S1. Supporting Information.

Figure S1. Histogram of the muskox distance data from all years after left truncation at 150m to account for the blind strip beneath the plane and right truncation at ½ the distance between transects. Note that detections at distances >2400m are less common due to variation in line spacing. We accounted for this variation during analysis. 

##JAGS code for the muskox open-population distance sampling IPM##

##Priors##

for(i in 1:N.trans){

for(j in 1:6){

e.clust[i,j]~dnorm(0,tau.clust) #overdispersion term for group size

}}

tau.clust<-1/(sigma.clust\*sigma.clust)

sigma.clust~dunif(0,25)

sigma.int~dunif(0.1,5) #prior for scale parameter of the detection function

S1~dunif(0,1) #prior for adult male survival

S2~dnorm(0.83,816)T(0,1) #prior for adult female survival based on previous study

S3~dunif(0,S2) #prior for juvenile survival

##Distance sampling sub-model##

for(i in 1:N.trans){

for(j in 1:6){ #includes extra NA's (i.e. data augmentation)

w[i,j]~dbern(psi[year.indicator[i]]) #presence by year

s[i,j]~dpois(delta[i,j])T(,50) #group size

delta[i,j]<-delta.prime[year.indicator[i]]+e.clust[i,j]

sigma1[i,j]<-sigma.int #scale parameter

sigma[i,j]<-exp(sigma1[i,j])

lp[i,j]<- (-(x[i,j]\*x[i,j])/(2\*sigma[i,j]\*sigma[i,j])) #half-normal detection function

p[i,j]<-exp(lp[i,j])

mu[i,j]<-w[i,j]\*p[i,j]

y[i,j]~dbern(mu[i,j])

}

}

##Composition sub-model##

for(i in 1:1){

for(j in 1:3){

psi.comp[i,j]~dunif(0,1) #priors

}}

#compostion for year 1

for(i in 1:1){

C.prime[i,1]<-psi.comp[i,1]

C.prime[i,2]<-psi.comp[i,2]

C.prime[i,3]<-psi.comp[i,3]

for(j in 1:3){

p.comp[i,j]<-C.prime[i,j]/sum(C.prime[i,1:3]) #must sum to 1

}

R[i,1:3]~dmulti(p.comp[i,1:3],m[i]) #composition

}

#composition years 2 through 8 a function of survival from previous year

for(i in 2:8){

psi.comp[i,3]~dunif(0,1) #restricted to positive values

C.prime[i,1]<-C.prime[i-1,1]\*S1\*(1-r[i])+C.prime[i-1,3]\*S3\*0.5 #Change in adult males

C.prime[i,2]<-C.prime[i-1,2]\*S2+C.prime[i-1,3]\*S3\*0.5 #Change in adult females

C.prime[i,3]<-psi.comp[i-1,3] #Juveniles

for(j in 1:3){

C[i,j]<-C.prime[i,j]/sum(C.prime[i,1:3])

}

R[i,1:3]~dmulti(C[i,1:3],m[i]) #composition

}

##Pop Dynamics##

kappa[1]<-1 #kappa=1 in year 1

psi[1]~dunif(0.01,0.4) #prior for group occurrence probability year 1

delta.prime[1]~dunif(1,20) #prior for group size year 1

for(i in 2:8){

kappa[i]~dunif(0.5,3) #prior

#Harvest rate, r, is a function of reported harvest, H, and the total number of adult males

r[i]<-H[i-1]/(p.comp[i,1]\*N[i]) #N is total abundance

#Mean group size a factor of survival of individual classes and kappa

delta.prime[i]<-

(((((delta.prime[i-1]\*C.prime[i-1,1])\*S1\*(1-r[i]))+S3\*0.5\*( delta.prime[i-1]\*C.prime[i-1,3])))+

((((delta.prime[i-1]\*C.prime[i-1,2])\*S2)+S3\*0.5\*( delta.prime[i-1]\*C.prime[i-1,3])))+

((delta.prime[i-1]\*C.prime[i,3])))/kappa[i]

#Calculate gamma from components

gamma[i-1]<-(S1\*(1-r[i])\*C.prime[i-1,1]+S3\*0.5\*C.prime[i-1,3])+

(S2\*C.prime[i-1,2]+S3\*0.5\*C.prime[i-1,3])+(C.prime[i,3])

#Probability of group occurrence as a function of gamma and kappa

psi[i]<-psi[i-1]\*kappa[i]\*gamma[i-1]

}