**Appendix S1**

Bugs model for Latent variable (with traits)

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# X0=Chl-a: X1=Temp; X2=ISS; X3=Zmix; X4=Kd; X5=Cond; X6=Alk;, X7=TN; X8=TP; X9=TZ; #X10=CLA

# Z= (V, S/V, MLD, Fla, Muc,Si)

# opt=Optimum; tol= Tolerance; logc= a

######################################################################################

model{ # N observations (species\*sites)

for (i in 1:N){

 y[i] ~ dbin(p.bound[i],1)

 p.bound[i]<-max(0,min(1,p[i]))

 logit(p[i])<-Xbeta[i]

 Xbeta[i]<-logc[sp[i]]-0.5\*pow((Xstar[i]-opt[sp[i]])/tol[sp[i]],2)+

 b.site[site[i]]

 Xstar[i]<-beta0\*X0[i]+beta[1]\*X1[i]+beta[2]\*X2[i]+beta[3]\*X3[i]+

 beta[4]\*X4[i]+beta[5]\*X5[i]+beta[6]\*X6[i]+beta[7]\*X7[i]+

 beta[8]\*X8[i]+beta[9]\*X9[i]+ beta[10]\*X10[i]

 }

for (j in 1:n.sp) {

 opt[j] ~ dnorm(opt.hat[j],tau.opt)

 opt.hat[j]<-b0+ inprod(b[],Z[j,])

 tol[j] ~ dnorm(tol.hat[j],tau.tol)

 tol.hat[j]<-c0+ inprod(c[],Z[j,])

 logc[j] ~ dnorm(a.hat[j],tau.a)

 a.hat[j]<-a0+inprod(a[],Z[j,])

 }

for (j in 1:n.site) {

 b.site[j] ~ dnorm(0,tau.site)

 }

for ( k in 1:n.env){

 beta[k]~ddexp (0,taubeta[k])

 taubeta[k]<-1/varbeta[k]

 varbeta[k]<-(1-gammbeta[k])\*0.001+gammbeta[k]\*10

 gammbeta[k]~dbern(pi.beta) }

 beta0<-1

 a0 ~dnorm(0,.0001)

 b0 ~dnorm(0,.0001)

 c0 ~dnorm(0,.0001)

for ( k in 1:6){

 a[k]~ddexp (0,taua[k])

 taua[k]<-1/vara[k]

 vara[k]<-(1-gamma[k])\*0.001+gamma[k]\*10

 gamma[k]~dbern(pi.a)

 b[k]~ddexp (0,taub[k])

 taub[k]<-1/varb[k]

 varb[k]<-(1-gammb[k])\*0.001+gammb[k]\*10

 gammb[k]~dbern(pi.b)

 c[k]~ddexp (0,tauc[k])

 tauc[k]<-1/varc[k]

 varc[k]<-(1-gammc[k])\*0.001+gammc[k]\*10

 gammc[k]~dbern(pi.c)

 }

tau.a<-pow(sigma.a,-2)

sigma.a~dunif(0,100)

tau.opt<-pow(sigma.opt,-2)

sigma.opt~dunif(0,100)

tau.tol<-pow(sigma.tol,-2)

sigma.tol~dunif(0,100)

tau.site<-pow(sigma.site,-2)

sigma.site~dunif(0,100)

pi.a<-0.5

pi.b<-0.5

pi.c<-0.5

pi.beta<-0.5

}