

Dessication 168 and SPOIIE

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2025-06-12

```
library(tidyr)
```

```
## Warning: package 'tidyr' was built under R version 4.4.3
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.4.3
```

```
library(stringr)
```

```
## Warning: package 'stringr' was built under R version 4.4.3
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.4.3
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
```

```
##
```

```
## filter, lag
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
## intersect, setdiff, setequal, union
```

```
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.4.3
```

```
## Warning: package 'tibble' was built under R version 4.4.3
```

```
## Warning: package 'readr' was built under R version 4.4.3
```

```
## Warning: package 'purrr' was built under R version 4.4.3
```

```
## Warning: package 'forcats' was built under R version 4.4.3

## Warning: package 'lubridate' was built under R version 4.4.3

## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v forcats   1.0.0     v readr     2.1.5
## v lubridate 1.9.4     v tibble   3.2.1
## v purrr     1.0.4

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
require(survival)
```

```
## Loading required package: survival
```

```
require(extrafont)
```

```
## Loading required package: extrafont
## Registering fonts with R
```

```
theme_set(theme_classic() +
  theme(axis.title = element_text(size = 16),
        axis.title.x = element_text(margin = margin(t = 15, b = 15)),
        axis.title.y = element_text(margin = margin(l = 15, r = 15)),
        axis.text = element_text(size = 13),
        axis.text.x = element_text(margin = margin(t = 5)),
        axis.text.y = element_text(margin = margin(r = 5)),
        #axis.line.x = element_line(linewidth = 1),
        #axis.line.y = element_line(linewidth = 1),
        axis.line.x = element_blank(),
        axis.line.y = element_blank(),
        axis.ticks.x = element_line(linewidth = 1),
        axis.ticks.y = element_line(linewidth = 1),
        axis.ticks.length = unit(.1, "in"),
        panel.border = element_rect(color = "grey20", fill = NA, linewidth = 1.5),
        legend.text = element_text(size = 14),
        strip.text = element_text(size = 14),
        strip.background = element_blank()
  ))
```

```
setwd("C:/Users/ajl21/github/division.labor/Survivorship.desiccation/Data_D6/")
#data: Turbidity 0 alive 1 death; Strain 1 Delta 6 0 SPOIIE;
#Experiment 5- desiccation 24 hr; Experiment 6 - desiccation 48 hr; desiccation 7 - 4 hours
data <- read.csv("20250612_1322_S2_3.csv")# 1 is D6 and 2 is SPO; Event - 0 if lived 1 if died
data
```

```
##      Well Event Strain Hour Experiment
## 1      A1      0      1      5          3
```

## 2	A2	0	1	5	3
## 3	A3	0	1	5	3
## 4	A4	0	1	5	3
## 5	A5	0	1	5	3
## 6	A6	0	1	5	3
## 7	A7	0	1	5	3
## 8	A8	0	1	5	3
## 9	A9	0	1	5	3
## 10	A10	0	1	5	3
## 11	A11	0	1	5	3
## 12	A12	0	1	5	3
## 13	B1	0	1	7	3
## 14	B2	0	1	7	3
## 15	B3	0	1	7	3
## 16	B4	0	1	7	3
## 17	B5	0	1	7	3
## 18	B6	0	1	7	3
## 19	B7	0	1	7	3
## 20	B8	0	1	7	3
## 21	B9	0	1	7	3
## 22	B10	0	1	7	3
## 23	B11	0	1	7	3
## 24	B12	0	1	7	3
## 25	C1	0	1	24	3
## 26	C2	0	1	24	3
## 27	C3	0	1	24	3
## 28	C4	0	1	24	3
## 29	C5	0	1	24	3
## 30	C6	0	1	24	3
## 31	C7	0	1	24	3
## 32	C8	0	1	24	3
## 33	C9	0	1	24	3
## 34	C10	0	1	24	3
## 35	C11	0	1	24	3
## 36	C12	0	1	24	3
## 37	D1	1	1	27	3
## 38	D2	0	1	27	3
## 39	D3	0	1	27	3
## 40	D4	0	1	27	3
## 41	D5	0	1	27	3
## 42	D6	0	1	27	3
## 43	D7	0	1	27	3
## 44	D8	0	1	27	3
## 45	D9	0	1	27	3
## 46	D10	0	1	27	3
## 47	D11	1	1	27	3
## 48	D12	0	1	27	3
## 49	E1	1	2	5	3
## 50	E2	1	2	5	3
## 51	E3	1	2	5	3
## 52	E4	1	2	5	3
## 53	E5	0	2	5	3
## 54	E6	1	2	5	3
## 55	E7	1	2	5	3

## 56	E8	1	2	5	3
## 57	E9	1	2	5	3
## 58	E10	0	2	5	3
## 59	E11	1	2	5	3
## 60	E12	1	2	5	3
## 61	F1	0	2	7	3
## 62	F2	0	2	7	3
## 63	F3	0	2	7	3
## 64	F4	0	2	7	3
## 65	F5	0	2	7	3
## 66	F6	0	2	7	3
## 67	F7	0	2	7	3
## 68	F8	0	2	7	3
## 69	F9	0	2	7	3
## 70	F10	0	2	7	3
## 71	F11	0	2	7	3
## 72	F12	0	2	7	3
## 73	G1	0	2	24	3
## 74	G2	0	2	24	3
## 75	G3	0	2	24	3
## 76	G4	0	2	24	3
## 77	G5	0	2	24	3
## 78	G6	0	2	24	3
## 79	G7	0	2	24	3
## 80	G8	0	2	24	3
## 81	G9	0	2	24	3
## 82	G10	0	2	24	3
## 83	G11	0	2	24	3
## 84	G12	0	2	24	3
## 85	H1	1	2	27	3
## 86	H2	1	2	27	3
## 87	H3	1	2	27	3
## 88	H4	1	2	27	3
## 89	H5	1	2	27	3
## 90	H6	1	2	27	3
## 91	H7	1	2	27	3
## 92	H8	1	2	27	3
## 93	H9	1	2	27	3
## 94	H10	1	2	27	3
## 95	H11	1	2	27	3
## 96	H12	1	2	27	3
## 97	A1	0	1	5	2
## 98	A2	0	1	5	2
## 99	A3	0	1	5	2
## 100	A4	0	1	5	2
## 101	A5	0	1	5	2
## 102	A6	0	1	5	2
## 103	A7	0	1	5	2
## 104	A8	0	1	5	2
## 105	A9	0	1	5	2
## 106	A10	0	1	5	2
## 107	A11	0	1	5	2
## 108	A12	0	1	5	2
## 109	B1	0	1	5	2

## 110	B2	0	1	5	2
## 111	B3	0	1	5	2
## 112	B4	0	1	5	2
## 113	B5	0	1	5	2
## 114	B6	0	1	5	2
## 115	B7	0	1	5	2
## 116	B8	0	1	5	2
## 117	B9	0	1	5	2
## 118	B10	0	1	5	2
## 119	B11	0	1	5	2
## 120	B12	0	1	5	2
## 121	C1	0	1	24	2
## 122	C2	0	1	24	2
## 123	C3	0	1	24	2
## 124	C4	0	1	24	2
## 125	C5	0	1	24	2
## 126	C6	0	1	24	2
## 127	C7	0	1	24	2
## 128	C8	0	1	24	2
## 129	C9	0	1	24	2
## 130	C10	0	1	24	2
## 131	C11	0	1	24	2
## 132	C12	0	1	24	2
## 133	D1	0	1	31	2
## 134	D2	0	1	31	2
## 135	D3	0	1	31	2
## 136	D4	0	1	31	2
## 137	D5	0	1	31	2
## 138	D6	0	1	31	2
## 139	D7	0	1	31	2
## 140	D8	0	1	31	2
## 141	D9	0	1	31	2
## 142	D10	0	1	31	2
## 143	D11	0	1	31	2
## 144	D12	0	1	31	2
## 145	E1	1	2	5	2
## 146	E2	0	2	5	2
## 147	E3	0	2	5	2
## 148	E4	0	2	5	2
## 149	E5	0	2	5	2
## 150	E6	0	2	5	2
## 151	E7	0	2	5	2
## 152	E8	0	2	5	2
## 153	E9	0	2	5	2
## 154	E10	0	2	5	2
## 155	E11	1	2	5	2
## 156	E12	0	2	5	2
## 157	F1	0	2	5	2
## 158	F2	0	2	5	2
## 159	F3	0	2	5	2
## 160	F4	0	2	5	2
## 161	F5	0	2	5	2
## 162	F6	0	2	5	2
## 163	F7	0	2	5	2

```
## 164 F8 0 2 5 2
## 165 F9 0 2 5 2
## 166 F10 0 2 5 2
## 167 F11 0 2 5 2
## 168 F12 0 2 5 2
## 169 G1 1 2 31 2
## 170 G2 0 2 31 2
## 171 G3 0 2 31 2
## 172 G4 0 2 31 2
## 173 G5 0 2 31 2
## 174 G6 0 2 31 2
## 175 G7 0 2 31 2
## 176 G8 0 2 31 2
## 177 G9 0 2 31 2
## 178 G10 0 2 31 2
## 179 G11 0 2 31 2
## 180 G12 0 2 31 2
## 181 H1 1 2 24 2
## 182 H2 0 2 24 2
## 183 H3 0 2 24 2
## 184 H4 0 2 24 2
## 185 H5 0 2 24 2
## 186 H6 0 2 24 2
## 187 H7 0 2 24 2
## 188 H8 0 2 24 2
## 189 H9 0 2 24 2
## 190 H10 0 2 24 2
## 191 H11 0 2 24 2
## 192 H12 1 2 24 2
```

```
data$Strain <- factor(data$Strain)
surv <- data
```

```
biofsurv <- Surv(surv$Hour,surv$Event)
print(biofsurv)
```

```
## [1] 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 7+ 7+ 7+ 7+ 7+ 7+
## [19] 7+ 7+ 7+ 7+ 7+ 7+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+
## [37] 27 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27 27+ 5 5 5 5 5+ 5
## [55] 5 5 5 5+ 5 5 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+
## [73] 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 27 27 27 27 27 27
## [91] 27 27 27 27 27 27 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+
## [109] 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 24+ 24+ 24+ 24+ 24+ 24+
## [127] 24+ 24+ 24+ 24+ 24+ 24+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+
## [145] 5 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5 5+ 5+ 5+ 5+ 5+ 5+ 5+
## [163] 5+ 5+ 5+ 5+ 5+ 5+ 31 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+
## [181] 24 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24
```

```
biofsurv.fit <- survfit(biofsurv ~ surv$Strain, conf.int = TRUE,
                        type = "kaplan-meier")
biofsurv.diff <- survdiff(Surv(surv$Hour,surv$Event) ~ surv$Strain, data = surv)
print(biofsurv)
```

```
## [1] 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 7+ 7+ 7+ 7+ 7+ 7+
## [19] 7+ 7+ 7+ 7+ 7+ 7+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+
## [37] 27 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27+ 27 27+ 5 5 5 5 5+ 5
## [55] 5 5 5 5+ 5 5 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+ 7+
## [73] 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 27 27 27 27 27 27
## [91] 27 27 27 27 27 27 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+
## [109] 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 24+ 24+ 24+ 24+ 24+ 24+
## [127] 24+ 24+ 24+ 24+ 24+ 24+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+
## [145] 5 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5+ 5 5+ 5+ 5+ 5+ 5+ 5+ 5+
## [163] 5+ 5+ 5+ 5+ 5+ 5+ 31 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+ 31+
## [181] 24 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24+ 24
```

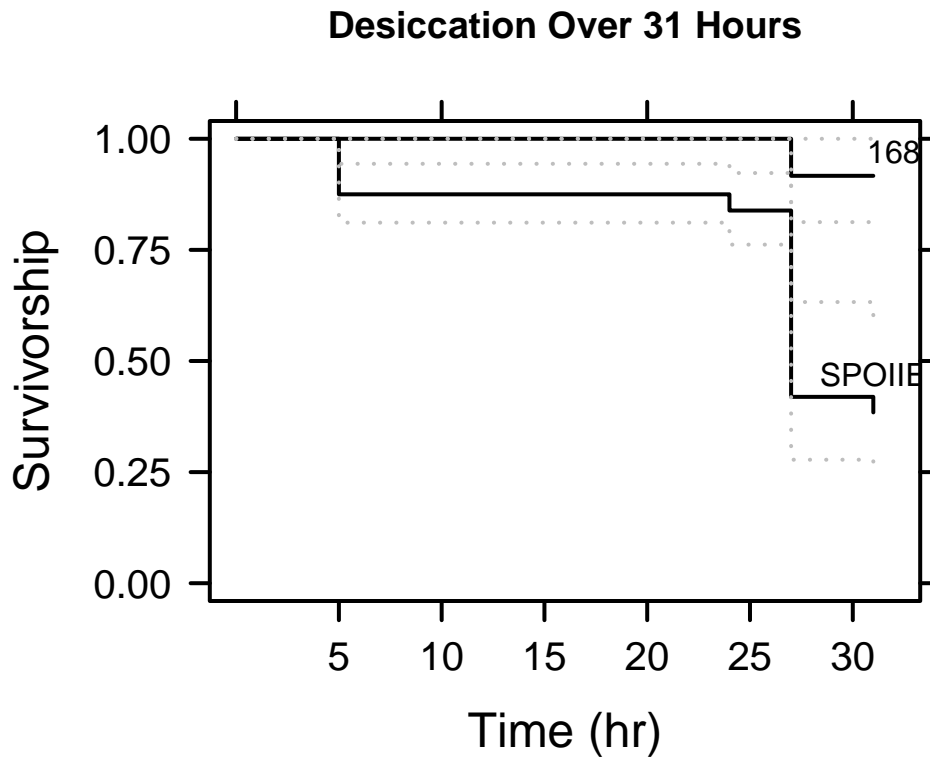
```
fit.data <- summary(biofsurv.fit )
fit.data
```

```
## Call: survfit(formula = biofsurv ~ surv$Strain, conf.int = TRUE, type = "kaplan-meier")
##
##               surv$Strain=1
##      time      n.risk      n.event      survival      std.err lower 95% CI
##      27.0000      24.0000       2.0000       0.9167       0.0564       0.8125
## upper 95% CI
##      1.0000
##
##               surv$Strain=2
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    5     96     12   0.875  0.0338     0.811     0.944
##   24     48      2   0.839  0.0410     0.762     0.923
##   27     24     12   0.419  0.0880     0.278     0.633
##   31     12      1   0.384  0.0873     0.246     0.600
```

```
par(mar = c(5, 7, 5, 7))
plot(biofsurv.fit, conf.int = TRUE, mark.time = FALSE,
     xlim = c(0,32), ylim = c(0,1),
     lty = c(1,3,3,1,3,3),
     col = c("black", "grey", "grey", "black", "grey", "grey"),
     xlab = "Time (hr)",
     ylab = "", cex.lab = 1.5, cex.axis = 1.2, las = 1, lwd = 2,
     main = "Desiccation Over 31 Hours",
     yaxt = "n", xaxt = "n")
box(lwd=2)

mtext("Survivorship", side = 2, outer = TRUE, cex = 1.5, line = -3, adj = 0.5)

axis(side = 2, labels = T, lwd.ticks = 2, las = 1, cex.axis = 1.25,
     at = c(0, 0.25, 0.5, 0.75, 1.0))
axis(side = 4, labels = F, lwd.ticks = 2,
     at = c(0, 0.25, 0.5, 0.75, 1.0))
axis(side = 1, labels = T, lwd.ticks = 2, las = 1, cex.axis = 1.25,
     at = c(5, 10, 15, 20, 25, 30, 35))
axis(side = 3, labels = F, lwd.ticks = 2, las = 1, cex.axis = 1.25,
     at = c(0, 10, 20, 30, 40, 50))
text(32, 0.97, "168", cex = 1)
text(31, 0.47, "SPOIIE", cex = 1)
```



```
plate.aov <- aov(Event ~ Strain, data = data)
summary(plate.aov)
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Strain         1  3.255    3.255   28.95 2.17e-07 ***
## Residuals     190 21.365    0.112
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(biofsurv.fit, fun = "cumhaz", col = c("black", "grey"), lty = c(1, 3), lwd = 2,
     xlab = "Time (hr)", ylab = "Cumulative Hazard", main = "Cumulative Hazard By Strain")
text(29, 0.12, "168", cex = 1)
text(29, 0.7, "SPOIIE", cex = 1)
```


Cumulative Hazard By Strain

