indicates the Cutoff level.

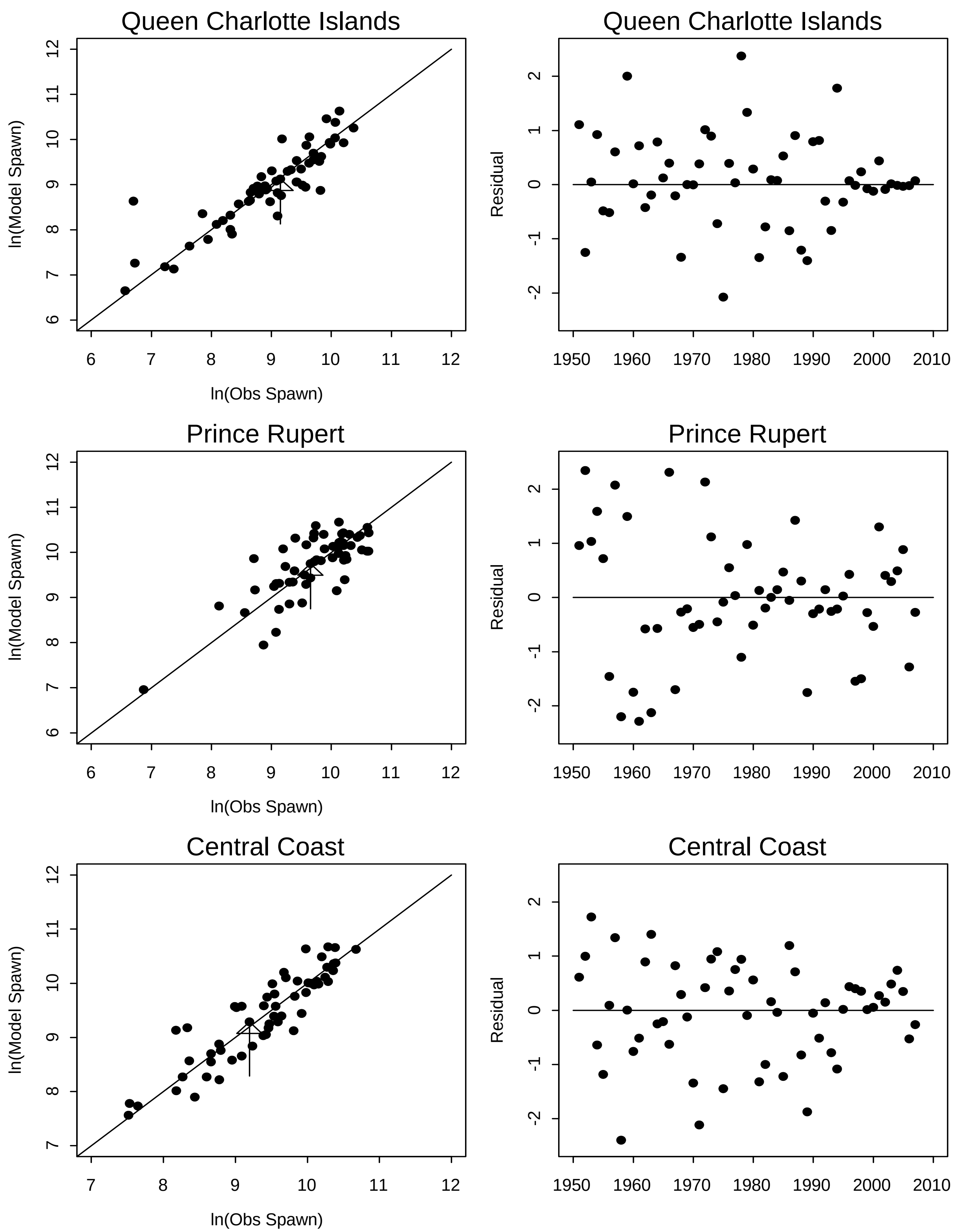


Figure 6. The residuals from the observed spawn - true spawn relationship for the northern assessment regions for the period 1951-2007. The arrow indicates the most recent data point.

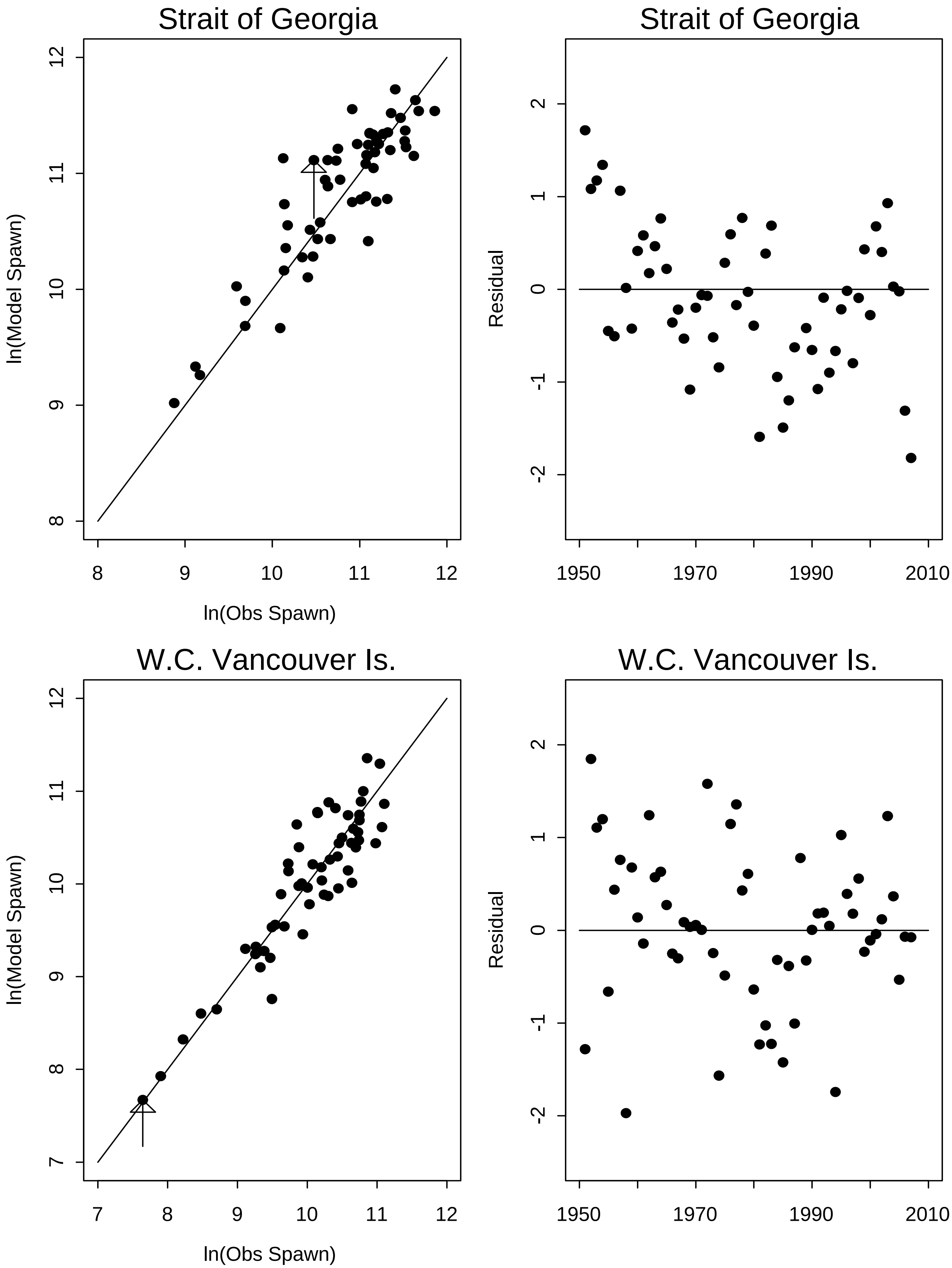


Figure 7. The residuals from the observed spawn - true spawn relationship for the southern assessment regions for the period 1951-2007. The arrow indicates the most recent data point.

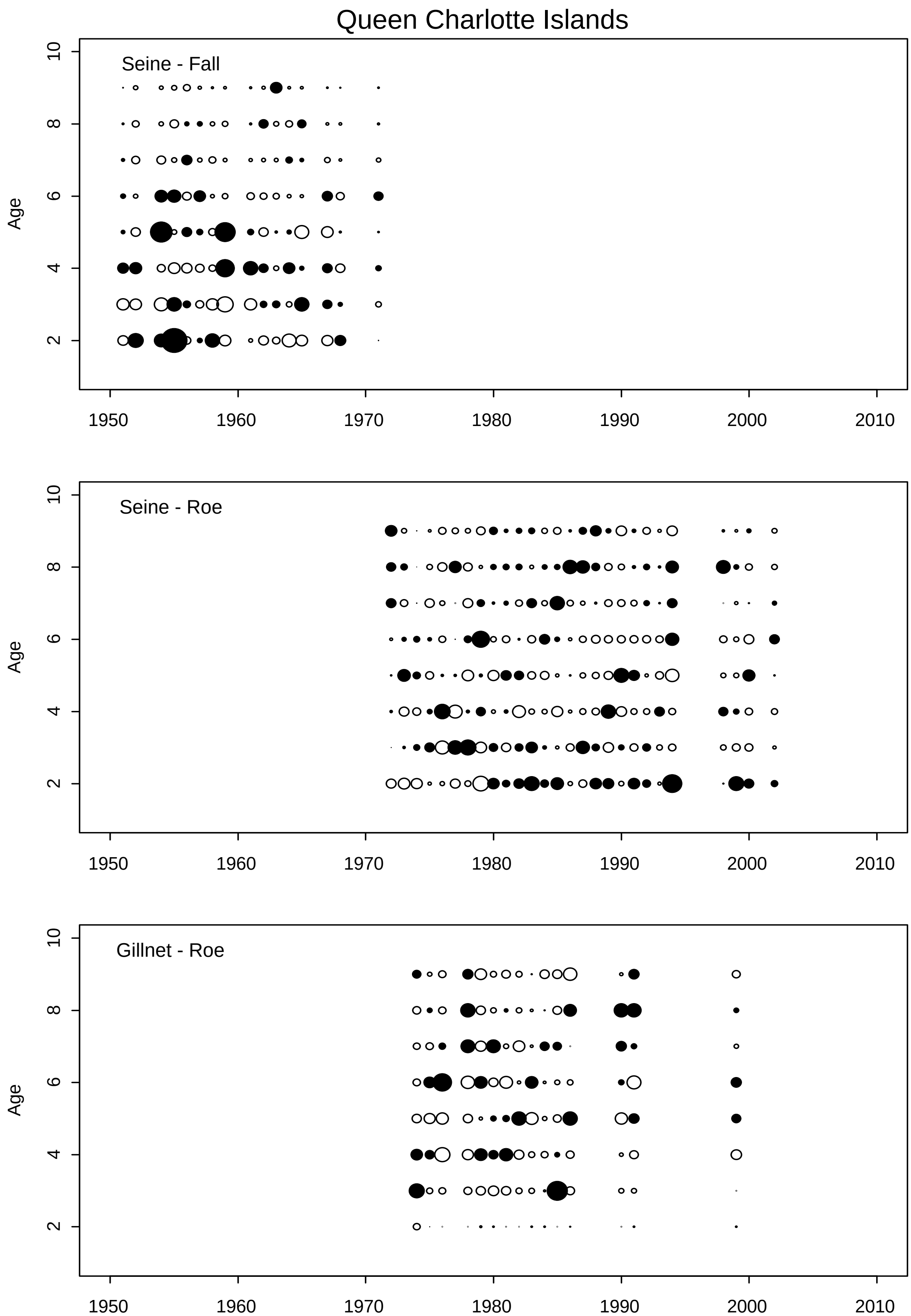


Figure 8. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Queen Charlotte Islands, 1951-2007. Filled circles are positive residuals and open circles are negative residuals.

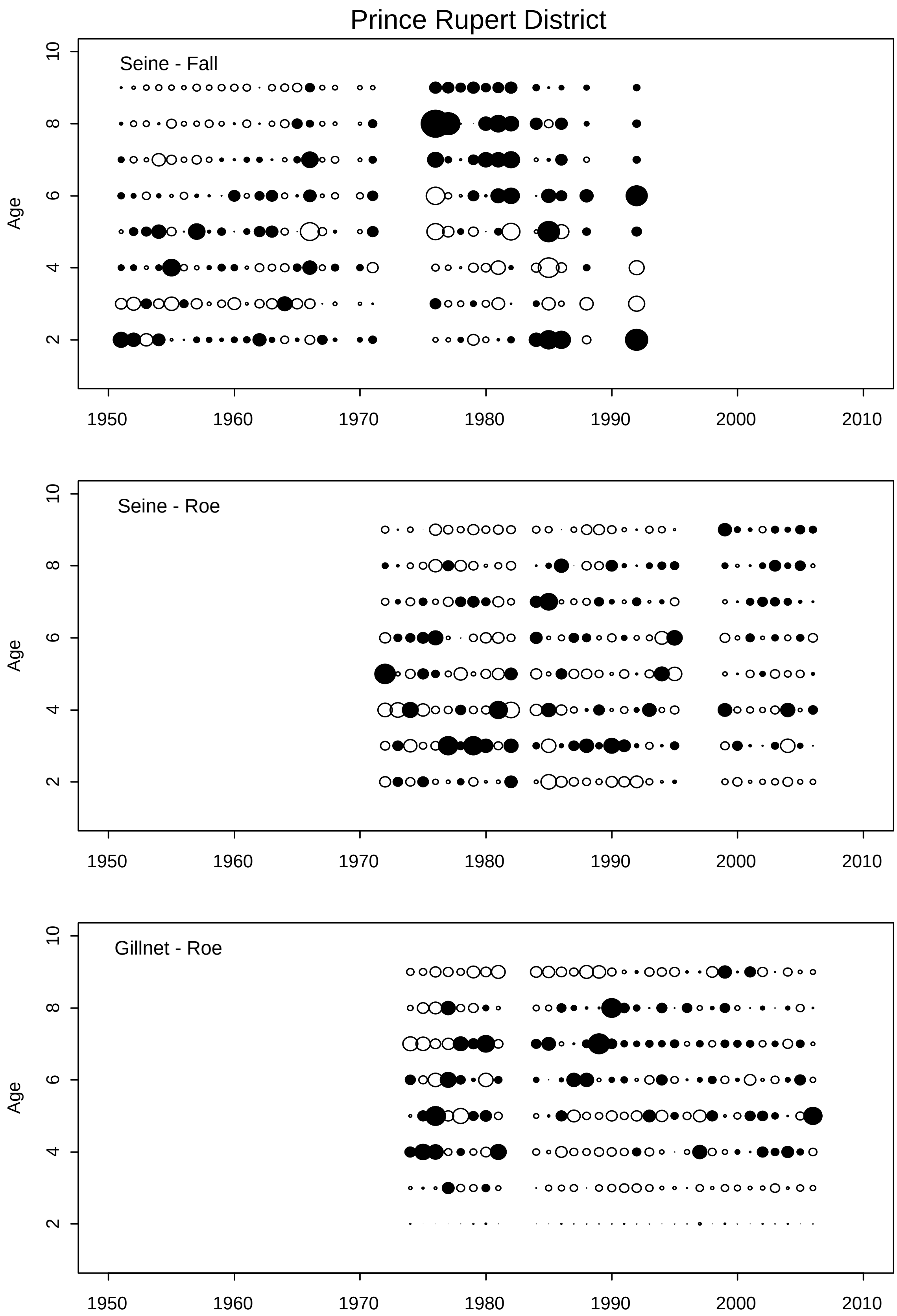


Figure 9. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Prince Rupert District for 1951-2007. Filled circles are positive residuals and open circles are negative residuals.

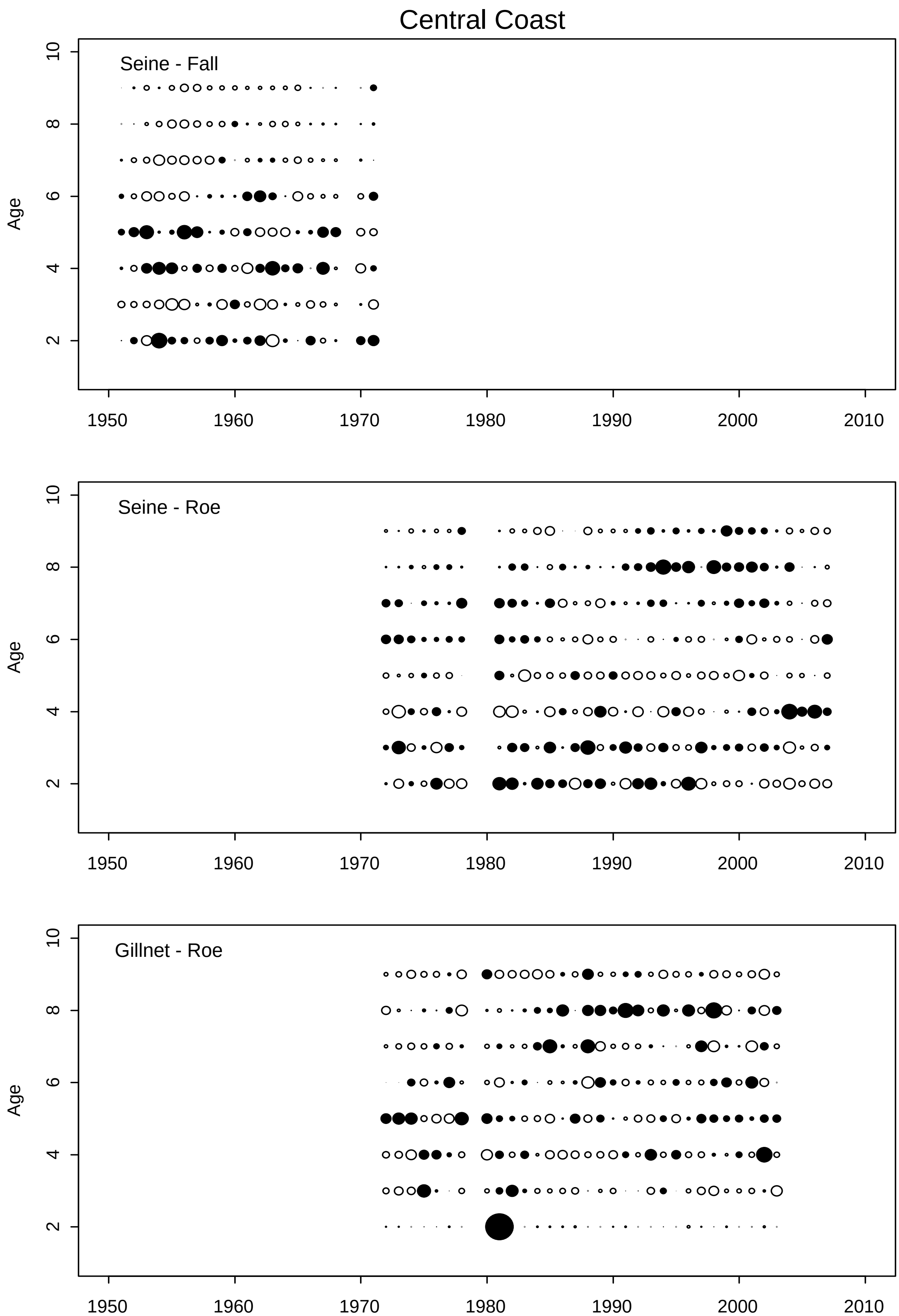


Figure 10. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Central Coast for 1951-2007. Filled circles indicate positive residuals and open circles are negative residuals.

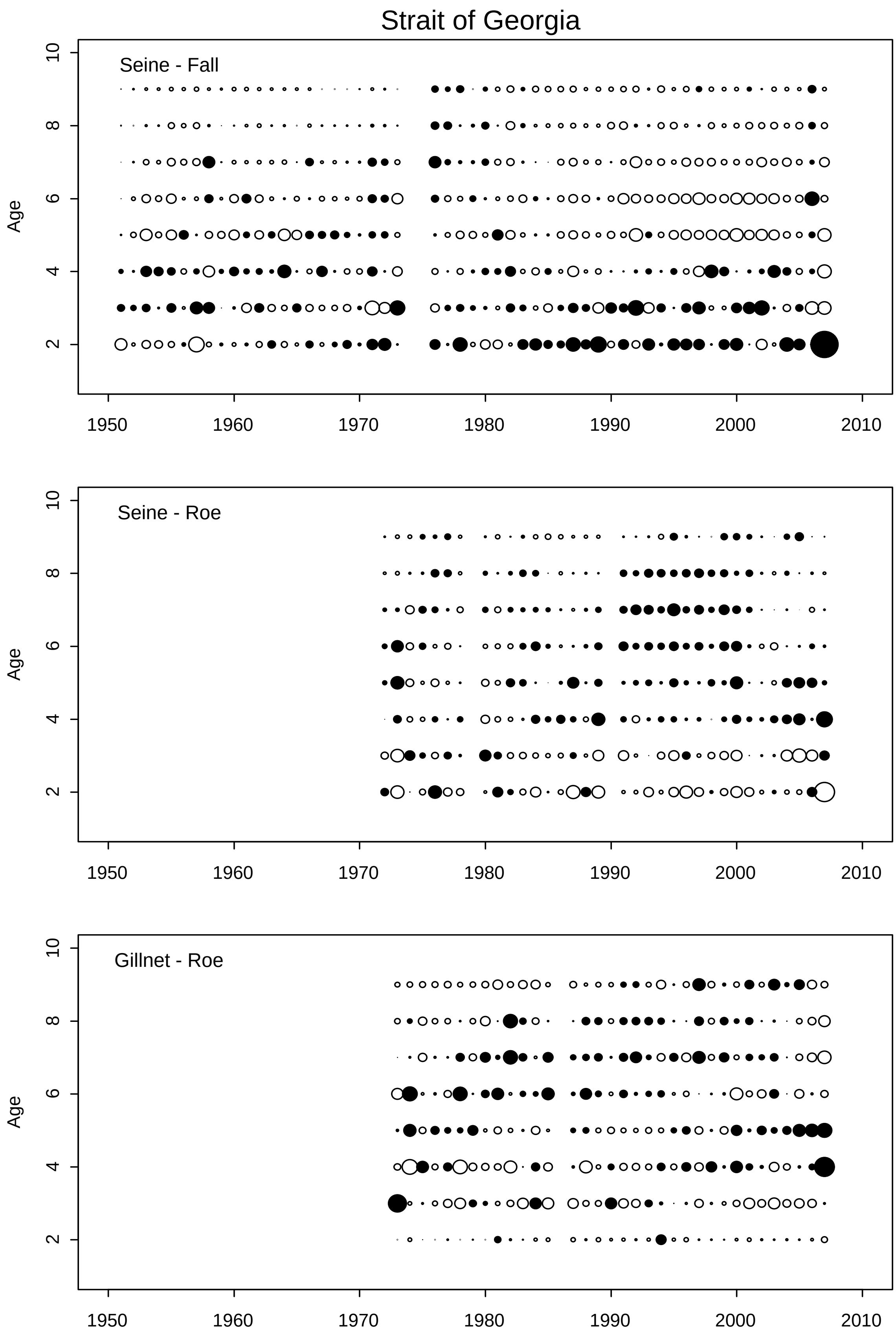


Figure 11. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Strait of Georgia for 1951-2007. Filled circles indicate positive residuals and open circles are negative residuals.

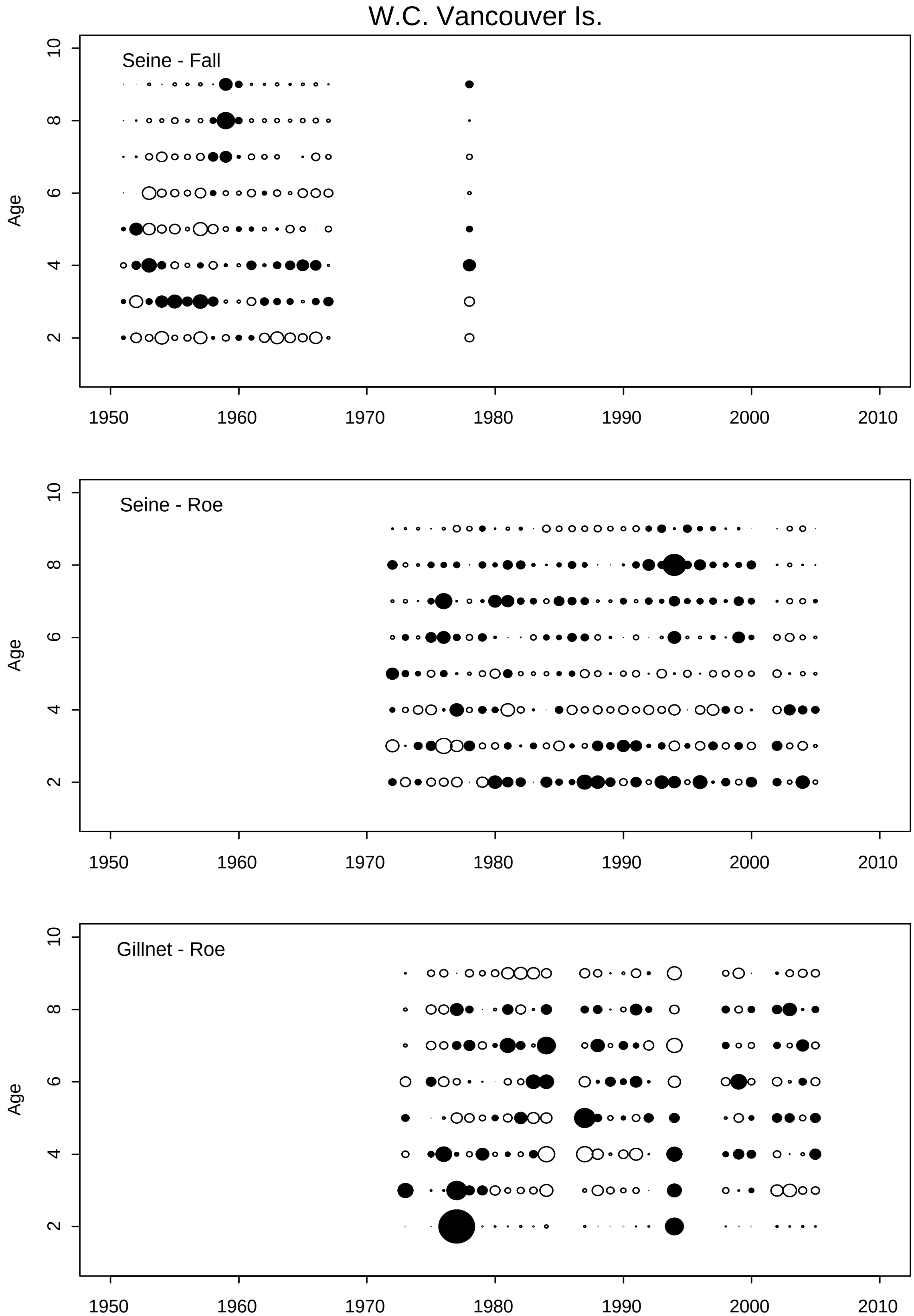


Figure 12. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the west coast of Vancouver Island for 1951-2007. Filled circles represent positive residuals and open circles are negative residuals.

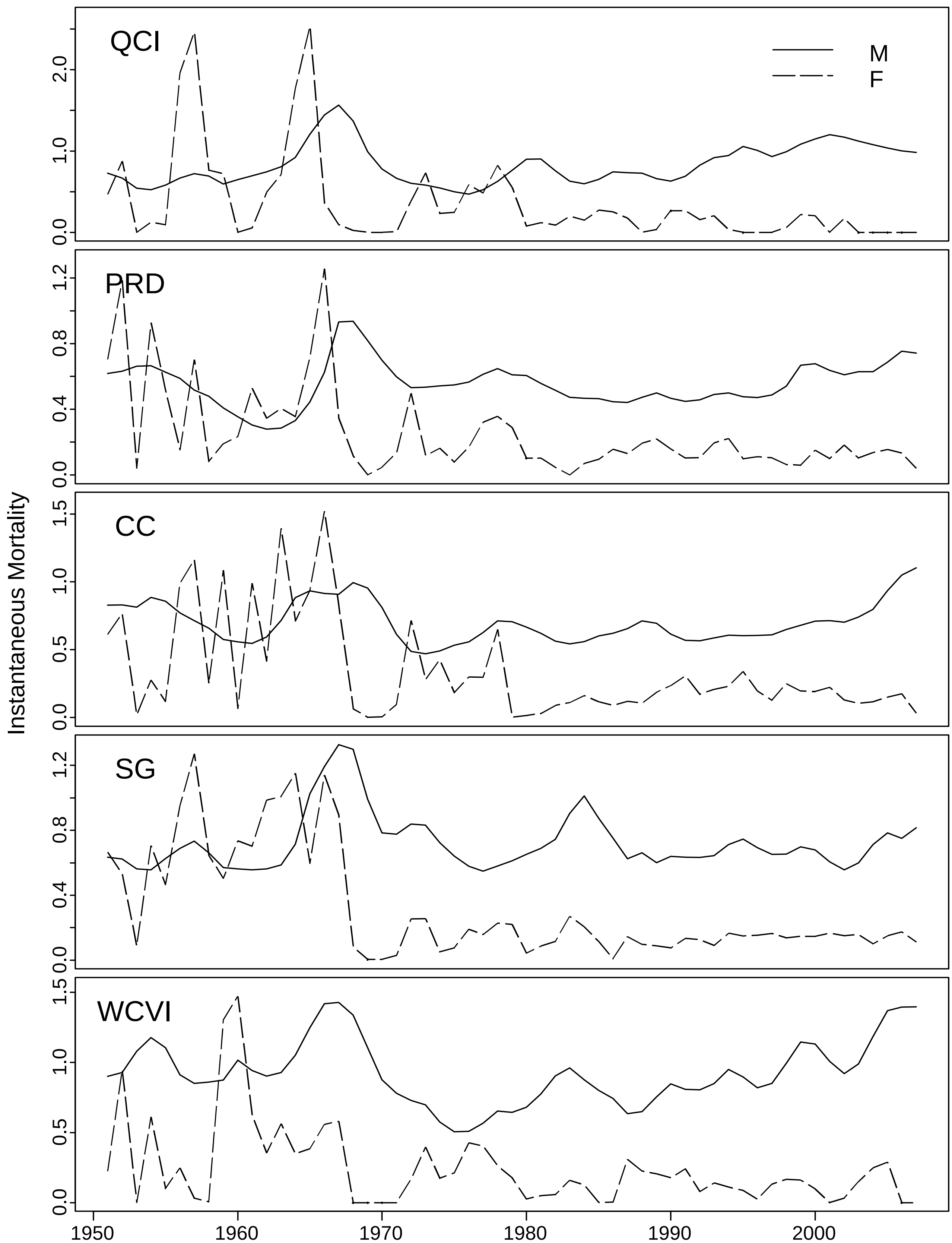


Figure 13. Estimates of annual instantaneous natural (M) and fishing (F) mortality for major B.C. herring stocks from 1951-2007.

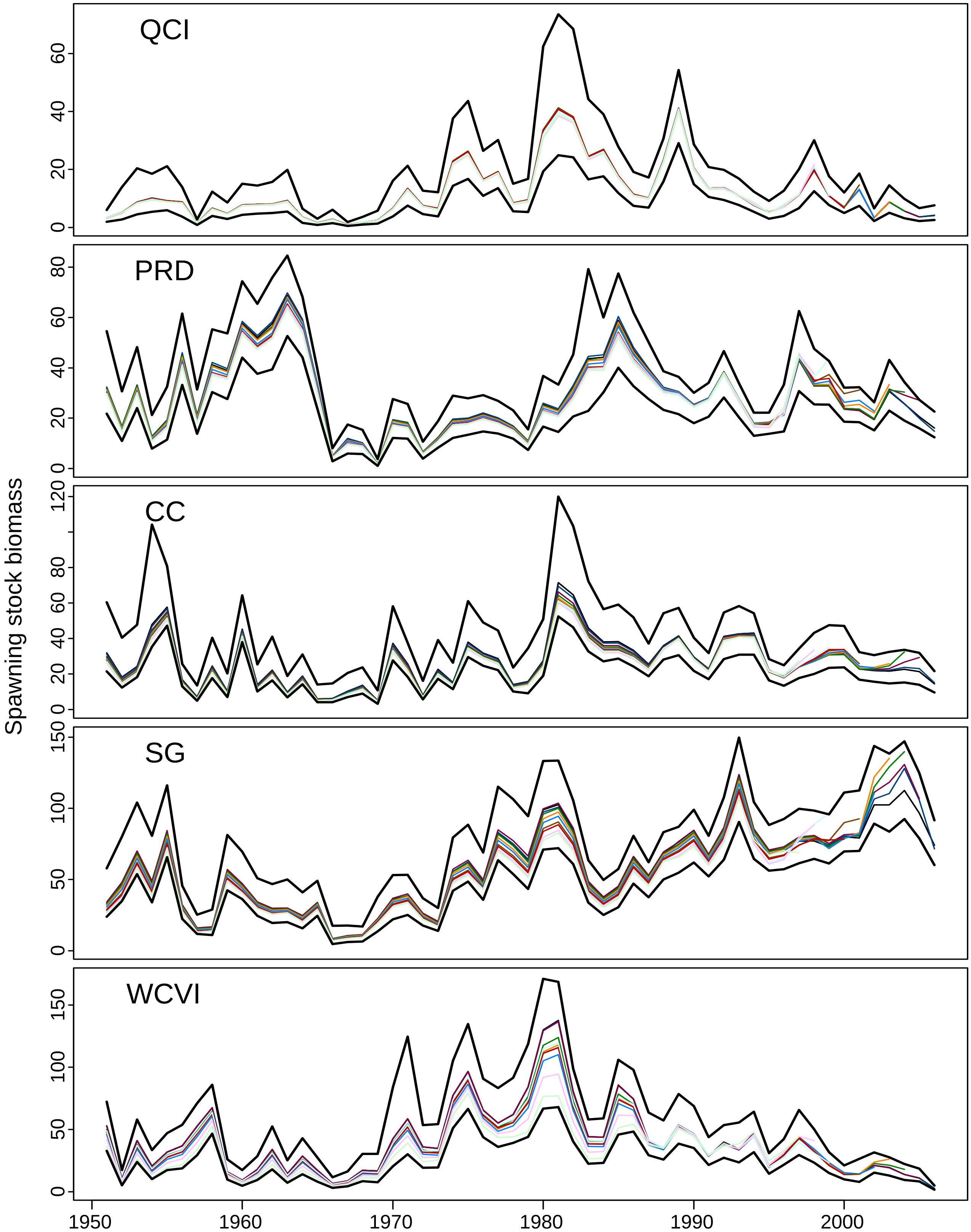
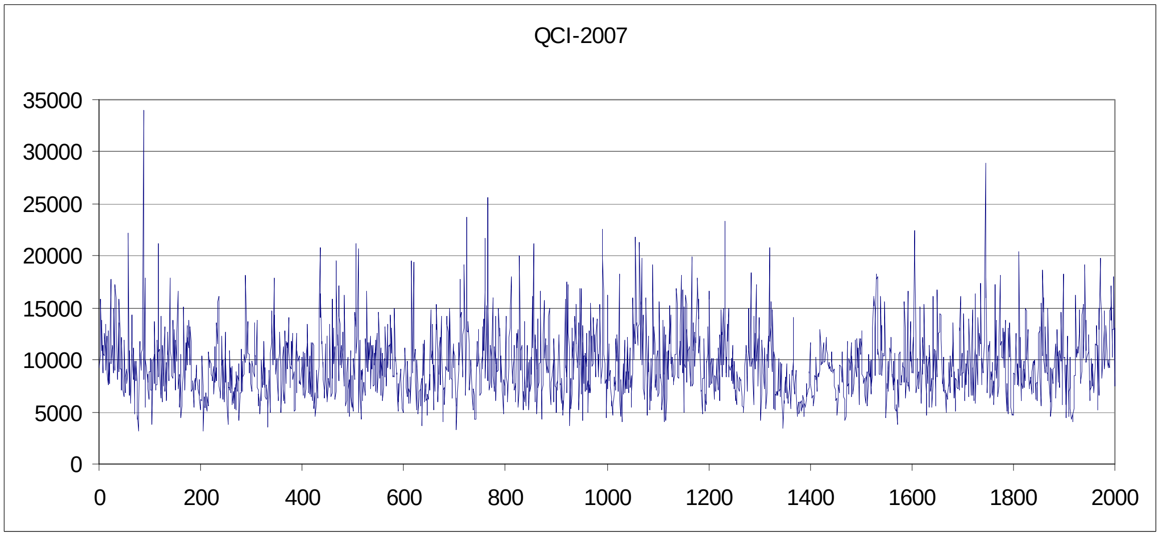
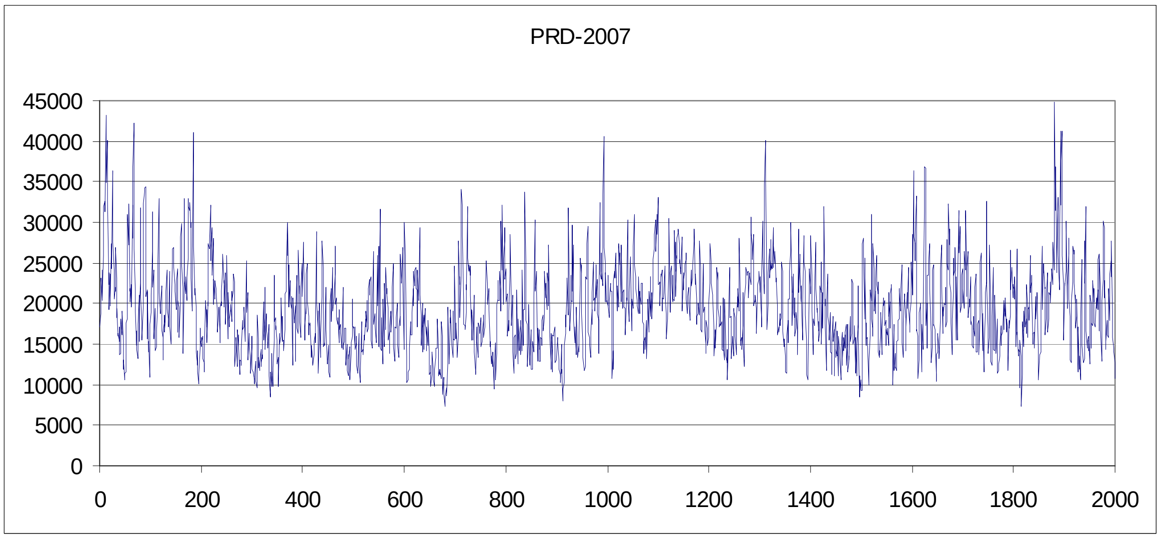
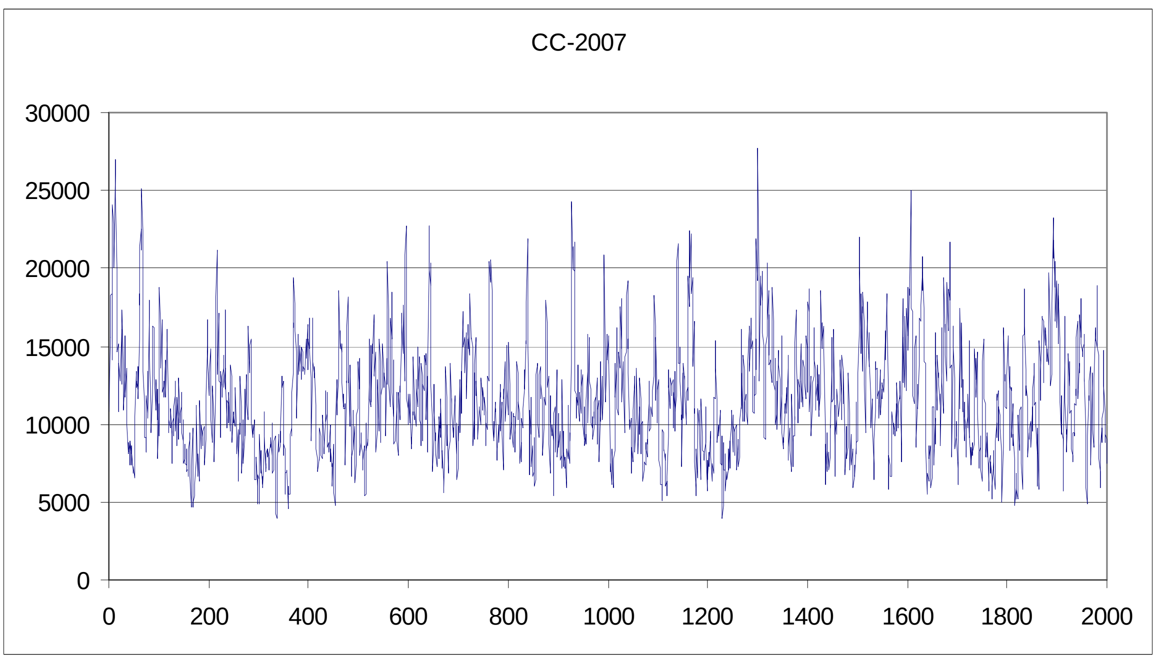
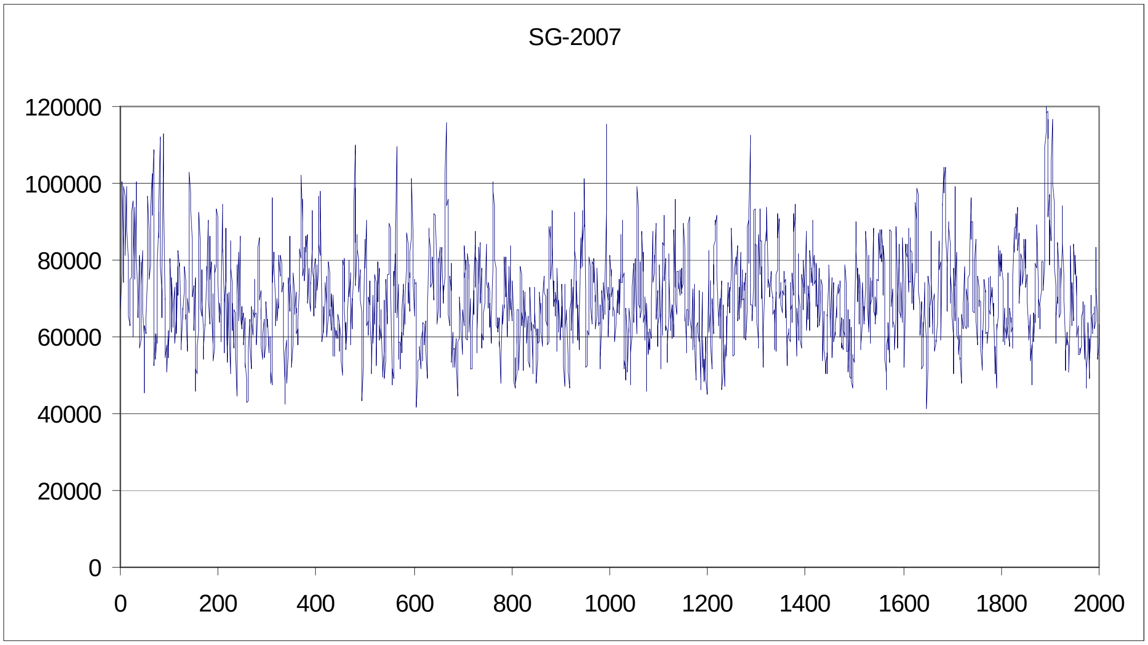


Figure 14. Estimates of spawning stock biomass from retrospective analyses (1996-2007, light coloured lines) and from marginal posterior estimates (using data through 2007, 5th and 95th percentiles of the distribution are shown as heavy lines). Results are from analyses using the R20 model parameterization.


QCI-2007
35000
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000


PRD-2007
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000


CC-2007
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000



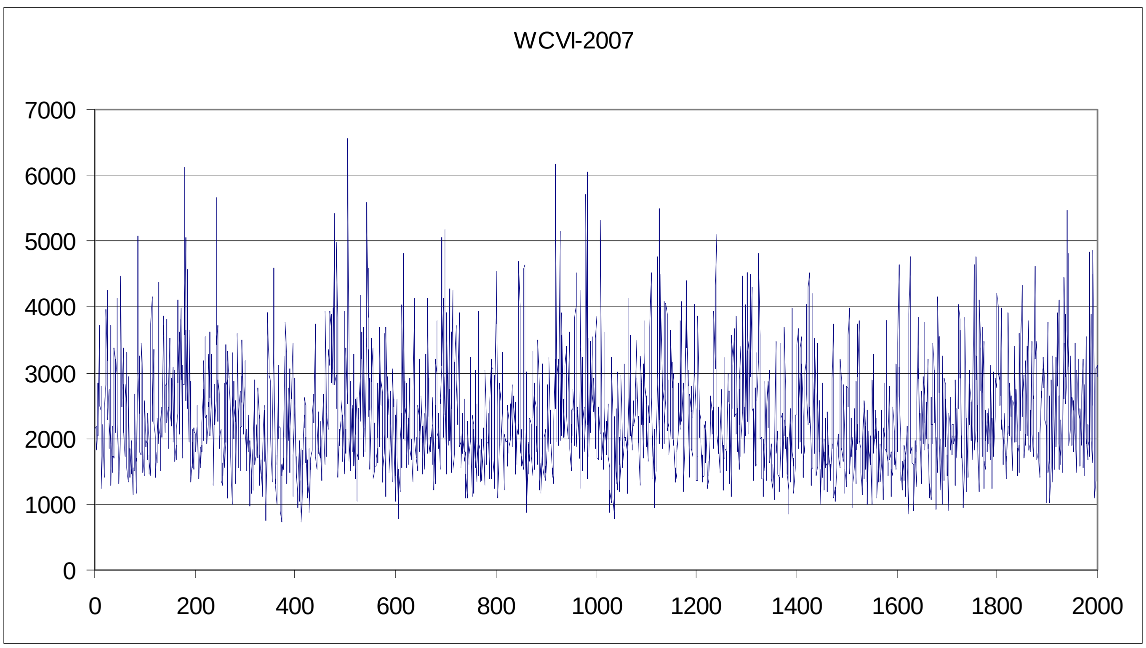


Figure 15. Trace plots from the MCMC analysis showing the sub-samples of estimated spawning biomass in 2007 for the five assessment regions.

ABUNDANCE FORECASTS

Forecasts of pre-fishery spawning stock abundance for 2006 and 2007 are calculated slightly differently than in past 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. The results are presented in Figures 16 and 17. 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 historic 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 2000 traces from the MCMC analysis.

Queen Charlotte Islands

The posterior distribution for the estimate of 2007 spawning biomass is presented in Figure 16 and suggests abundance of slightly less than 10,000 tonnes. The distribution of forecast biomass with poor and average recruitment indicates that abundance will be between 5-10,000 tonnes in 2008. A good recruitment in 2008 could increase biomass to about 15,000 tonnes bringing the stock above the Cutoff level (Figure 16). However, all estimates have a high degree of uncertainty. Recruitment to this stock has been generally poor for the past decade (Fig. 18) with good year-classes occurring in 1995 and 2000. The 2001 through 2004 year-classes have been poor or average. The spawning run in 2007 was composed primarily of age 3^+ fish from the 2003 year-class constituting 45% of the run while age 4^+ fish from the 2001 year-class contributed another 21% (Appendix 1.1). The forecast with a poor recruitment is 6,900 tonnes and 8,900 tonnes with an average recruitment (Table 1).

Prince Rupert District

The posterior distribution from the MCMC simulation indicates that the spawning biomass in 2007 was slightly less than 20,000 tonnes (Fig. 16). The distributions of forecast biomass with poor or average recruitment will result in abundance of between 15,000 and 20,000 tonnes well above the Cutoff level of 12,100 tonnes for this assessment region. A good recruitment would increase abundance to 30,000 tonnes. Recruitment to this stock has been consistent, with good year-classes occurring roughly every few years since 1980 (Figure 18). Both the 1998 and 2000 year-classes were good but the 2001, 2003 and the 2004 year-class that recruited in 2007 were poor. The spawning run consisted of about 48% age 2^+ recruits and 22% comprised of age 3^+ fish from the 2003 year-class with another 11% age 4^+ fish from the 2002 year-class (Appendix 1.2). The forecast run size to the Prince Rupert District in 2008 with poor recruitment is 15,800 tonnes and with average recruitment 20,100 tonnes (Table 1).

Central Coast

The estimate of the 2007 spawning biomass and 2008 pre-fishery forecasts are presented in Figure 16. The posterior distribution indicates that spawning abundance in 2007 was about 10,000 tonnes. The forecast for 2008 with poor recruitment would result in a similar level of abundance. An average recruitment would result in run size of about 15,000 tonnes whereas a good recruitment would increase abundance to between 25-30,000 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 2002 (37% of the 2007 run) that recruited in 2005 (Fig. 18). The other strong year-class occurred in 2000, still accounting for 9% of the spawning run at age 6^+ while the 2003 and recruiting 2004 year-classes are poor and constituted only 14% and 30% of the run in 2007, respectively (Appendix 1.3). The forecast run size to the Central Coast in 2007 with poor recruitment is 11,100 tonnes and with average recruitment is 15,600 tonnes (Table 1).

Strait of Georgia

The Strait of Georgia herring stock remains the most productive on the coast. The posterior distribution of the 2007 spawning biomass and the pre-fishery forecasts for 2008 is presented in Figure 17. The 2007 biomass was about 60-70,000 tonnes and a similar level is projected in 2008 with a poor recruitment. An average recruitment would produce a run of about 80,000 tonnes while a good recruitment would return the stock to more than 100,000 tonnes. Although abundance declined substantially in 2006 and to a lesser extent in 2007, 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 1998-2002 are among the largest ever observed in this assessment region. The more recent 2003 and 2004 year-classes are average. The 2002 through 2004 year-classes contributed 12, 29, and 49% of the 2007 spawning run, respectively (Appendix 1.4). The forecast run size to the Strait of Georgia in 2008 with a poor recruitment is 67,300 and with average recruitment is 85,500 tonnes (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 2007 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 18). The forecast pre-fishery abundance for 2008 indicates that even a poor recruitment should double current levels to at least 10,000 tonnes. An average recruitment would increase abundance to around 20,000 tonnes just above the Cutoff level of 18,800 tonnes for this assessment region. A good recruitment would increase abundance to above 30,000 tonnes. However, all the forecasts for this stock are very poorly determined (Figure 17). 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 (Fig. 19). However, the last four year-classes have been poor or barely average. The majority of the 2007 run was comprised of only three year-classes (Appendix Table 1.5). The 2002 year-class contributed 11%, the 2003 contributed 35% while the recruiting 2004 year-class, while poor, contributed 50%. The forecast run size to the west coast of Vancouver Island in 2008 with a poor recruitment is 11,700 tonnes and with an average recruitment is 19,100 tonnes (Table 1).

Table 1. Estimated 50th percentiles of the posterior distributions from Bayesian analysis of 2007 spawning biomass and forecasts of the 2008 pre-fishery biomass with poor, average, and good recruitment.

			Forecast Biomass			Available Harvest		
	2007 SB	2008 – 3+	Poor	Avg	Good	Poor	Avg	Good
QCI	9127	5978	6891	8869	15191	0	0	3038
PRD	18678	14074	15757	20071	29834	2815	4014	5967
CC	11129	8608	11124	15634	27397	0	0	5479
SG	68880	49200	67350	85484	104843	13470	17097	20969
WCVI	2144	6178	11690	19117	35417	0	317*	7083

* Harvest level is Forecast*0.2 minus Cutoff

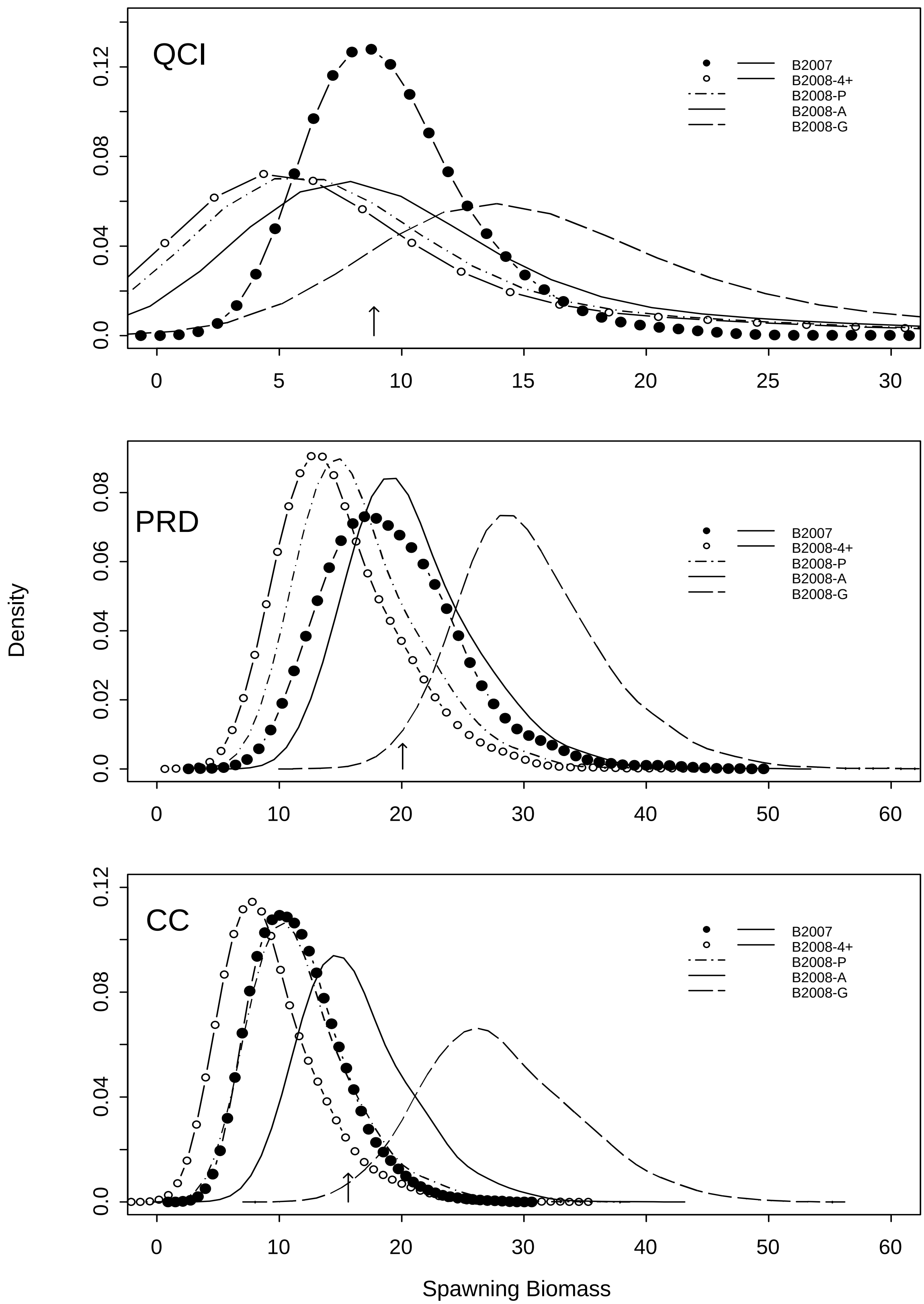


Figure 16. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for spawning biomasss in 2007 and the forecast pre-fishery biomass in 2008 for the northern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

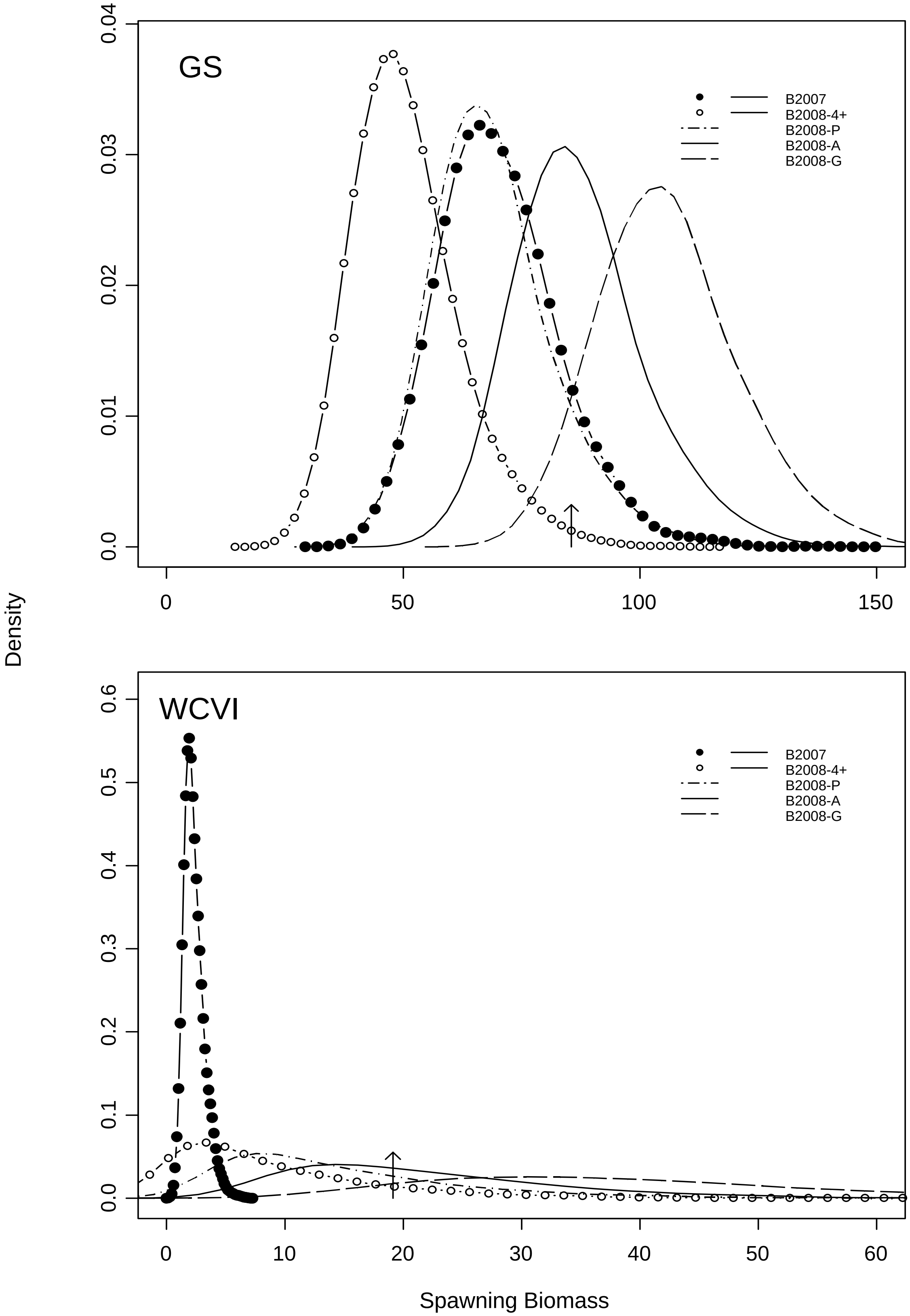


Figure 17. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for the 2007 spawning biomass and the forecast pre-fishery biomass for 2008 for the southern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

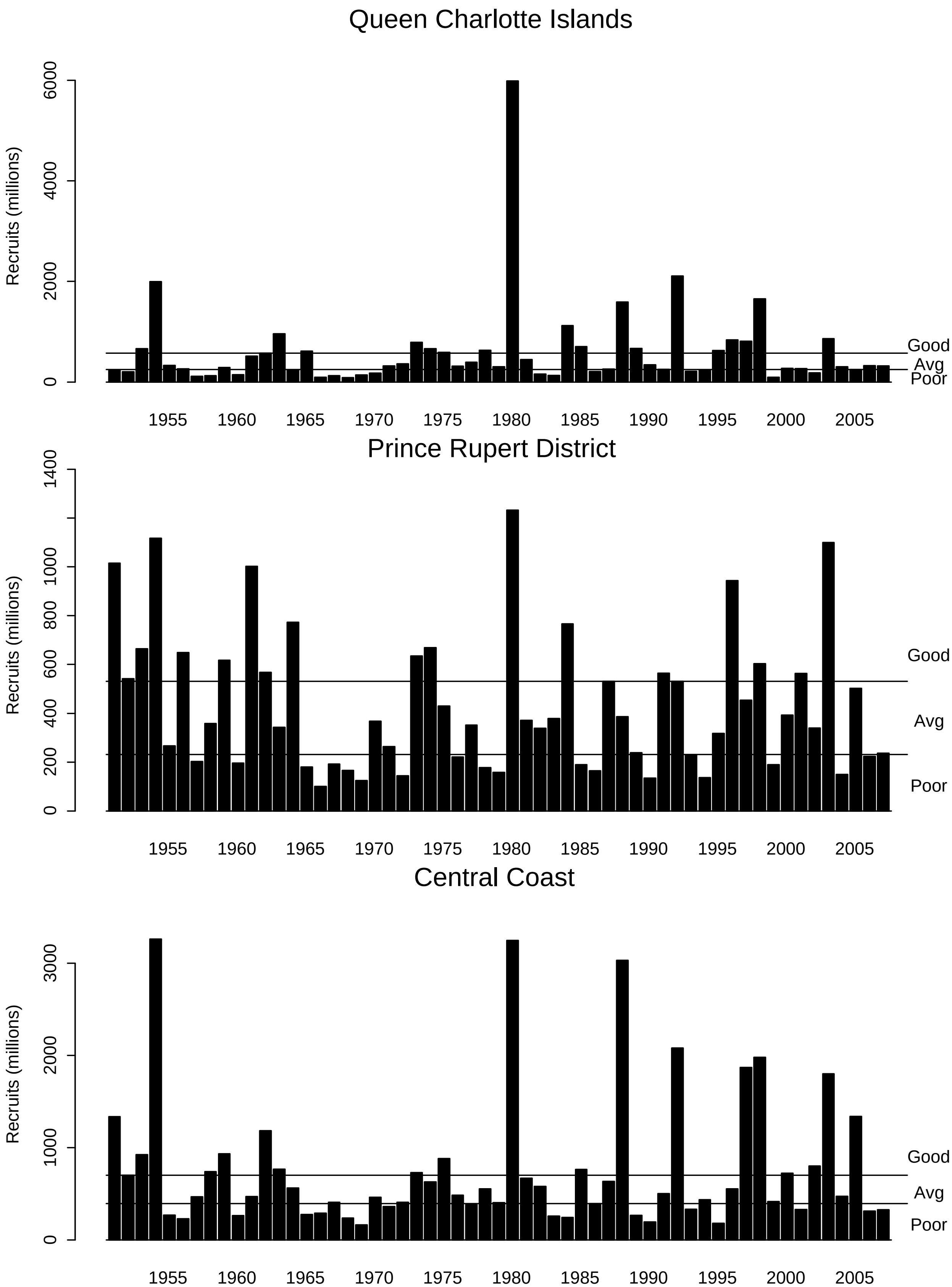


Figure 18. Estimates of abundance of recruiting age 2^+ year-classes from age-structured analysis for northern B.C. herring stock assessment regions, 1951-2007. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

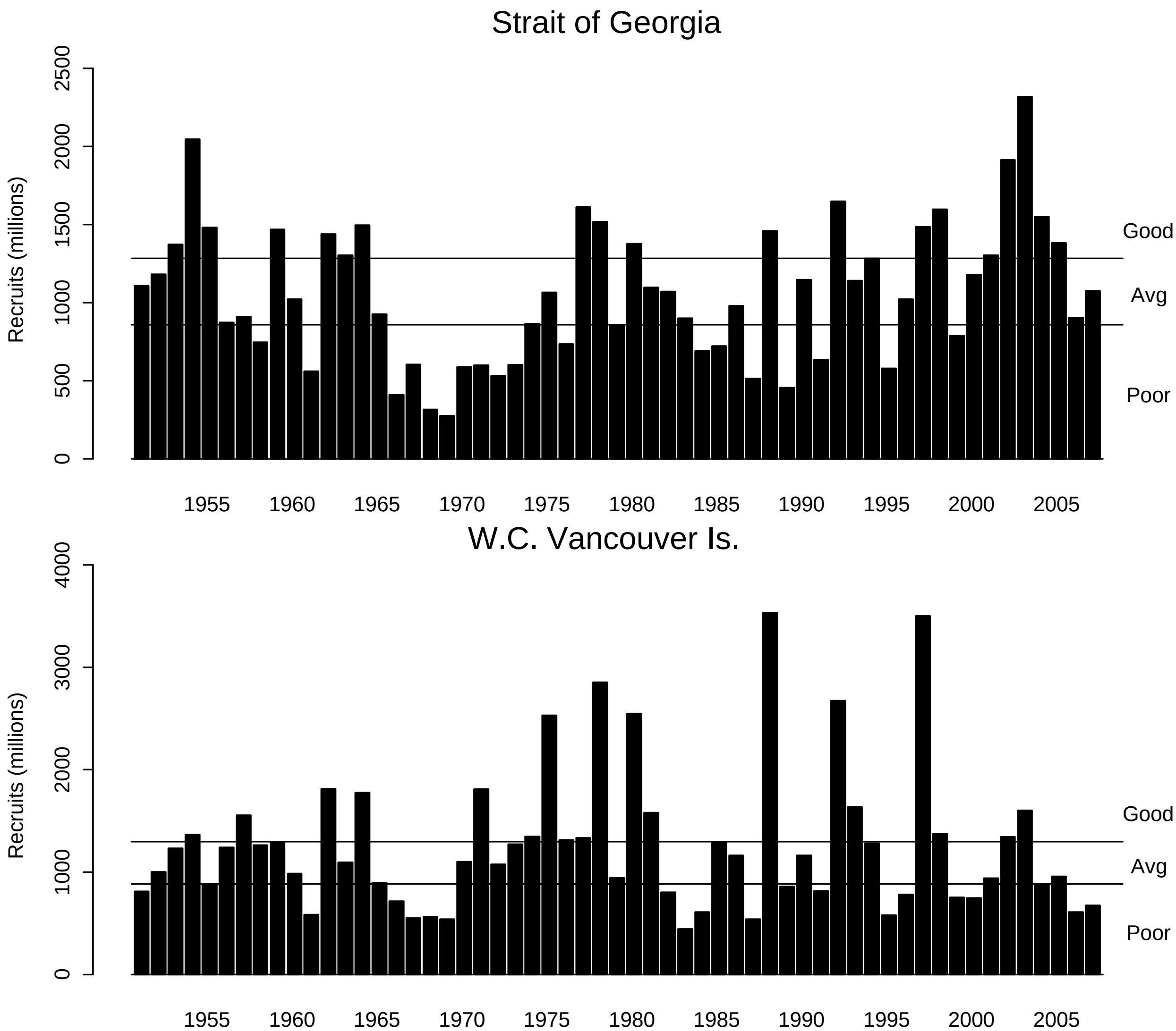


Figure 19. Estimates of abundance of recruiting age 2^+ year-classes from age-structured analysis for southern B.C. herring stock assessment regions, 1951-2007. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

MINOR STOCKS – AREA 27 & 2W

Abundance estimates for the minor herring stocks in Areas 2W and 27 were also obtained using the HCAM assessment model. The version of the model used was R18 as described in Schweigert and Haist (2006). Because of data limitations for these two stocks it was not possible to obtain estimates with the preferred model R20. In addition, the model was run for shorter time periods for these two stocks because of data limitations. Given the novelty of this approach and the patchiness of the data we continue to recommend a harvest rate of 10% of the forecast biomass for these two stocks 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 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 HCAM analysis for this stock is consistent and fits the spawn deposition data closely suggesting a spawning biomass ranging between 1-5,000 tonnes (Figure 20). The lowest level occurred in 2001 and the stock has been increasing slowly since then. The forecast biomass for 2008 based on the HCAM model and assuming an average recruitment is 2743 tonnes (Table 2).

Area 2W

The availability of relatively consistent age structure and spawn deposition estimates for this stock began in 1972/73. Unfortunately, there was also a period from 1995-1997 when no biological samples were collected. 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 20). 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 HCAM model and assuming an average recruitment is 2444 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*		
	2007 SB	2008 – 4+	Poor	Avg	Good	Poor	Avg	Good
Area 27	1745	2164	2606	2743	3593	261	274	359
Area 2W	1661	2186	2252	2444	4198	225	244	420

*Assumes a 10% harvest rate.

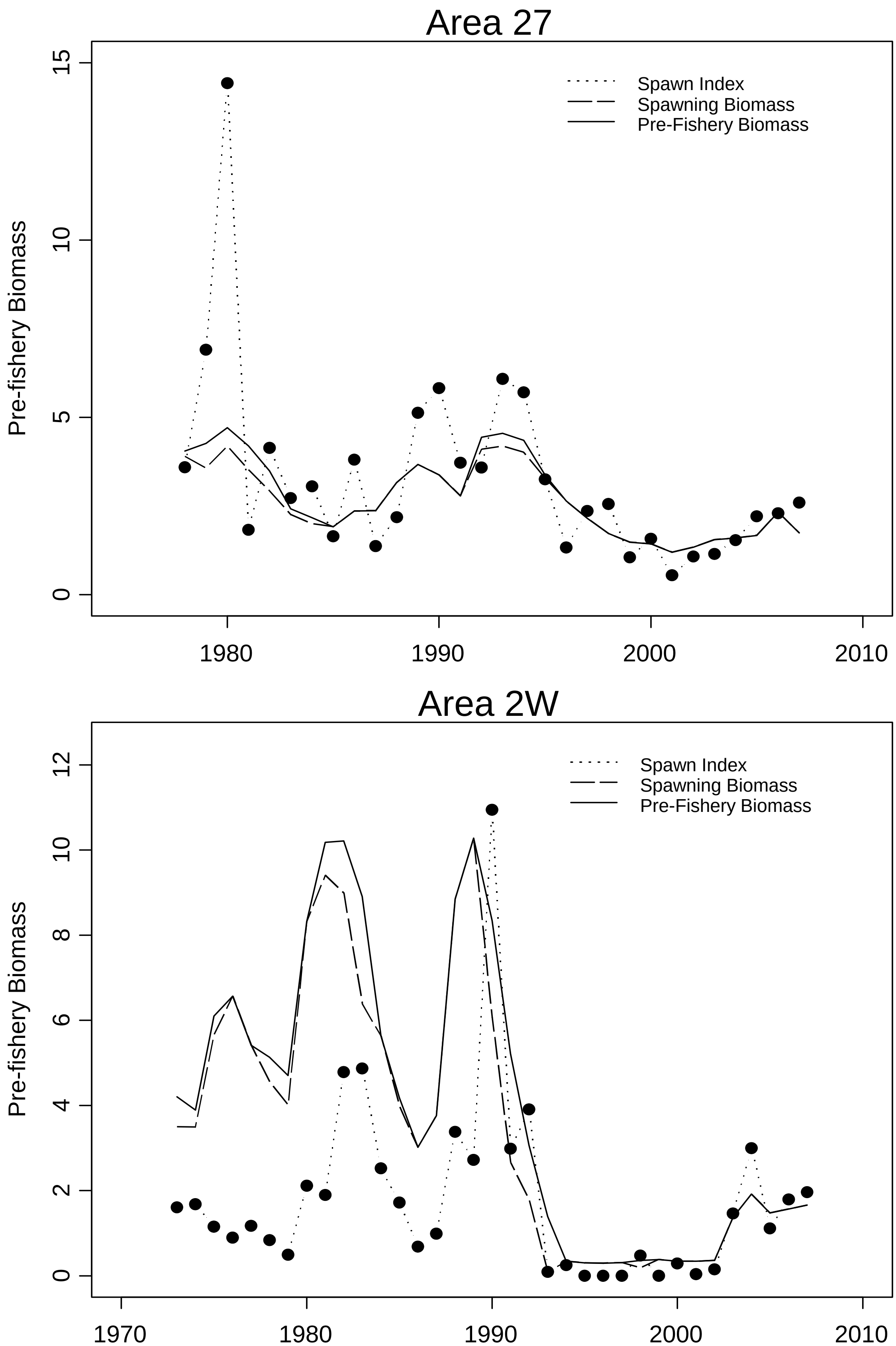


Figure 20. Estimated pre-fishery biomass for the minor stocks in Area 27 and Area 2W.

Table 3. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 27 for 1951-2007.

	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

Table 4. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 2W for 1951 to 2007.

	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	1468.69			1,468.69					1,468.69

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 (Schweigert and Ware 1995). 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 level is used to ensure that adequate spawning biomass to sustain each population during natural reductions in abundant stock productivity, is maintained for each stock. 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:

$$\text{Catch} = \text{Forecast Run} - \text{Cutoff}.$$

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 through a stock-recruitment curve or bootstrapping of the observed 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[c]**
Queen Charlotte Islands	11700	10700	10700	**10700**
Prince Rupert District[b]	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.
[b] - Because of the poor performance of the age-structured model in this region in the past the Cutoff has not been recalculated using the bootstrap approach but is based on a stock-recruitment relationship.
[c] – A Cutoff of 14,000 tonnes was proposed for the Central Coast in 1998. Uncertainty about ASM performance in 1998 resulted in retention of the existing Cutoff.

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 and most other 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 DO 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 has been possible until now. The harvest rule for minor stocks is 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 (Fig. 21). Trends in size at age continue 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 2007 assessment data. Howard Stiff provided programming support for the Access databases used to summarize the assessment data series. Database upgrades and ongoing maintenance have been funded by the Herring Conservation and Research Society (HCRS). The Fishery Managers throughout the coast along with CCG captains and crew of the Vector, Kitimat II, and Arrow Post and Bryce Gillard (C&P) aboard the Manyberries were instrumental in facilitating the diver survey program supported by DFO funding. The HCRS through a modified test fishing program provided biological sampling support in Georgia Strait, the Central Coast and Prince Rupert area. John Legate and Ross Holkestad were contracted by DFO to conduct stock assessment surveys of the Queen Charlotte Islands and west coast of Vancouver Island, respectively. Don Houston and North Delta Seafoods were contracted to support the dive spawn survey in Georgia Strait.

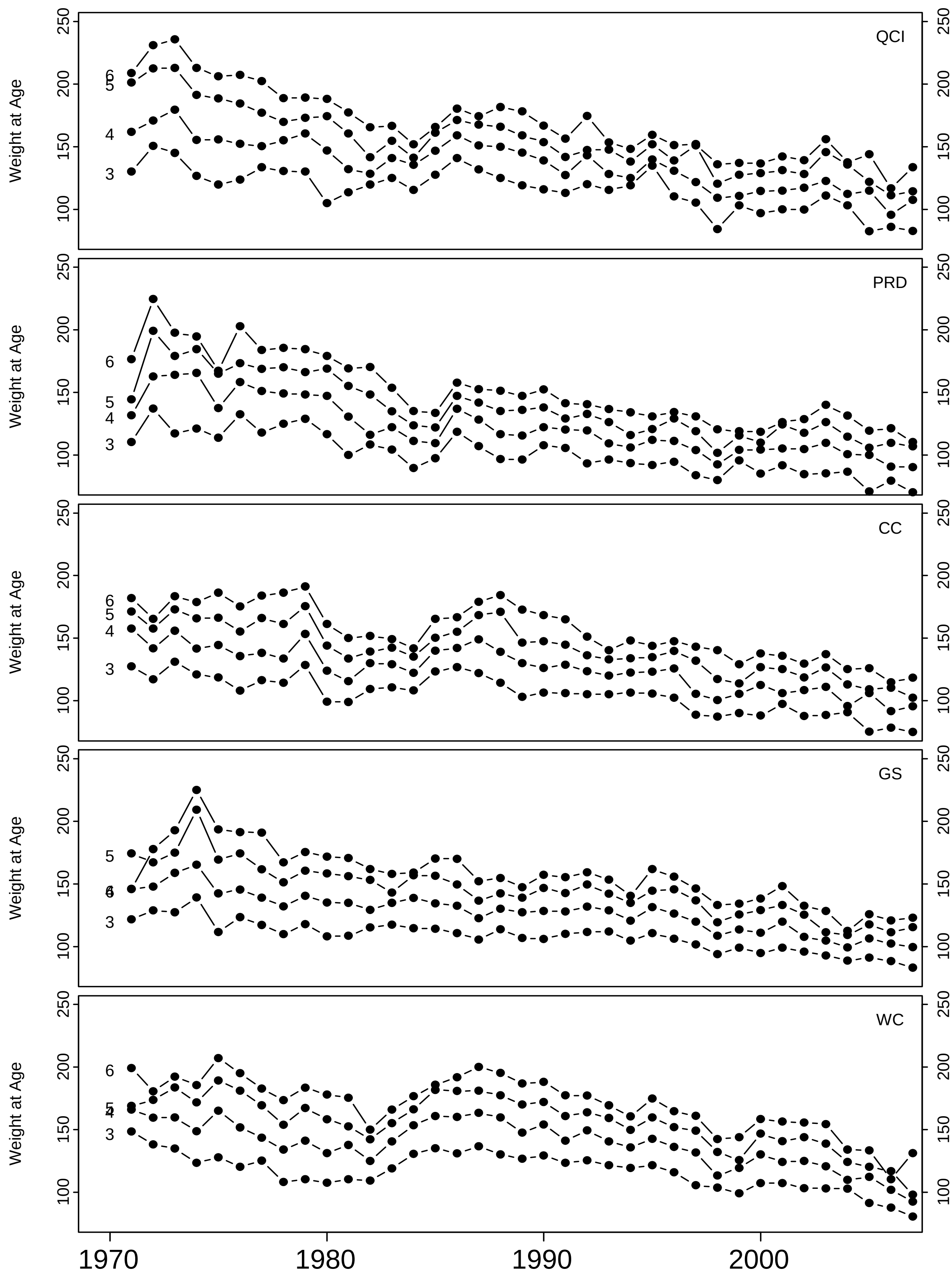


Figure 21. Estimates of weight-at-age (g) for 3-6 year old herring from 1951-2007 for the five major assessment regions.

REFERENCES

Fournier, D. A., Sibert, J. R., Majkowski, J., and Hampton, J. 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, C.C. 2004. An evaluation of alternative age-structured models for risk assessment of Pacific herring stocks in British Columbia. DFO. Can. Sci. Advis. Sec. 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. Secr. Res. Doc. 2006/064: 59p.

Hall, D. L., R. Hilborn, M. Stocker, 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. Secr. Res. Doc. 2007/002: 71p.

Schweigert, J. 2005. An assessment framework for Pacific herring (*Clupea pallasi*) in British Columbia. PSARC Res. Doc. P2005/083: 35p.

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

Schweigert, J., and D. Ware. 1995. Review of the biological basis for B.C. herring stock harvest rates and conservation levels. PSARC Working Paper H95: 2.

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 Maunder, M.N. 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.

			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	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 ~

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												CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number 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

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.

			PERCENT AT AGE												CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	(tonnes)	(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

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.

Season	Gear	Fishery	PERCENT AT AGE 0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number Aged	CATCH (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.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
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

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.

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	0.10	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.

			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	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 ~

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.

			P E R C E N T A T A G E										Mean	Number	C A T C H	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(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 ~

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												CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Mean Weight	Number 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	0.18	59.43	10.23	5.57	3.05	19.03	1.80	0.54	0.18	104.5	557	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	4243	2293	1834	334	167	47	7	1	0	3203	4213	1.11
1951/52	13070	2045	1058	784	130	58	14	2	0	5039	2578	-1.25
1952/53	34466	6623	834	340	211	31	12	3	0	8774	7555	0.05
1953/54	5561	19985	3840	483	197	122	18	7	2	10151	12408	0.92
1954/55	4697	3288	11711	2212	272	107	64	9	5	9251	6437	-0.48
1955/56	2288	2627	1835	6503	1217	147	55	33	7	8804	6042	-0.52
1956/57	3195	1129	713	294	729	106	11	4	3	1480	1592	0.60
1957/58	7687	1257	109	43	14	32	4	0	0	6661	815	-4.83
1958/59	2732	2857	306	26	10	3	8	1	0	4779	8981	2.00
1959/60	9835	1474	1126	99	8	3	1	2	0	7768	6599	0.02
1960/61	11543	5139	770	588	52	4	1	0	1	7986	8981	0.72
1961/62	20220	5752	2536	375	283	25	2	1	1	8033	5730	-0.42
1962/63	5348	9588	2575	1033	137	93	7	1	0	9332	7297	-0.19
1963/64	15702	2377	3875	898	308	35	20	2	0	3550	4104	0.79
1964/65	3442	6134	666	714	114	28	2	1	0	1554	1378	0.12
1965/66	5343	940	585	33	25	3	1	0	0	2853	2824	0.40
1966/67	4177	1227	174	101	6	4	1	0	0	912	710	-0.21
1967/68	5460	872	252	35	20	1	1	0	0	1686	833	-1.34
1968/69	4741	1387	220	63	9	5	0	0	0	2457	2075	0.00
1969/70	6974	1757	514	81	23	3	2	0	0	6587	5552	-0.01
1970/71	7029	3197	805	236	37	11	1	1	0	13516	13291	0.38
1971/72	14457	3618	1642	413	121	19	5	1	0	7531	9542	1.01
1972/73	11908	7881	1893	801	185	49	7	2	0	6586	7960	0.90
1973/74	10225	6633	4195	923	343	66	13	2	1	22921	14510	-0.72
1974/75	5147	5902	3697	2217	461	163	30	6	1	26311	9686	-2.08
1975/76	6297	3122	3471	2068	1172	231	77	14	3	16588	16374	0.39
1976/77	10698	3930	1887	1961	1042	498	76	25	6	19186	16408	0.03
1977/78	5652	6333	2244	1002	940	436	176	27	11	8411	18371	2.38
1978/79	128453	3016	3291	1092	429	323	90	36	8	9476	13649	1.34
1979/80	10970	59882	1368	1398	406	133	74	20	10	33674	31904	0.29
1980/81	3867	4462	24195	545	520	140	43	24	10	41223	20294	-1.35
1981/82	2798	1569	1790	9476	203	176	44	13	10	38160	23593	-0.78
1982/83	21022	1311	729	816	4217	87	72	18	9	24422	21391	0.09
1983/84	12795	11188	689	374	403	1969	38	31	12	26917	23439	0.08
1984/85	3994	7027	6041	362	189	196	922	18	20	17850	18625	0.53
1985/86	5388	2083	3618	3017	171	82	75	346	14	11407	6847	-0.85
1986/87	33191	2562	984	1679	1353	72	30	27	130	10137	12289	0.90
1987/88	13869	15921	1222	463	773	599	29	12	63	23298	15245	-1.21
1988/89	6615	6702	7693	590	224	373	289	14	36	41200	25201	-1.40
1989/90	4671	3412	3433	3907	298	112	186	144	25	20506	27058	0.79
1990/91	42075	2486	1783	1730	1851	130	44	72	65	13540	17998	0.81
1991/92	4899	21104	1231	859	796	790	49	16	50	13764	12376	-0.30
1992/93	5783	2144	9176	528	361	322	296	18	25	10973	8152	-0.85
1993/94	16017	2308	848	3558	199	129	105	96	14	7657	14293	1.78
1994/95	24002	6237	898	329	1373	76	49	39	42	5263	4701	-0.32
1995/96	22256	8349	2170	312	114	478	26	17	28	7202	7377	0.07
1996/97	41884	8122	3047	792	114	42	174	10	16	11266	11215	-0.01
1997/98	2489	16516	3203	1202	312	45	16	69	10	19945	21649	0.23
1998/99	8014	922	6042	1153	427	110	16	6	28	10899	10610	-0.08
1999/00	8400	2707	303	1898	343	115	27	4	7	6987	6698	-0.12
2000/01	6024	2663	827	88	528	92	30	7	3	13032	15195	0.44
2001/02	27787	1810	800	249	27	159	28	9	3	3358	3257	-0.09
2002/03	9357	8612	545	231	69	7	41	7	3	8753	8801	0.02
2003/04	7231	3051	2808	178	75	23	2	14	3	5697	5668	-0.02
2004/05	9217	2461	1038	956	60	26	8	1	6	3656	3614	-0.03
2005/06	8735	3268	873	368	339	21	9	3	2	4122	4097	-0.02
2006/07	7477	3207	1200	320	135	124	8	3	2	9204	9436	0.07

Estimated average availability at age (Si):

0.03 0.23 0.42 0.60 0.78 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.01 0.05 0.24 0.55 0.76 0.88 0.95 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.84

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	10123	10150	11252	1606	583	257	25	6	0	31990	27149	0.96
1951/52	12614	5412	4595	4084	474	156	69	7	2	16283	24047	2.34
1952/53	21690	6639	2359	1461	866	77	25	11	1	32573	28468	1.03
1953/54	5216	11170	3381	1186	727	429	38	13	6	12392	13535	1.59
1954/55	12197	2670	5149	1266	318	148	87	8	4	18783	14482	0.72
1955/56	3811	6488	1276	2105	441	102	47	28	4	45007	14533	-1.46
1956/57	6345	2033	3140	612	1006	210	49	23	15	20754	27518	2.08
1957/58	10298	3580	743	995	184	297	62	14	11	41215	9882	-2.20
1958/59	2993	6181	2054	425	569	105	170	36	15	38974	40961	1.49
1959/60	15853	1969	3660	1159	235	312	58	93	28	57593	16545	-1.75
1960/61	8183	10024	1103	2036	643	130	173	32	67	52045	12059	-2.29
1961/62	4614	5678	4887	497	893	280	57	75	43	57499	26329	-0.58
1962/63	12611	3427	3473	2744	269	479	150	30	64	68798	16981	-2.13
1963/64	2698	7733	1742	1747	1377	135	240	75	47	58553	26919	-0.57
1964/65	1790	1798	4061	887	882	693	68	121	62	33147	6055	-2.88
1965/66	3607	1009	624	1311	280	276	217	21	57	4881	7105	2.31
1966/67	4967	1921	469	222	298	43	42	33	12	11581	3386	-1.71
1967/68	3324	1655	542	131	62	83	12	12	13	10021	5197	-0.27
1968/69	8342	1251	582	189	46	22	29	4	8	1815	965	-0.21
1969/70	5344	3676	552	256	84	20	10	13	6	19039	8814	-0.56
1970/71	2643	2637	1758	262	122	40	10	5	9	17885	8480	-0.50
1971/72	10806	1442	1327	860	127	59	19	5	6	6464	8774	2.13
1972/73	11426	6346	824	710	391	45	21	7	4	12130	10959	1.12
1973/74	7397	6688	3679	468	386	203	24	11	6	19137	9244	-0.45
1974/75	3837	4296	3843	2038	233	178	93	11	8	19633	10949	-0.09
1975/76	6194	2218	2471	2185	1128	125	95	50	10	21644	15587	0.55
1976/77	3281	3518	1253	1375	1160	541	60	46	29	19770	11589	0.03
1977/78	3026	1777	1875	639	622	451	209	23	29	16578	6164	-1.10
1978/79	22687	1580	897	866	250	215	154	71	18	10763	9195	0.98
1979/80	6809	12323	844	455	391	99	84	61	35	25321	11937	-0.51
1980/81	5921	3713	6586	432	215	177	45	38	43	23130	14087	0.13
1981/82	6345	3387	2097	3628	226	107	88	22	40	32176	17186	-0.20
1982/83	12307	3785	2006	1226	2088	129	61	50	35	43634	25247	0.00
1983/84	3033	7667	2358	1249	764	1300	80	38	53	44132	27041	0.15
1984/85	2662	1902	4753	1440	738	433	714	42	47	58839	41028	0.47
1985/86	8317	1652	1142	2800	823	399	221	341	41	47054	26638	-0.05
1986/87	6008	5310	1015	663	1523	434	208	114	196	39038	39905	1.42
1987/88	3839	3861	3352	618	372	805	224	106	156	31861	35444	0.31
1988/89	2233	2389	2334	1940	325	169	336	93	105	30247	16379	-1.75
1989/90	9024	1350	1384	1287	956	130	62	113	66	25190	22679	-0.30
1990/91	8314	5650	825	810	704	485	64	30	85	27836	25811	-0.22
1991/92	3658	5308	3557	502	463	383	251	32	56	38190	40145	0.14
1992/93	2239	2310	3303	2163	267	216	168	104	34	27424	25071	-0.26
1993/94	5246	1370	1389	1905	1134	110	76	55	40	17882	16589	-0.21
1994/95	15204	3181	821	808	1022	533	42	28	32	18341	18516	0.03
1995/96	7264	9439	1967	503	475	569	284	21	30	21415	24854	0.43
1996/97	9845	4533	5890	1218	295	237	271	127	22	43070	25037	-1.55
1997/98	3256	6040	2778	3566	667	124	71	63	25	32838	19420	-1.50
1998/99	7662	1896	3516	1609	2003	350	48	20	13	32842	29745	-0.28
1999/00	11106	3928	970	1775	792	932	160	19	13	23757	19694	-0.54
2000/01	6427	5631	1961	473	797	333	350	48	9	23254	36684	1.30
2001/02	20295	3398	2942	1003	232	347	143	139	23	19470	22449	0.41
2002/03	2801	11000	1800	1505	469	93	117	44	40	30703	34007	0.29
2003/04	9437	1492	5773	925	702	180	30	35	23	25648	30493	0.49
2004/05	4442	5027	780	2926	439	284	53	7	11	20528	27956	0.88
2005/06	5030	2231	2477	375	1286	179	92	10	3	16080	10251	-1.29
2006/07	6156	2364	1032	1120	164	487	56	23	3	17154	15562	-0.28

Estimated average availability at age (Si): 0.08 0.42 0.65 0.86 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.01 0.15 0.37 0.57 0.73 0.88 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.58

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	16210	13382	11192	1716	634	146	8	0	0	31949	15390	0.61
1951/52	21418	7014	5057	3630	484	164	35	2	0	18318	10295	1.00
1952/53	73579	9263	2645	1603	961	113	33	7	0	24277	18237	1.72
1953/54	6606	32627	4094	1164	702	419	49	14	3	47886	13967	-0.64
1954/55	5555	2702	11949	1393	379	224	132	15	6	57734	13564	-1.18
1955/56	11020	2316	1044	4547	527	143	84	50	8	16907	6626	0.10
1956/57	15822	4685	558	207	830	93	25	15	10	7137	4607	1.34
1957/58	18451	7423	1365	120	37	137	14	4	4	24565	3549	-2.40
1958/59	4817	9349	3250	571	49	15	55	6	3	10333	3904	0.00
1959/60	8567	2663	3946	1039	144	11	3	10	2	45285	12615	-0.76
1960/61	21117	4722	1434	2122	559	77	6	2	7	13905	4265	-0.52
1961/62	14042	11852	1836	428	534	129	17	1	2	22158	11948	0.89
1962/63	11768	7688	5776	801	171	204	47	6	1	9810	6485	1.40
1963/64	7405	5630	2660	1417	144	25	25	6	1	18960	6464	-0.25
1964/65	7559	2777	1346	575	295	30	5	5	1	6040	2097	-0.21
1965/66	14522	2910	796	300	107	50	5	1	1	6345	1863	-0.63
1966/67	7568	4096	318	76	27	9	4	0	0	10366	5434	0.82
1967/68	4560	2395	788	58	14	5	2	1	0	13659	5790	0.29
1968/69	12006	1655	837	274	20	5	2	1	0	5116	1837	-0.12
1969/70	8165	4621	637	322	105	8	2	1	0	37309	8230	-1.34
1970/71	7566	3617	2044	282	142	47	3	1	0	25673	4156	-2.12
1971/72	11924	4075	1850	1024	140	70	23	2	1	8009	3572	0.42
1972/73	10105	7293	2305	925	433	51	21	7	1	22593	12434	0.94
1973/74	14459	6294	4340	1274	468	206	23	9	3	15233	8852	1.08
1974/75	8285	8836	3785	2449	612	179	56	6	3	38000	8037	-1.45
1975/76	6866	4856	5093	2066	1187	269	73	22	4	31831	13849	0.36
1976/77	10404	3927	2697	2670	925	454	88	23	8	28693	14613	0.75
1977/78	8308	5551	2046	1319	1139	337	148	28	10	14102	7747	0.94
1978/79	65827	4067	2630	877	441	250	45	18	5	15908	5779	-0.10
1979/80	13068	32495	2007	1298	433	218	123	22	11	27593	13012	0.56
1980/81	10805	6715	16693	1029	657	214	104	59	16	71483	15919	-1.32
1981/82	4554	5809	3605	8867	529	315	96	45	32	64623	16333	-1.00
1982/83	4224	2594	3285	2002	4713	271	155	46	36	45943	18482	0.16
1983/84	13390	2452	1497	1869	1100	2486	137	77	41	38213	14185	-0.04
1984/85	7205	7642	1379	819	976	544	1168	62	52	38248	8850	-1.22
1985/86	11832	3945	4119	720	410	475	256	548	54	33417	20342	1.20
1986/87	58416	6357	2094	2136	363	202	229	123	289	25589	12827	0.71
1987/88	5471	30330	3265	1053	1035	170	91	103	185	35923	26916	-0.83
1988/89	3920	2679	14685	1547	480	453	71	38	121	41552	21561	-1.87
1989/90	9354	1953	1304	6879	661	187	157	25	55	29547	28980	-0.06
1990/91	36809	5050	1037	670	3299	288	72	60	30	22977	19183	-0.52
1991/92	5876	20809	2788	549	329	1493	115	28	35	41189	43274	0.14
1992/93	7891	3329	11454	1475	276	158	682	52	29	42579	32392	-0.78
1993/94	3351	4382	1786	5850	704	123	66	276	32	43019	29432	-1.08
1994/95	10175	1817	2243	860	2641	302	50	26	122	22200	22348	0.02
1995/96	34358	5545	945	1091	382	1084	113	18	54	18563	21646	0.44
1996/97	36491	18717	2956	487	535	179	480	50	32	24577	28255	0.40
1997/98	7992	19816	10004	1543	247	260	83	222	38	27867	31503	0.35
1998/99	14306	4167	10049	4857	705	105	96	30	92	31664	31813	0.01
1999/00	6766	7243	2068	4823	2199	299	38	30	37	32017	32652	0.06
2000/01	16462	3317	3462	954	2111	913	116	15	25	22820	25109	0.27
2001/02	36417	8039	1576	1578	413	866	351	44	15	21953	23147	0.15
2002/03	9960	18013	3898	744	720	183	369	148	25	21668	25679	0.49
2003/04	29835	4744	8487	1806	335	315	77	154	72	22709	29407	0.74
2004/05	8017	13407	2097	3665	759	138	126	31	90	21392	24158	0.35
2005/06	9389	3140	5116	773	1305	263	47	43	41	14491	12051	-0.53
2006/07	5106	3277	1053	1640	238	392	77	14	25	10817	9857	-0.27

Estimated average availability at age (Si): 0.06 0.34 0.54 0.73 0.86 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.02 0.17 0.43 0.67 0.83 0.93 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.38

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	22803	11072	4118	892	176	42	12	3	0	32779	66143	1.72
1951/52	26374	11811	4163	1254	250	48	12	3	1	46225	72376	1.08
1952/53	36105	13725	4508	1387	400	79	15	4	1	68486	111307	1.17
1953/54	26076	20480	7426	2380	726	209	41	8	3	47279	82141	1.34
1954/55	16850	14816	9554	2674	725	206	59	12	3	82334	69854	-0.45
1955/56	18646	8722	5755	3342	907	243	69	20	5	30945	25667	-0.51
1956/57	16296	9101	2755	1330	678	176	47	13	5	15527	24126	1.06
1957/58	28813	7474	2251	459	189	91	24	6	2	15796	16149	0.02
1958/59	19294	14700	3055	727	131	51	25	6	2	55829	47864	-0.43
1959/60	10814	10212	5511	1066	238	41	16	8	3	45959	55082	0.41
1960/61	27113	5598	3190	1556	293	65	11	4	3	33436	42864	0.58
1961/62	23954	14395	1849	942	446	83	18	3	2	28541	31078	0.17
1962/63	28116	13042	4616	448	207	95	18	4	1	28729	35135	0.46
1963/64	19595	14952	4034	1074	94	42	19	4	1	24013	33117	0.76
1964/65	12648	9270	4246	782	176	15	7	3	1	33450	37116	0.22
1965/66	20963	4095	1990	856	155	35	3	1	1	8129	7153	-0.36
1966/67	14576	6044	644	226	86	15	3	0	0	10333	9619	-0.22
1967/68	10185	3163	720	71	25	9	2	0	0	11117	9128	-0.53
1968/69	15830	2753	809	182	18	6	2	0	0	22222	14644	-1.08
1969/70	13124	5865	1016	299	67	7	2	1	0	36205	33970	-0.20
1970/71	11595	5986	2667	461	135	30	3	1	0	38533	38180	-0.06
1971/72	14006	5329	2707	1195	206	60	14	1	1	25478	25165	-0.07
1972/73	19924	6022	2066	952	400	68	20	4	1	19607	16191	-0.52
1973/74	21948	8643	2488	758	305	122	20	6	2	55635	40354	-0.84
1974/75	13945	10640	4145	1079	316	125	50	8	3	61666	70211	0.28
1975/76	28768	7351	5556	2019	422	112	44	17	4	47071	60642	0.59
1976/77	26344	16121	4037	2760	869	167	44	17	8	82751	78562	-0.17
1977/78	15393	15187	8906	2033	1219	355	67	18	10	73881	102115	0.77
1978/79	25427	8597	8078	4316	837	444	125	23	10	63955	64266	-0.03
1979/80	21080	13769	4535	3948	1864	334	175	49	13	99030	85991	-0.39
1980/81	21390	10977	7099	2298	1919	886	158	83	29	102561	55121	-1.59
1981/82	19000	10713	5326	3340	1008	811	371	66	47	85219	100987	0.38
1982/83	17138	8994	4873	2297	1362	386	307	140	42	48290	64575	0.69
1983/84	19966	6911	3392	1602	634	348	92	71	42	37646	26227	-0.94
1984/85	23643	7214	2350	1025	382	134	73	19	23	45141	25247	-1.49
1985/86	10928	9788	2848	848	317	106	36	19	11	66074	41575	-1.20
1986/87	27368	5137	4581	1332	397	148	49	17	14	52742	41737	-0.63
1987/88	8824	14585	2623	2163	519	124	39	12	8	68158	24976	-2.87
1988/89	20983	4552	7365	1217	875	190	43	13	6	76495	66052	-0.42
1989/90	12027	11465	2434	3739	537	352	73	16	7	84462	67152	-0.66
1990/91	31119	6346	6010	1220	1610	203	128	26	8	66798	45830	-1.08
1991/92	21536	16490	3302	2905	500	572	67	41	11	85311	82656	-0.09
1992/93	24617	11413	8476	1571	1175	179	198	23	18	123592	90198	-0.90
1993/94	11868	12836	5748	4003	662	454	66	72	15	84738	67144	-0.67
1994/95	21673	5794	6009	2470	1415	181	112	14	17	70030	64899	-0.22
1995/96	30024	10213	2615	2522	889	465	56	35	9	71769	71326	-0.02
1996/97	30885	14847	4735	1142	957	293	147	17	13	77005	58232	-0.80
1997/98	15204	15977	7164	2138	440	293	81	38	7	77085	74616	-0.09
1998/99	23821	7882	7936	3358	868	141	59	10	4	73226	85095	0.43
1999/00	25977	11786	3725	3532	1313	278	38	14	3	80094	72639	-0.28
2000/01	35263	13033	5601	1695	1418	383	66	7	3	79081	100248	0.68
2001/02	40615	19155	6706	2729	695	483	110	18	3	102420	117864	0.40
2002/03	28320	23181	10366	3412	1251	224	128	23	3	102371	141651	0.93
2003/04	28316	15503	12125	5082	1500	494	56	20	6	112588	113689	0.03
2004/05	19984	13822	7272	5484	2170	572	178	15	7	96676	95851	-0.02
2005/06	23181	9044	5924	3000	2027	663	142	38	6	73968	46752	-1.31
2006/07	22700	10743	3865	2446	1138	678	177	30	5	67022	35446	-1.82

Estimated average availability at age (Si): 0.09 0.70 0.89 0.97 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.02 0.21 0.50 0.73 0.85 0.94 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 1.02

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	25056	8124	8066	1092	250	53	4	4	0	52913	19597	-1.28
1951/52	31316	10027	2814	2692	359	82	17	1	1	10288	13310	1.85
1952/53	40184	12316	3425	801	637	71	13	3	0	41117	39571	1.11
1953/54	29103	13657	4185	1164	272	216	24	4	1	20678	20648	1.20
1954/55	37701	8832	3172	833	213	48	36	4	1	31840	15112	-0.66
1955/56	39157	12406	2735	964	251	64	14	11	1	36878	27183	0.44
1956/57	29604	15571	4299	898	309	80	20	4	4	52647	44114	0.76
1957/58	30616	12635	6537	1793	373	128	33	8	3	67568	18986	-1.97
1958/59	24260	12963	5332	2756	756	157	54	14	5	16009	12979	0.68
1959/60	16863	9861	3274	966	403	94	17	6	2	9207	6015	0.14
1960/61	48306	5853	1771	411	100	37	8	1	1	18066	10556	-0.14
1961/62	27276	18153	1502	404	90	21	8	2	0	33916	34470	1.24
1962/63	45132	10944	6129	466	120	26	6	2	1	14461	11245	0.57
1963/64	25822	17768	3880	1921	130	30	6	1	1	28575	22761	0.63
1964/65	25054	8969	5523	1101	513	33	8	1	0	17248	11891	0.27
1965/66	22804	7162	2336	1309	242	107	7	1	0	6656	3722	-0.25
1966/67	23950	5498	1583	462	232	39	15	1	0	8779	4813	-0.30
1967/68	20615	5660	1014	252	68	32	5	2	0	17220	11029	0.09
1968/69	33203	5406	1484	266	66	18	9	1	1	16681	10465	0.04
1969/70	43503	11001	1791	492	88	22	6	3	1	42546	26912	0.06
1970/71	23520	18111	4580	746	205	37	9	2	1	58469	36206	0.00
1971/72	26401	10778	8299	2099	342	94	17	4	2	35998	41857	1.58
1972/73	27134	12730	5071	3781	925	146	38	7	2	34760	19481	-0.25
1973/74	45151	13471	5986	2199	1498	336	47	12	3	77262	25540	-1.57
1974/75	21778	25313	7159	2996	1024	668	146	21	7	96608	49149	-0.49
1975/76	22235	13117	14580	3819	1430	462	287	63	12	65640	64222	1.15
1976/77	50326	13348	7549	7680	1635	510	134	83	21	55106	58679	1.36
1977/78	18158	28553	7347	3858	3468	630	161	42	33	62116	45607	0.43
1978/79	48558	9435	14621	3631	1649	1213	173	43	20	84171	66397	0.61
1979/80	31270	25485	4827	7201	1611	668	460	65	24	129996	62308	-0.64
1980/81	17437	15820	12826	2413	3530	771	317	218	42	137760	52063	-1.23
1981/82	10989	8026	7145	5716	1040	1493	322	132	108	80568	33047	-1.03
1982/83	15986	4444	3201	2805	2178	380	534	113	84	44258	16771	-1.23
1983/84	31196	6096	1609	1109	922	694	118	166	61	43865	23872	-0.32
1984/85	25957	12903	2357	600	403	332	248	42	81	85737	30010	-1.42
1985/86	11394	11643	5780	1056	269	181	149	111	55	74501	39514	-0.39
1986/87	66864	5421	5532	2745	501	128	86	71	79	40777	16858	-1.01
1987/88	16475	35334	2696	2529	1157	199	48	32	56	35196	46242	0.78
1988/89	24764	8599	18110	1335	1186	511	79	19	35	53462	47718	-0.33
1989/90	19052	11637	3947	7944	548	456	182	28	19	46410	46464	0.00
1990/91	60090	8163	4879	1596	3067	203	160	64	17	28589	30456	0.18
1991/92	36584	26735	3561	2049	633	1131	67	53	26	39948	42687	0.19
1992/93	29988	16368	11857	1556	876	265	459	27	32	34166	34728	0.05
1993/94	14970	12824	6898	4890	625	342	98	171	22	47190	25625	-1.75
1994/95	19144	5782	4842	2534	1745	218	116	33	65	19583	28057	1.03
1995/96	79435	7817	2346	1945	1004	679	81	43	37	29642	33986	0.39
1996/97	32248	35009	3430	1024	845	434	292	35	35	43674	46490	0.18
1997/98	20370	13769	14579	1387	403	325	163	110	26	34200	41556	0.56
1998/99	23454	7530	4970	5073	460	119	83	40	32	22119	20390	-0.23
1999/00	29116	7454	2338	1496	1445	124	28	19	16	13788	13267	-0.11
2000/01	36825	9393	2386	738	456	420	34	8	10	14154	13955	-0.04
2001/02	40222	13455	3432	872	270	167	154	12	6	21184	22086	0.12
2002/03	23752	16034	5344	1354	337	101	60	55	7	19339	29750	1.23
2003/04	31374	8825	5857	1901	455	101	26	15	15	13940	15844	0.37
2004/05	24072	9582	2601	1638	500	107	20	4	5	10942	9075	-0.54
2005/06	27284	6109	2288	582	321	83	12	2	1	2773	2705	-0.07
2006/07	27397	6760	1514	567	144	79	21	3	1	2144	2089	-0.08

Estimated average availability at age (Si): 0.02 0.36 0.57 0.72 0.84 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.02 0.23 0.56 0.78 0.90 0.96 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.62