```
#
# Text S1. R script for simulations
#

#
# Assume a 100-day long season.
#

#
# simulate run distributions
#

tt <- 1:100

set.seed(1)
lam <- dnorm(tt,50,14)
rd1 <- rpois(100,lam*10000)  # unimodal RD

set.seed(7)
lam <- 0.1*dnorm(tt,20,3)+0.9*dnorm(tt,55,16)
rd2 <- rpois(100,lam*10000)  #bimodal RD

#
# constant survival probabilities
#

D <- 1:100
ES <- matrix(0,4,2)

set.seed(16)
D1 <- rnorm(100,0.6,0.06)
sp1 <- mean(D1)
ES[1,1] <- sum(D1*rd1)
ES[1,2] <- sum(D1*rd2)

#
# linearly increasing survival probabilities
#

s <- 0.25/99
yi <- 0.45
set.seed(14)
D2 <- yi + s*D + rnorm(100,0,0.06)
sp2 <- mean(D2)
ES[2,1] <- sum(D2*rd1)
ES[2,2] <- sum(D2*rd2)
```

```
#
# increasing then decreasing survival probabilities
#

a = -0.25/2450
b = -101*a
c = 0.45 - a - b

set.seed(13)
D3 <- a*D^2+b*D+c + rnorm(100,0,.06)
sp3 <- mean(D3)
ES[3,1] <- sum(D3*rd1)
ES[3,2] <- sum(D3*rd2)

#
# two pulse survival probabilities
#

set.seed(15)
D4 <- 0.55 + 0.1*exp(-(D-25)^2/80) + 0.20*exp(-(D-70)^2/170) + rnorm(100,0,0.06)
sp4 <- mean(D4)
ES[4,1] <- sum(D4*rd1)
ES[4,2] <- sum(D4*rd2)

truth = c(sp1,sp2,sp3,sp4)
sp.mat = cbind(D1,D2,D3,D4)
ss = c(12,20,100)
##############################################################################
#
# PEAK sampling scheme.
#
##############################################################################
set.seed(42)
peak.arr <- array(0,c(4,2,3,1000))
peak.EC <- array(0,c(4,2,3,1000))

#
# survival probability estimates:
#
#   dimension 1 is the four survival probability patterns (const,lin,quad,2pulse)
#   dimension 2 is the two run distributions (uni,bi)
#   dimension 3 is the three sample sizes (12,20,100)
#   dimension 4 is the 1000 simulations
#
for (i in 1:4) { # loop through SP functions
```

```
        for (j in 1:2) { # loop through RD
   if(j==1) rdcur=rd1 else rdcur=rd2
   for (l in 1:1000) { # simulations
                        d = round(runif(1,40,60)) # select Day
    phat = rbinom(3,ss,sp.mat[d,i])/ss
                        peak.arr[i,j,,l] = phat
    peak.EC[i,j,,l] = phat*sum(rdcur)
                }
        }
}
#############################################################################
#
# SYST sampling scheme.
#
#############################################################################
set.seed(55)
syst.arr1 <- array(0,c(4,2,3,1000))
syst.arr2 <- array(0,c(4,2,3,1000))
syst.EC1 <- array(0,c(4,2,3,1000))
syst.EC2 <- array(0,c(4,2,3,1000))

ss = c(12,20,100)
ns = c(3,5,25)

for (i in 1:4) {
  for (j in 1:2) {
    if (j==1) rdcur=rd1 else rdcur=rd2
        for (l in 1:1000) {
        d = round(runif(1,20,40))
        ps1 = sp.mat[c(d,d+7,d+14,d+21),i]
      ps2 = sp.mat[c(d,d+14,d+28,d+42),i]
      for (k in 1:3) {
        phat1 = sum(rbinom(4,ns[k],ps1))/ss[k]
        phat2 = sum(rbinom(4,ns[k],ps2))/ss[k]
        syst.arr1[i,j,k,l] = phat1
        syst.EC1[i,j,k,l] = phat1*sum(rdcur)
        syst.arr2[i,j,k,l] = phat2
        syst.EC2[i,j,k,l] = phat2*sum(rdcur)
         }
   }
         }
}
```

```
#############################################################################
#
# Random Sampling Scheme (select 4 days, randomly between 1 and 100)
#
#############################################################################
set.seed(46)
rand.arr <- array(0,c(4,2,3,1000))
rand.EC <- array(0,c(4,2,3,1000))

#
# survival probability estimates:
#
#   dimension 1 is the four survival probability patterns (const,lin,quad,2pulse)
#   dimension 2 is the two run distributions (uni,bi)
#   dimension 3 is the three sample sizes (12,20,100)
#   dimension 4 is the 1000 simulations
#

for (i in 1:4) { # loop through SP functions
  for (j in 1:2) { # loop through RD
    if(j==1) rdcur=rd1 else rdcur=rd2
    for (l in 1:1000) { # simulations
      d = round(runif(4,1,100))
      ps = sp.mat[d,i]
      for (k in 1:3) {
        phat = sum(rbinom(4,ns[k],ps))/ss[k]
        rand.arr[i,j,k,l] = phat
        rand.EC[i,j,k,l] = phat*sum(rdcur)
      }
    }
  }
}
```