

WCVI Worked Example

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S1. Document Summary

Lorem ... - Reference to comparison paper: https://publications.gc.ca/collections/collection__2023/mpo-dfo/fs70-5/Fs70-5-2023-010-eng.pdf

S2. Data Map

The following worked example is from the IWAM Package Repo hosted publicly through the Pacific Salmon Assess organization available at this link.

The package currently utilizes the following data sets:

- CUPars_nBC *
- CUPars_wBC *
- ParkenSMSY *
- ParkenSREP *
- SRinputs *
- Surv *
- WA_Parken *
- WatershedArea *
- WCVIEsc *
- *WCVIStocks (Public)*

(*) Currently private, but available upon request.

S3: IWAM Model (Produce initial SREP estimates)

- IWAM_model - produce the initial SREP estimates

Initial code summary ...

Source Files

Data Setup

Summary of data setup ...

Description of data list ...

```

data <- list()

scale_TMB <- srdat$scale # scale enters the TMB data as: scale
data$S <- srdat$Sp/scale_TMB # Spawners / scale
data$logRS <- log( (srdat$Rec/srdat$scale) / (srdat$Sp/srdat$scale) )
data$stk <- as.numeric(srdat$Stocknumber) # stock number
data$yr <- srdat$yr_num
N_Stocks <- length(unique(srdat$Name))
data$logMuA_stream_mean <- 1.5
data$logMuA_stream_sig <- 2
data$logMuA_ocean_mean <- 0 #1.5
data$logMuA_ocean_sig <- 2
data$HalfNormMean <- 0 #TMB_Inputs$Tau_sigma
data$HalfNormSig <- 1 #TMB_Inputs$Tau_sigma
data$HalfNormMeanA <- 0 #0.44 #TMB_Inputs$Tau_sigma
data$HalfNormSigA <- 1 #0.5 #TMB_Inputs$Tau_sigma
data$WA <- WA$WA
data$stream <- stream$lh
data$scale <- srdat_scale # Ordered by Stocknumber
data$SigRicPriorNorm <- as.numeric(F)
data$SigRicPriorGamma <- as.numeric(T)
data$SigRicPriorCauchy <- as.numeric(F)
data$biasCor <- as.numeric(TRUE)
data$SigDeltaPriorNorm <- as.numeric(F)
data$SigDeltaPriorGamma <- as.numeric(T)
data$SigDeltaPriorCauchy <- as.numeric(F)
data$Tau_dist <- 0.1
data$Tau_D_dist <- 1
data$SigDelta_mean <- 0.80 # See KFrnn.R, #For half-normal use N(0,1)
data$SigDelta_sig <- 0.28 # See KFrnn.R,
data$SigNu_mean <- 0.84 # See KFrnn.R,
data$SigNu_sig <- 0.275 # See KFrnn.R,
data$pred_lnWA <- seq(min(log(WA$WA)), max(log(WA$WA)), 0.1)

```

Description of params list ...

```

param <- list()

param$logA <- ( srdat %>%
  group_by (Stocknumber) %>%
  summarise(yi = lm(log( Rec / Sp) ~ Sp )$coef[1] ) )$yi

B <- srdat %>%
  group_by(Stocknumber) %>%
  summarise( m = - lm(log( Rec / Sp) ~ Sp )$coef[2] )

param$logB <- log ( 1/ ( (1/B$m)/data$scale ) )
param$logSigma <- rep(-2, N_Stocks)
param$logMuA_stream <- 1.5
param$logSigmaA <- -2
param$logMuA_ocean <- 0
param$logDelta1 <- 3
param$logDelta1_ocean <- 0
param$logDelta2 <- log(0.72)
param$Delta2_ocean <- 0
param$logDeltaSigma <- -0.412

```

```

param$logNu1 <- 3
param$logNu1_ocean <- 0
param$logNu2 <- log(0.72)
param$Nu2_ocean <- 0
param$logNuSigma <- -0.412

```

TMB Model Call and Run

Summary of IWAM model running/setup ...

What data is output ...

Add functionality to turn on and off.

Plotting IWAM Results

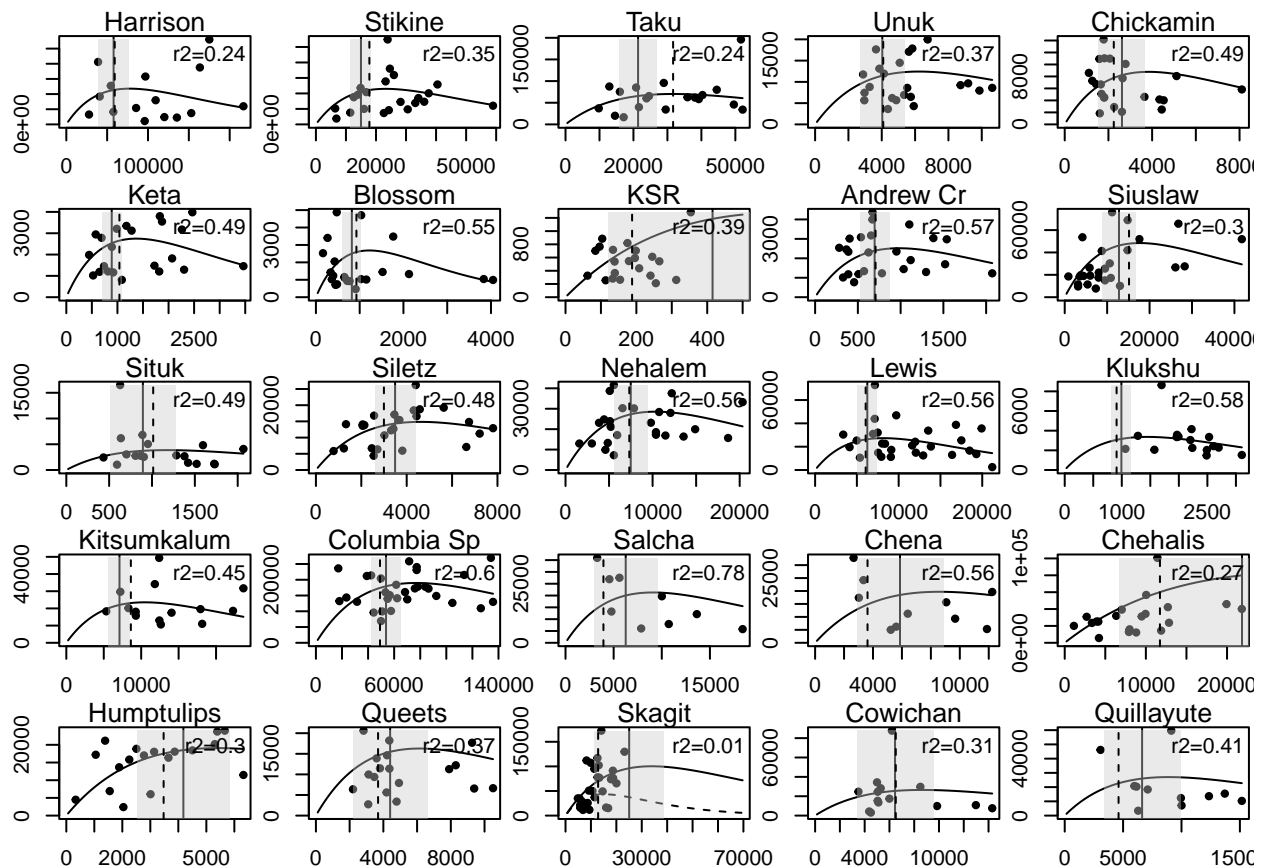


Figure 1. Stock-Recruitment Curves per WCVI Stock. INCLUDE UNITS.

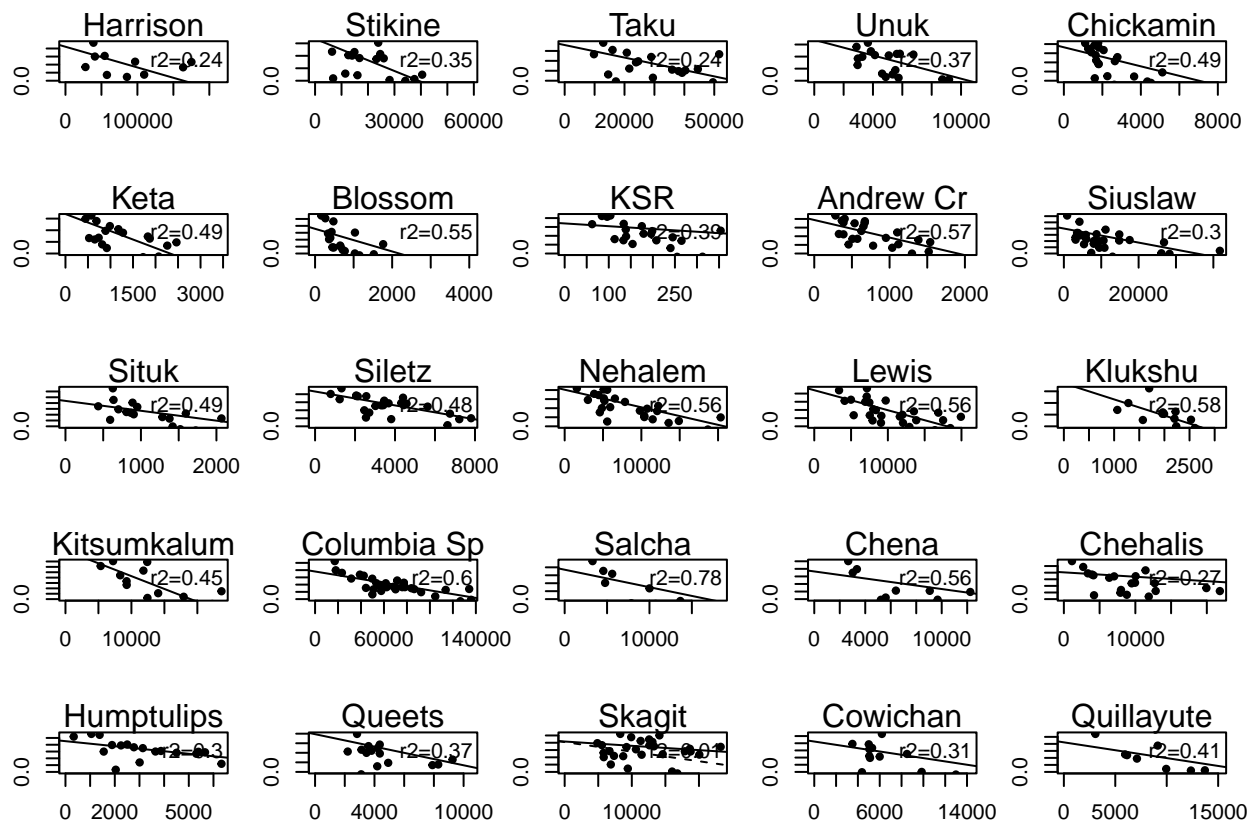


Figure 2. Stock-Recruitment Linear Relationship per WCVI Stock. INCLUDE UNITS.

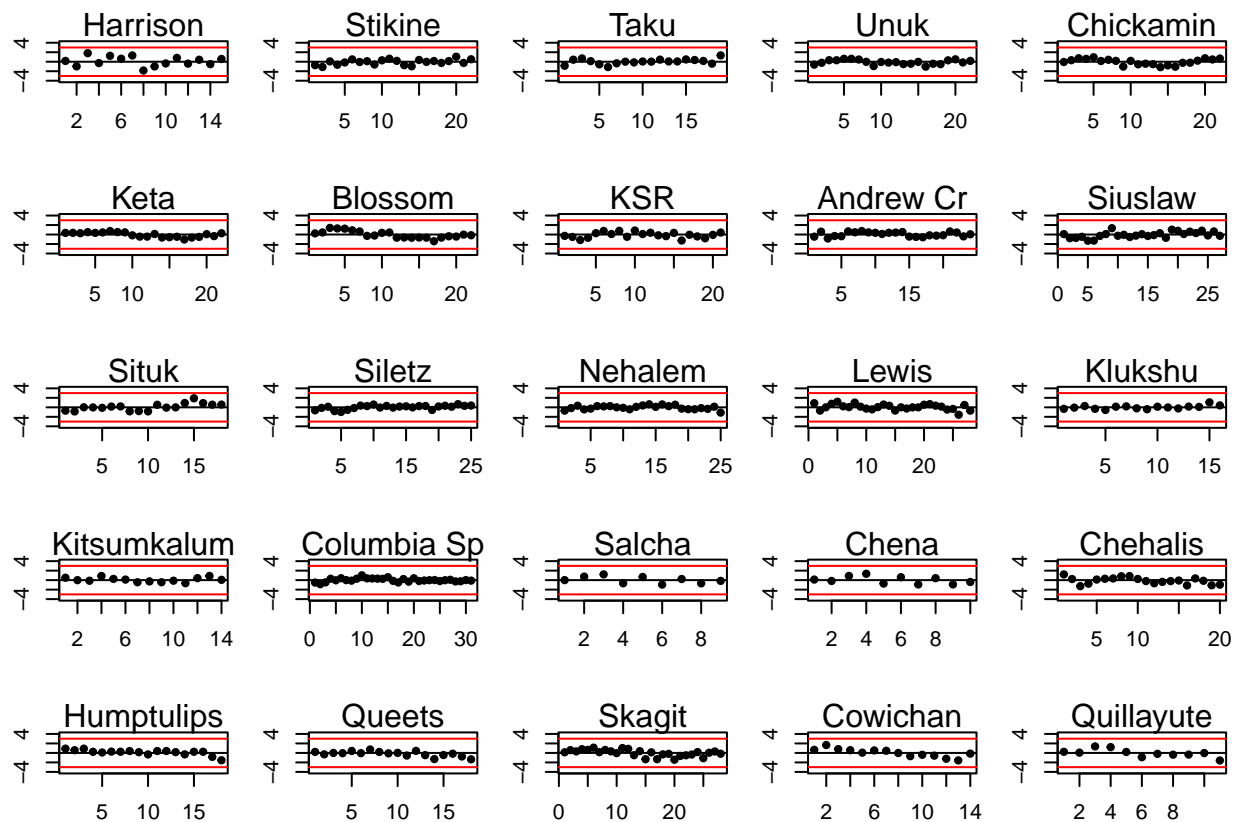


Figure 3. Standard Residuals. INCLUDE UNITS.

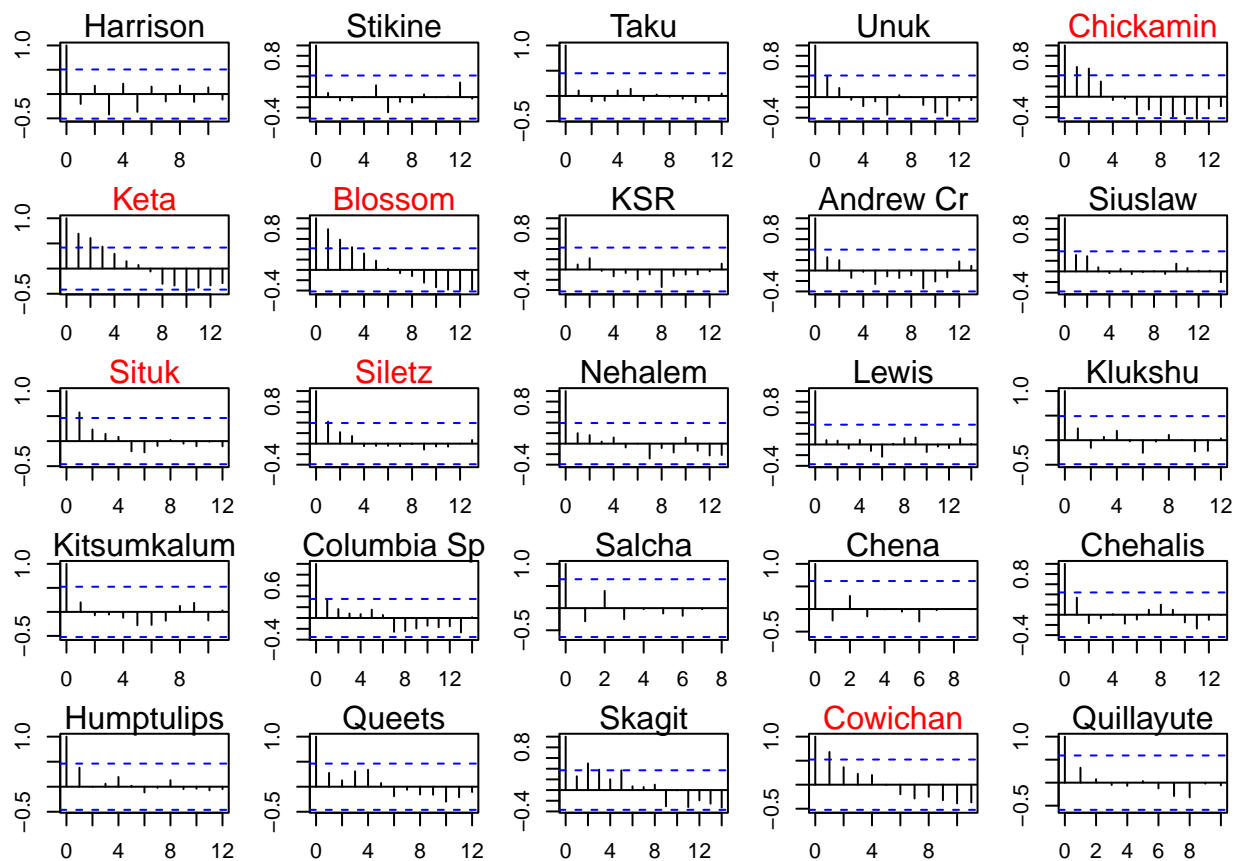


Figure 4. ACF. INCLUDE UNITS.

Prior Ricker sigma and prior WA regression sigma

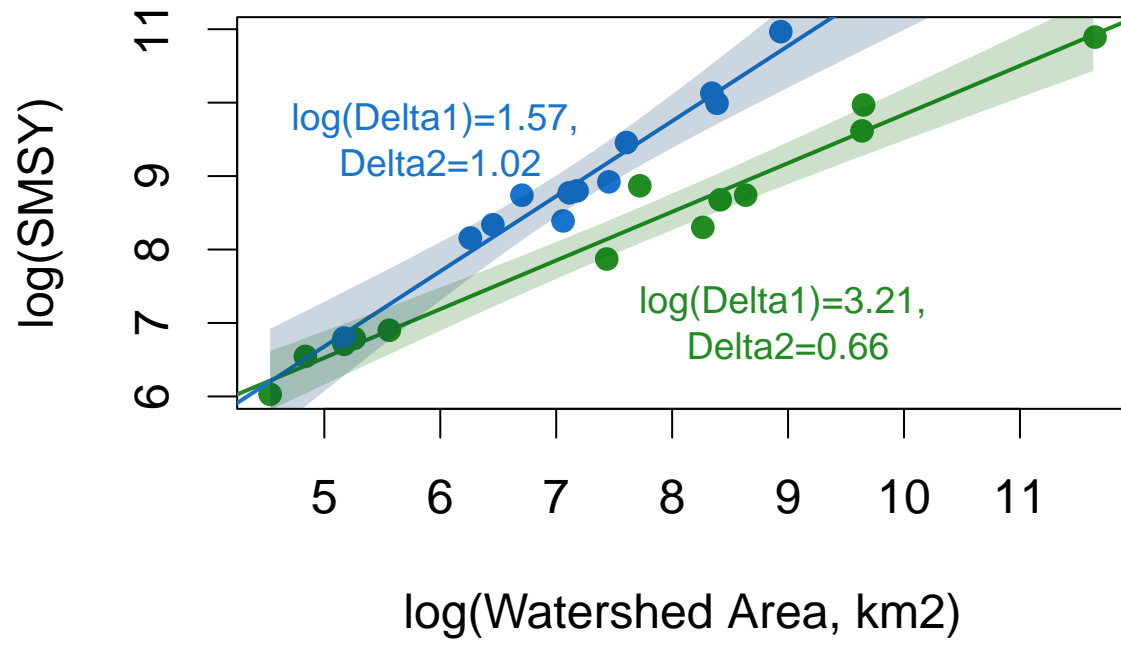


Figure 5. Prior Ricker sigmas and prior on WA regression for $\log(\text{SMSY})$ and $\log(\text{Watershed Area (km}^2\text{)})$.

Prior Ricker sigmas and prior on WA regression sigma

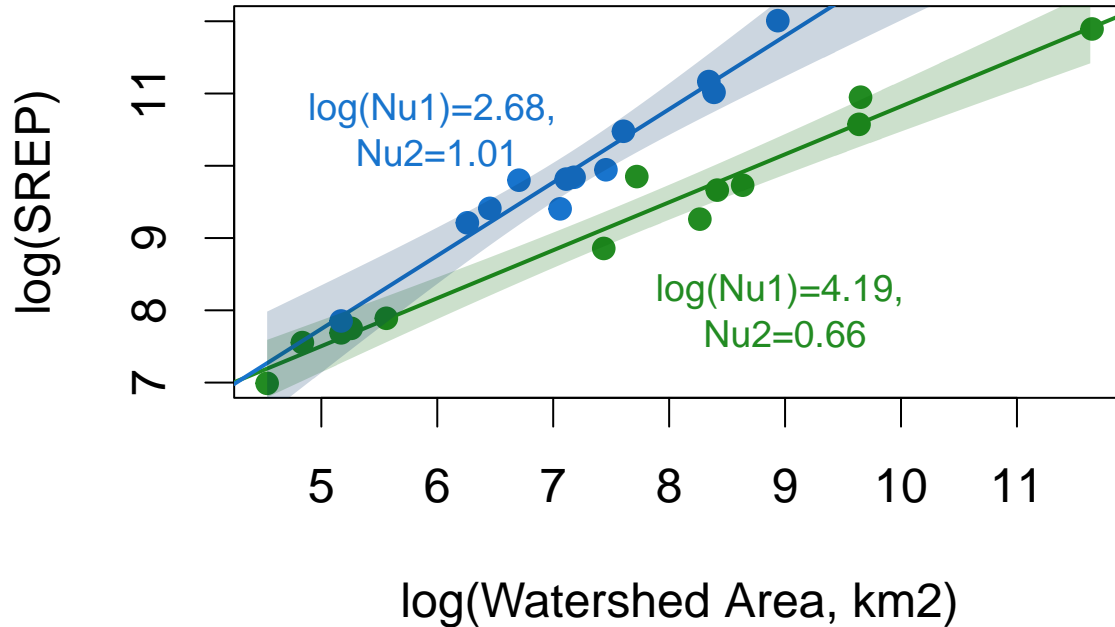


Figure 6. Prior Ricker sigmas and prior on WA regression for $\log(\text{SREP})$ and $\log(\text{Watershed Area (km}^2\text{)})$.

Fix the equation placement.

Output Data from IWAM Model

What data is put out ...

- predictions $\ln\text{msy}$ and $\ln\text{rep}$ (pi)

S3: Bootstrapping and final estimates of SREP, SGEN, and SMSY

The following section includes the code for bootstrapping and the re-calculation of the SREP, SGEN, and SMSY estimates for the West-Coast Vancouver Island Stocks (Table 1-3). The following stocks of; Barkley, Clayoquot, Kyuquot, Nootka/Esperanza, and Quatsino, are displayed for direct comparison, however all stocks are available and can be accessed in this example if further comparison is desired. The bootstrap was run in this case with 10 trails to reduce run time and for ease of sharing. To change the number of trails - please see the `{r}` `nBS` object. The final estimates include the median (50%) their 2.5% and 97.5% quantiles, rounded to two significant figures.

S4: SREP, SGEN, SMSY Estimates

Stock	SREP	Lower Quantile	Upper Quantile
Barkley	550	420	950
Clayoquot	8000	5000	15000
Kyuquot	5900	3200	8200
Nootka/Esperanza	1300	710	1800

Stock	SREP	Lower Quantile	Upper Quantile
Quatsino	2900	1600	3800

Table 1. *SREP estimates including 0.25% and 97.5% quantiles for Barkley, Clayoquot, Kyuquot, Nootka/Esperanza, Quatsino.*

Stock	SGEN	Lower Quantile	Upper Quantile
Barkley	73	43	320
Clayoquot	2600	640	7000
Kyuquot	1400	450	1800
Nootka/Esperanza	340	100	650
Quatsino	530	200	1000

Table 2. *SGEN estimates including 0.25% and 97.5% quantiles for Barkley, Clayoquot, Kyuquot, Nootka/Esperanza, Quatsino.*

Stock	SMSY	Lower Quantile	Upper Quantile
Barkley	230	180	440
Clayoquot	3500	2100	7500
Kyuquot	2600	1400	3600
Nootka/Esperanza	540	310	800
Quatsino	1200	670	1700

Table 3. *SMSY Estimates including 0.25% and 97.5% quantiles for Barkley, Clayoquot, Kyuquot, Nootka/Esperanza, Quatsino.*