Alaska Fisheries Science Center

A VAST model for the eastern GOA pollock assessment

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Historical context

- Historically Eastern GOA pollock been assessed at tier 5

- The assessment has been done using area-swept biomass for eastern GOA (east Yakutat and Southeast Alaska management areas)

- A random effects (RE) model is then fitted to biomass estimates.

- OFL = RE biomass * M

- Using the VAST model combines the two steps of historical assessments into single analysis that takes into account the spatial and temporal correlation of the stock.

- Temporal autocorrelation options available in VAST provide the smoothing that was previously done by the RE model.

- Evaluated options for modeling autocorrelation: a random walk (RW), and an AR1 process

VAST wrapper function

```
#load data set
library(VAST)
workdat = read.csv('pollCPUE.csv')
#Catch data are CPUE rather than raw catches
workdat$Effort=1
#Data for eastern gulf only
workdat = subset(workdat, Long > -140)
#workdat = subset(workdat, Long > -159)
#Exclude the 1984 and 1987 surveys
workdat = subset(workdat, Year > 1989)

### Defining strata limits
strata.limits <- data.frame(
  'STRATA' = "east_of_140W",
  'west_border' = -140,
  'east_border' = Inf)
#settings = make_settings(..., strata.limits=strata.limits)
#For random walk process
RhoConfig = c("Beta1"=2,"Beta2"=2, "Epsilon1"=0,"Epsilion2"=2)
ObsModel=c(2,1)
#For AR1 process
#ObsModel=c(2,0)
#RhoConfig = c("Beta1"=4,"Beta2"=4, "Epsilon1"=0,"Epsilion2"=4)
```

VAST wrapper function (2)

```
#Make settings
settings = make_settings( n_x=500, Region="gulf_of_alaska",
ObsModel=ObsModel,purpose="index",
RhoConfig=RhoConfig,strata.limits=strata.limits,bias.correct=TRUE, fine_scale=TRUE,
treat_nonencounter_as_zero = FALSE)


#Run model
dir.create('goawp8')
wd <- paste0(getwd(), '/goawp8/')
fit = fit_model( "settings"=settings, "Lat_i"=workdat[,'Lat'],
                 "Lon_i"=workdat[,'Long'], "t_i"=as.numeric(workdat[,'Year']),
                 "c_i"=rep(0,nrow(workdat)), "b_i"=workdat[,'WeightCPUE'],
                 "a_i"=workdat[,'Effort'],working_dir=wd)


#Plot results
plot( fit,working_dir=wd )
```
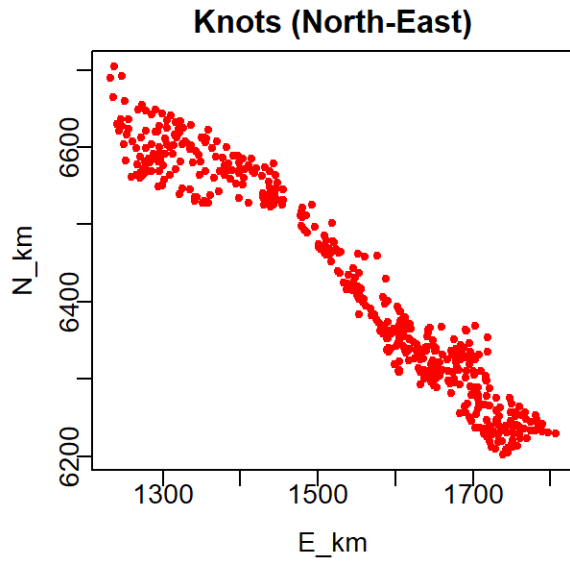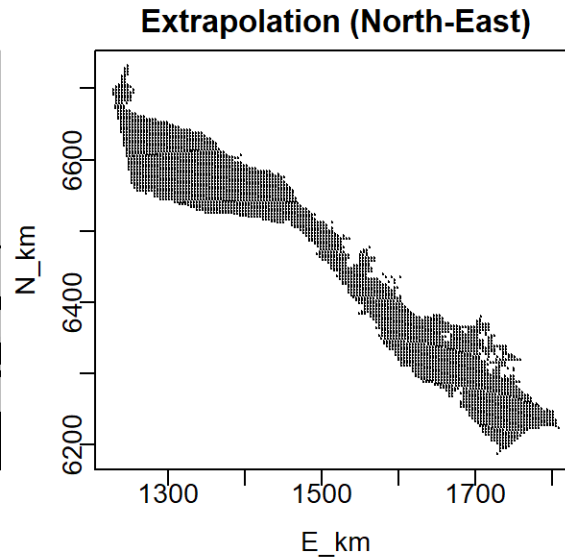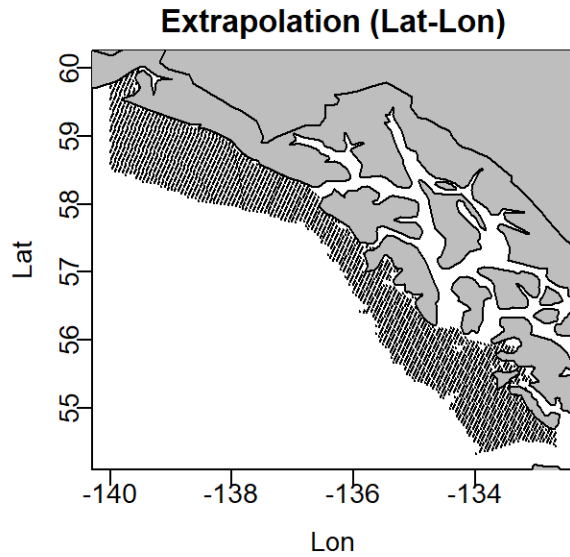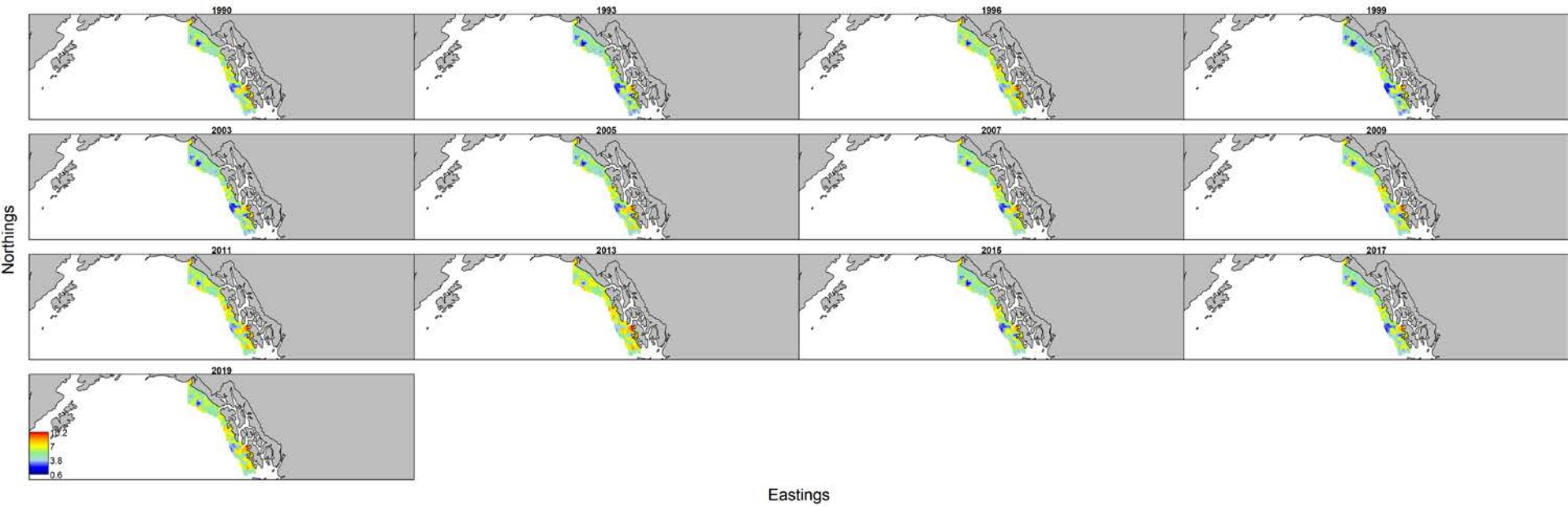
Estimation details

- Estimation of the full suite of autocorrelation parameters was not possible.

- Only a subset of the temporal parameters were estimated.

- Estimation problems arose only for modeling spatial-temporal variation in the encounter probability.

- For an AR1 process, the autogressive coefficient "epsilon_rho1_f" had a large gradient and went to the parameter bound.

- For a random walk process, the variance term for temporal autocorrelation "L_beta1_z" went to zero.

- Result suggest that the data do not support modeling assumptions about autocorrelation in spatial-temporal processes for the encounter probability.

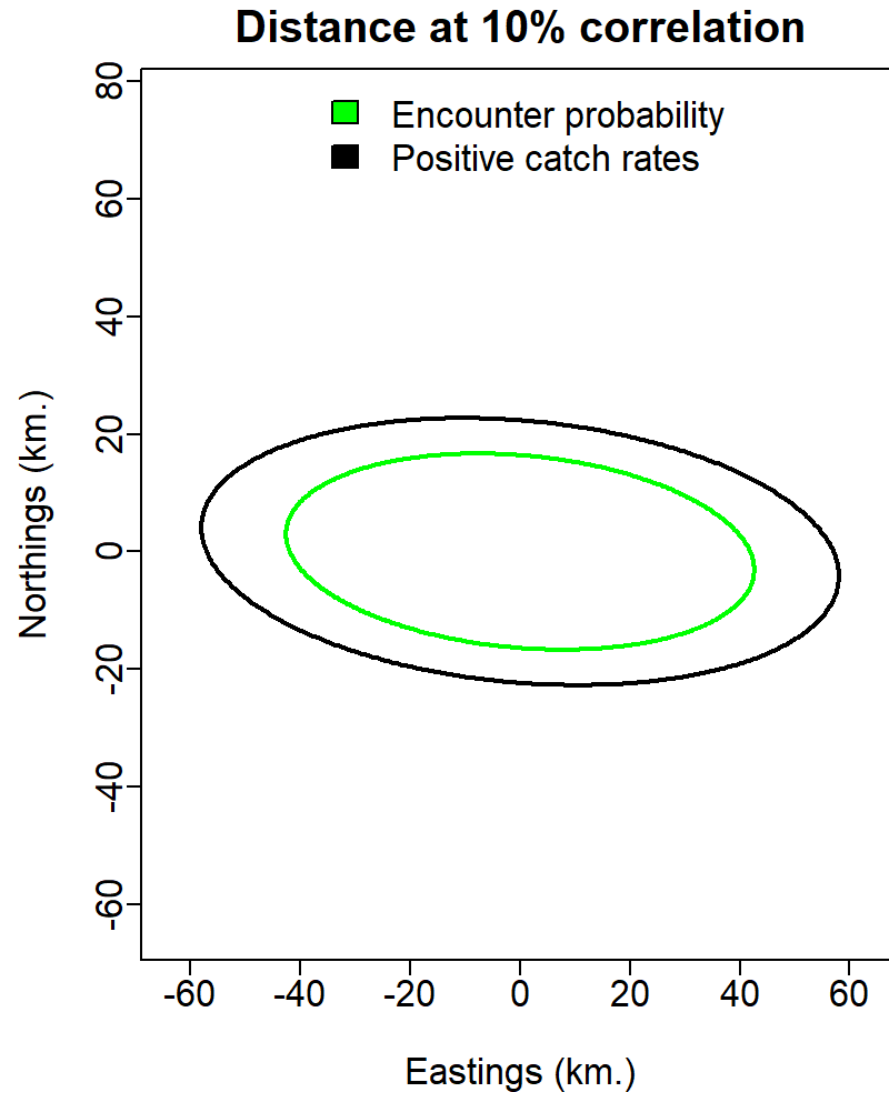- Therefore epsilon1 was set zero in RhoConfig
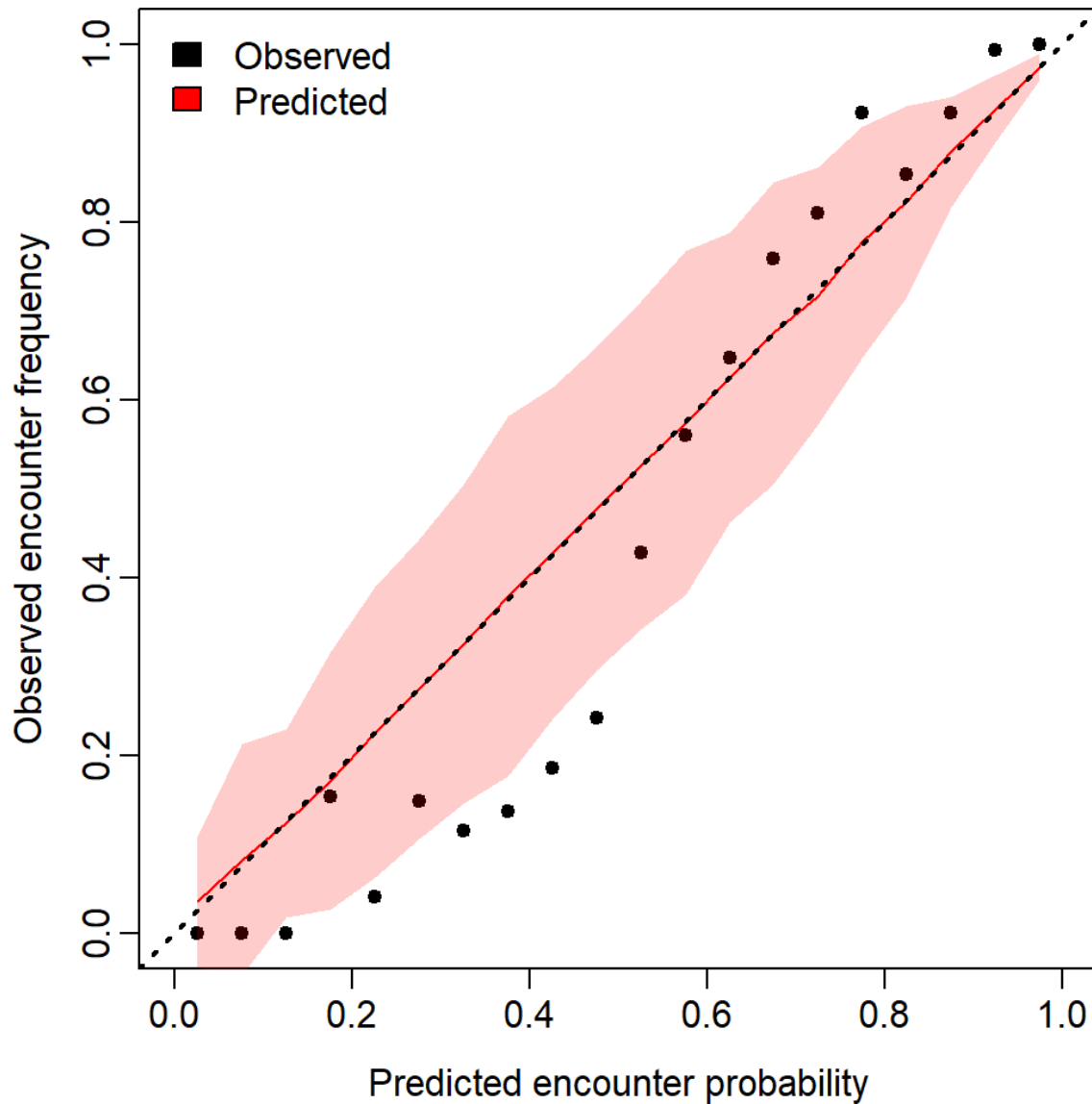
Estimation details
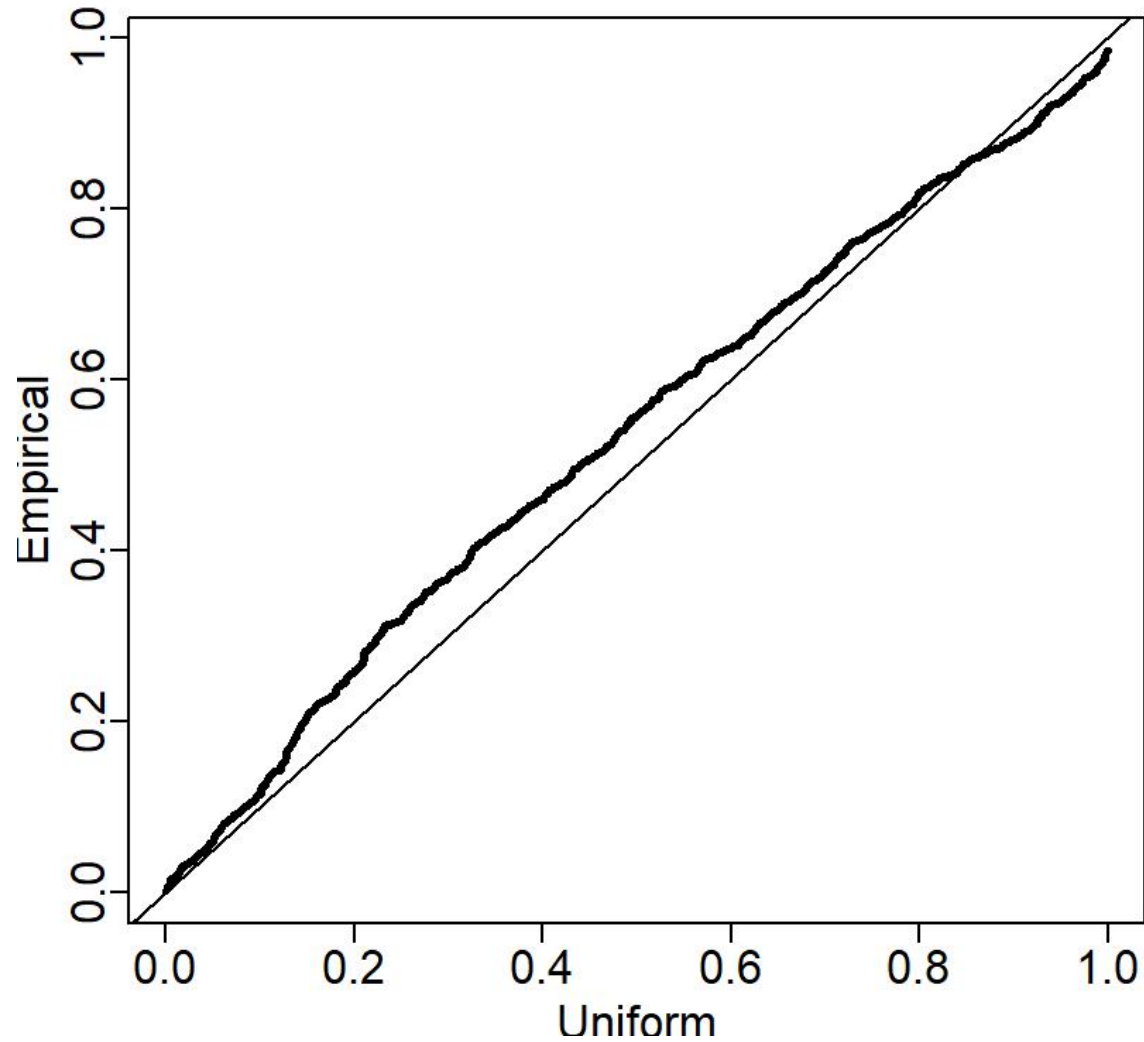
Estimation details

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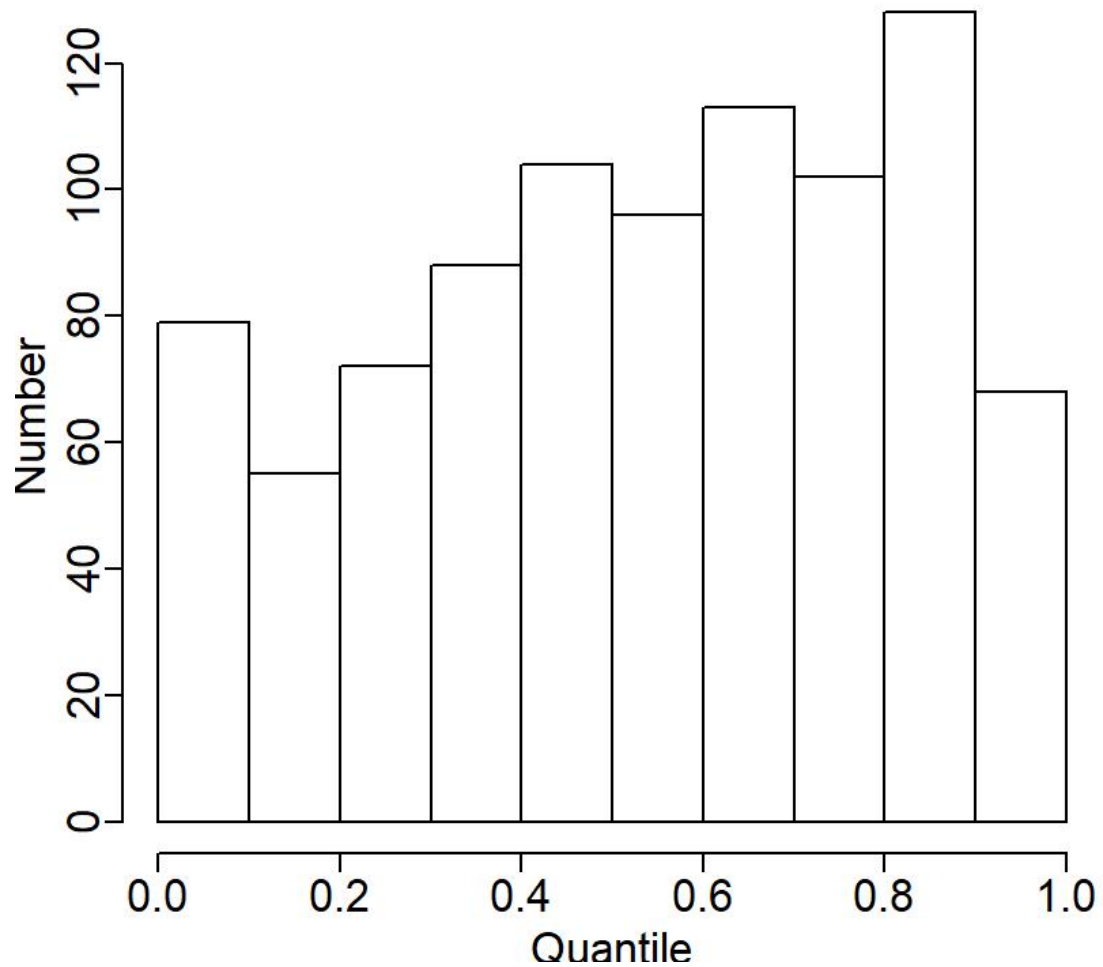

Distance at 10% correlation
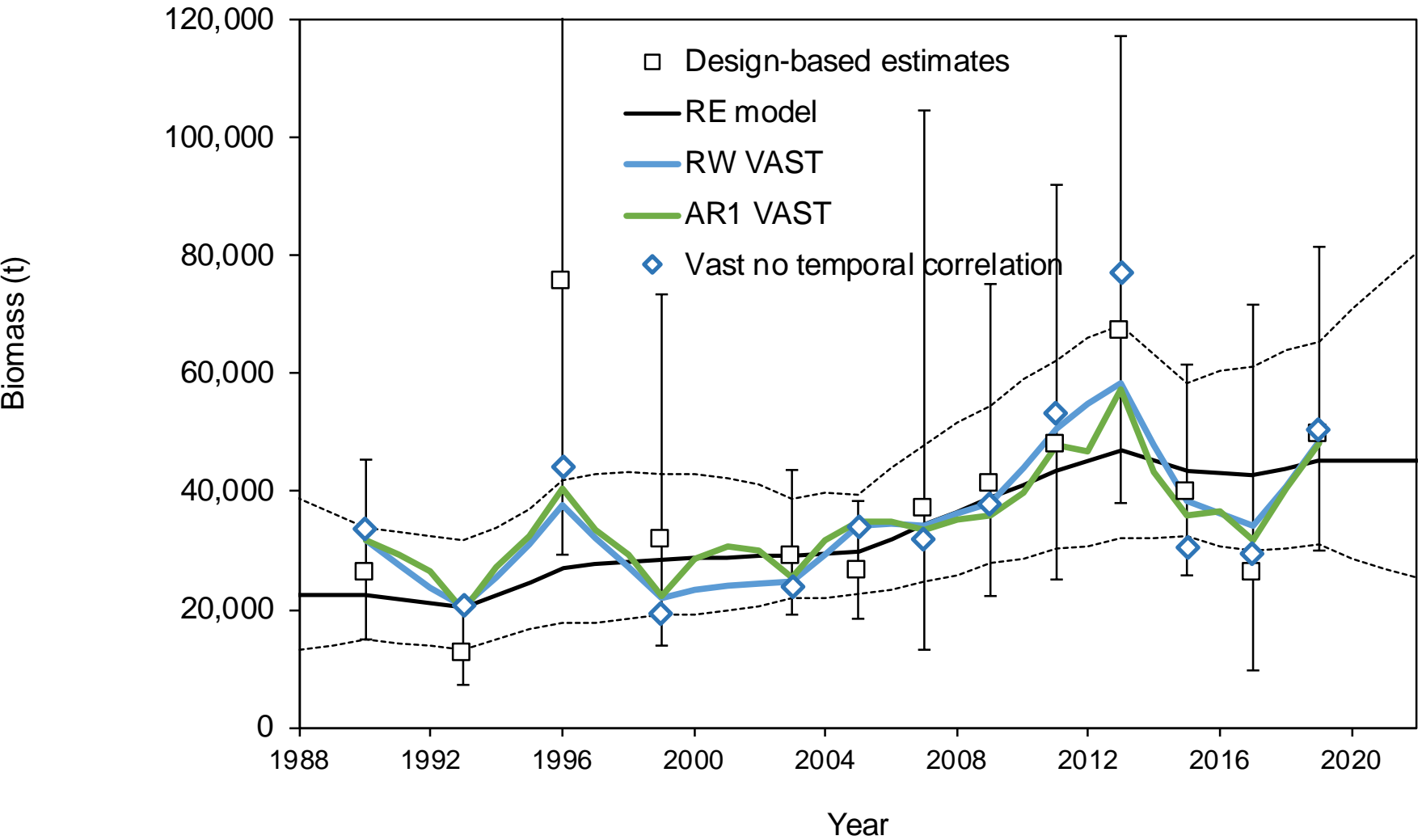
Diagnostics

Diagnostics

Q-Q plot

Diagnostics

Quantile_histogram

Comparison of biomass estimates

Conclusions

- On the whole, VAST models seemed to perform adequately

- The RW model showed a more plausible trend and would be the preferred configuration.

- Request plan team support for the use of VAST with RW for the Eastern GOA assessment.