



# COASTAL AND MARINE LAB - FSUCML

## Web-based tools to explore the stakeholder decision-making process

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**1) What's Shiny App?**

**2) Examples**

**3) Pros (Benefits)**

**4) Oyster Decision-Support Tool**

**5) Next Steps**

**Presentation Overview**

# Shiny

by RStudio

# Web-based tool



<https://shiny.rstudio.com/>

# Structure

```
# Define UI
ui <- fluidPage(theme = shinytheme("lumen"),
  titlePanel("Google Trend Index"),
  sidebarLayout(
    sidebarPanel(

      # Select type of trend to plot
      selectInput(inputId = "type", label = strong("Trend index"),
        choices = unique(trend_data$type),
        selected = "Travel"),

      # Select date range to be plotted
      dateRangeInput("date", strong("Date range"), start = "2007-01-01", end = "2017-07-31",
        min = "2007-01-01", max = "2017-07-31"),

      # Select whether to overlay smooth trend line
      checkboxInput(inputId = "smoother", label = strong("Overlay smooth trend line")),

      # Display only if the smoother is checked
      conditionalPanel(condition = "input.smoother == true",
        sliderInput(inputId = "f", label = "Smoother span:",
          min = 0.01, max = 1, value = 0.67, step = 0.01,
          animate = animationOptions(interval = 100)),
        HTML("Higher values give more smoothness."))
    )
  ),
  # Output: Description, lineplot, and reference
  mainPanel(
    plotOutput(outputId = "lineplot", height = "300px"),
    textOutput(outputId = "desc"),
    tags$a(href = "https://www.google.com/finance/domestic_trends", "Source: Google D")
  )
)
```

```
# Define server function
server <- function(input, output) {

  # Subset data
  selected_trends <- reactive({
    req(input$date)
    validate(need(!is.na(input$date[1]) & !is.na(input$date[2]), "Error: Please provide
    validate(need(input$date[1] < input$date[2], "Error: Start date should be earlier t
    trend_data %>%
      filter(
        type == input$type,
        date > as.POSIXct(input$date[1]) & date < as.POSIXct(input$date[2])
      )
    })

  # Create scatterplot object the plotOutput function is expecting
  output$lineplot <- renderPlot({
    color = "#434343"
    par(mar = c(4, 4, 1, 1))
    plot(x = selected_trends()$date, y = selected_trends()$close, type = "l",
      xlab = "Date", ylab = "Trend index", col = color, fg = color, col.lab = color,
      # Display only if smoother is checked
      if(input$smoother){
        smooth_curve <- lowess(x = as.numeric(selected_trends()$date), y = selected_trend
        lines(smooth_curve, col = "#E6553A", lwd = 3)
      }
    })

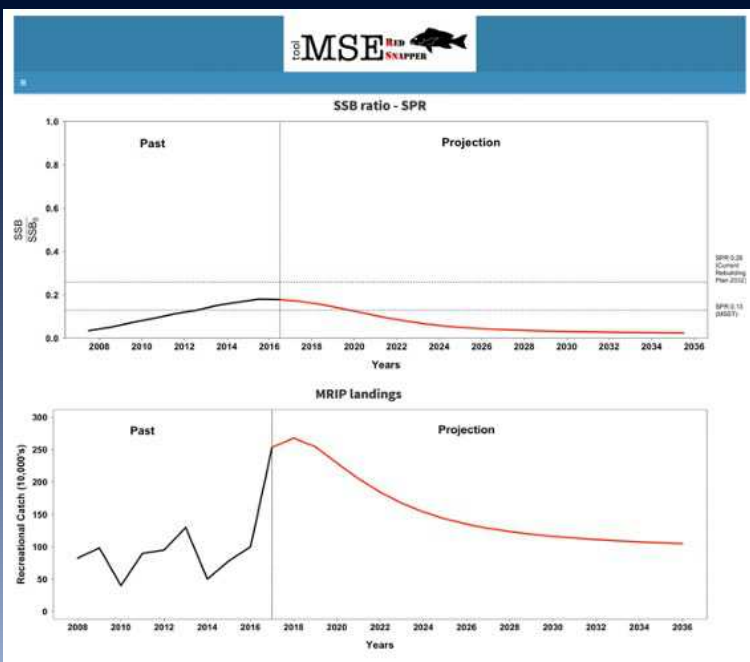
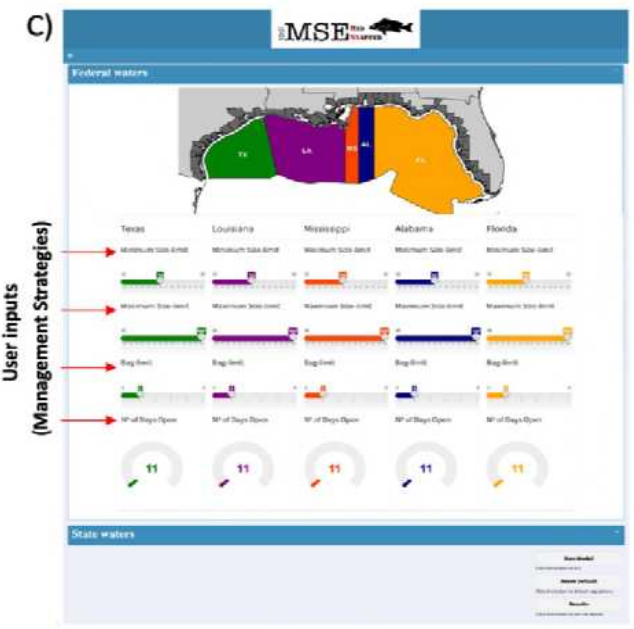
  # Pull in description of trend
  output$desc <- renderText({
    trend_text <- filter(trend_description, type == input$type) %>% pull(text)
    paste(trend_text, "The index is set to 1.0 on January 1, 2004 and is calculated onl
  })
}

# Create Shiny object
shinyApp(ui = ui, server = server)
```

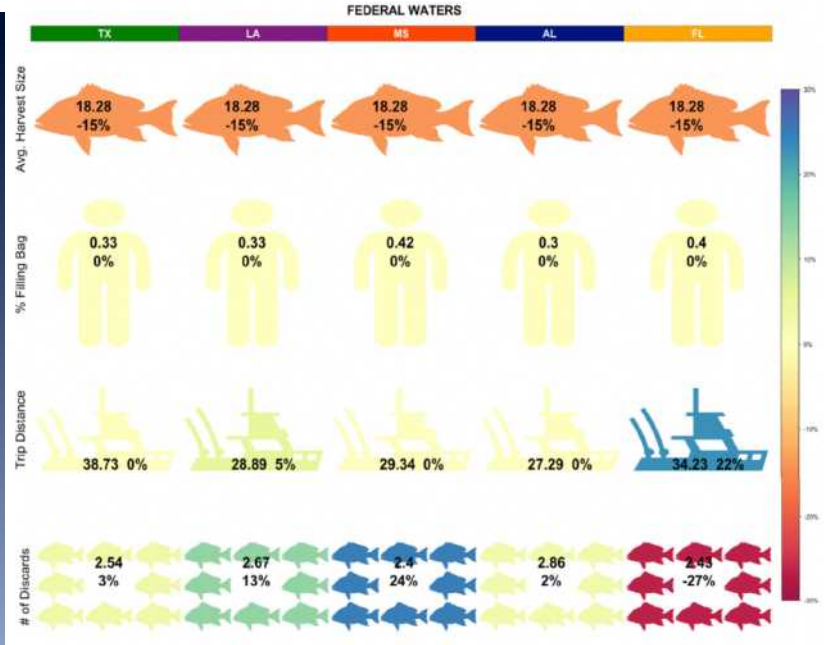
# Management Decision Support Tool







```
body <- dashboardBody(
  shinyjs::useShinyjs(),
  tags$head(
    tags$style(HTML("main-header logo { font-family: Times;
    topStyle(HTML("main-sidebar { font-family: Times; font
    topStyle(HTML("irs-grid-text { font-size: 13pt; font-w
    topStyle(HTML("irs-grid-text { font-family: Times; colo
    topStyle(HTML("nav-tabs {font-family: Times; color: b)
    topStyle(HTML("content-wrapper {margin-top: 25px; con
    topStyle(HTML("title-box {position: absolute;text-align
    topStyle(HTML("main-header logo {height: 130px;}"),
    topStyle(HTML("main-header {padding: 0;position: relat
    topStyle(HTML("main-sidebar {position: absolute;.left
    topStyle(HTML("irs-grid-pol.small {height: 0px;}"),
    topStyle(HTML("irs-grid-pol {height: 18px;}"),
    topStyle(HTML("irs-line {border: none; height: 30px; b
    topStyle(HTML("span.irs-single {font-family: Times; fo
    topStyle(HTML("box-header h3.box-title {font-family:
    topStyle(HTML("irs-bar {width: 100%; height: 18px; bor
    topStyle(HTML("irs-bar-edge {height: 18px; border-colo
```



```
#####

# Do Projection

observeEvent(input$doShiny,{

  theta <- List()
  theta$nsim <- 20
  theta$DO.st <- c(input$FL_DO_st,input$AL_DO_st,input$MS_DO_st,input$LA_DO_st,input$TX_DO_st)
  theta$DO.fed <- c(input$FL_DO_fed,input$AL_DO_fed,input$MS_DO_fed,input$LA_DO_fed,input$TX_DO_fed)
  ON <- input$effort.tracking_on
  theta$LSL.st <- c(input$FL_LSL_st,input$AL_LSL_st,input$MS_LSL_st,input$LA_LSL_st,input$TX_LSL_st)
  theta$LSL.fed <- c(input$FL_LSL_fed,input$AL_LSL_fed,input$MS_LSL_fed,input$LA_LSL_fed,input$TX_LSL_fed)
  theta$USL.st <- c(input$FL_USL_st,input$AL_USL_st,input$MS_USL_st,input$LA_USL_st,input$TX_USL_st)
  theta$USL.fed <- c(input$FL_USL_fed,input$AL_USL_fed,input$MS_USL_fed,input$LA_USL_fed,input$TX_USL_fed)
  theta$BL.st <- c(input$FL_BL_st,input$AL_BL_st,input$MS_BL_st,input$LA_BL_st,input$TX_BL_st)
  theta$BL.fed <- c(input$FL_BL_fed,input$AL_BL_fed,input$MS_BL_fed,input$LA_BL_fed,input$TX_BL_fed)

  withProgress(message = 'Calculation in progress', {
    for(i in 1:N){

      # Long Running Task
      Sys.sleep(0.20)

      # Update progress
      incProgress(1/N)
    }
    options(warn=-1)
    OM <- Full_OM_model(theta)
  })

#####
```

~ 500 lines of code

```
Full_OM_model.R
1 Full_OM_model <- function(theta){
2   ###
3   #-----
4   # Parameterization
5   #-----
6   # MRIP/R_Clsd EFFORT ALLOCATION
7   ##### MRIP.wt.fun takes arguments hab.fac, dist.wt, and power to control the gravity weights of the MRIP/R_Clsd
8   # fleet
9
10  #MRIP and R_Clsd are conditioned on Trips (Effort) and use q to convert Effort to F. Needs a knob to increase or
11  # decrease effort as a function of days open
12
13  #-----
14  # KNOBS TO ADJUST EFFORT
15
16  days_open_df <- data.frame(Area = rep(c("Federal","State"),5),
17                             State=rep(c("Florida","Alabama","Mississippi","Louisiana","Texas"),each=2),
18                             Days_open=NA)
19
20  # fed_days is a knob for adjusting the federal days. It can either be one value to set all federal waters or can
21  # be a vector in order of FL, AL, MS, LA, TX to set a different number of days per state. If it is not set it is
22  # set at 2016 federal days open (11 days)
23  days_open_df$Days_open[days_open_df$Area=="Federal"] <- theta$DO.fed
24
25  # state_days is a knob for adjusting the state days. It can either be one value to set all state waters or can
26  # be a vector in order of FL, AL, MS, LA, TX to set a different number of days per state. If it is not set it is
27  # set at 2016 state days open (85, 66, 102, 272, 365 days)
28  days_open_df$Days_open[days_open_df$Area=="State"] <- theta$DO.st
29
30  # tack on to the effort and q
31  rec_eff_ch_st$Days_open <- unlist(days_open_df[match(rec_eff_ch_st$State, days_open_df$State)+1, "Days_open"])
32  rec_eff_ch_fed$Days_open <- unlist(days_open_df[match(rec_eff_ch_fed$State, days_open_df$State), "Days_open"])
33  rec_eff_pr_st$Days_open <- unlist(days_open_df[match(rec_eff_pr_st$State, days_open_df$State)+1, "Days_open"])
34  rec_eff_pr_fed$Days_open <- unlist(days_open_df[match(rec_eff_pr_fed$State, days_open_df$State), "Days_open"])
```

# Marine Science Day 2022

Hatfield Marine Science: White Lab



Population Growth

Sea Turtles

Age/Length Bias



## Population Growth

Fisheries scientists use mathematical models to understand how fishery stock fluctuate and what to expect in the future. Essentially, we try to estimate all of the important processes in a population (birth, death, growth, harvest) and combine them in mathematical equations to make predictions.

Sometimes, these mathematical models reveal unexpected features of how populations work. Here's an example of how a fish population could vary a lot from year to year in an unpredictable way. This variability is not from the environment but just from its own birth-death processes. This happens when adults make lots of babies, and the young compete with the adults for the same resources (or perhaps the adults cannibalize the young, as often happens), so there are lots of booms and busts.

You can see how this type of population works by varying the inputs in the model below. If you increase the intrinsic growth rate (this is how fast the population would grow when there is not much competition for resources), then the population will get bigger faster. At some point, if there are more fish than what the environment can support (the "carrying capacity"), then the babies and adult fish will compete for the same food and habitats, and the population will actually go down, even with a really high growth rate. However, if you remove some of these competing individuals through fishing, then there is less competition and the population size will actually even out! But, if you catch too many fish in the beginning, before the population has the chance to grow, then it will crash and there won't be any fish left at all. On top of all this, environmental variability can change how many babies are born and survive. For example, if the ocean is too warm for too long and there's so little food that not many young fish survive, there is a bad year for them. Or, sometimes, there's a really good year, with lots of food, and then more young fish can survive for that year!

Now that you know all this, play around with the values for the growth rate, carrying capacity, and fishing to try to end up with the most fish left after 100 years! The starting values represent how the Pacific yellowfin tuna fishery grows over time and is fished.



# Outreach & Extension

# Marine Science Day 2022

Hatfield Marine Science: White Lab



Population Growth

Sea Turtles

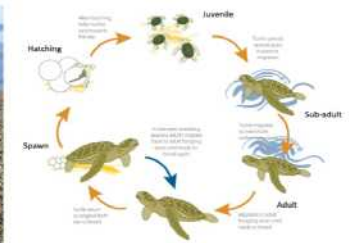
Age/Length Bias



## Challenge

## Management Actions

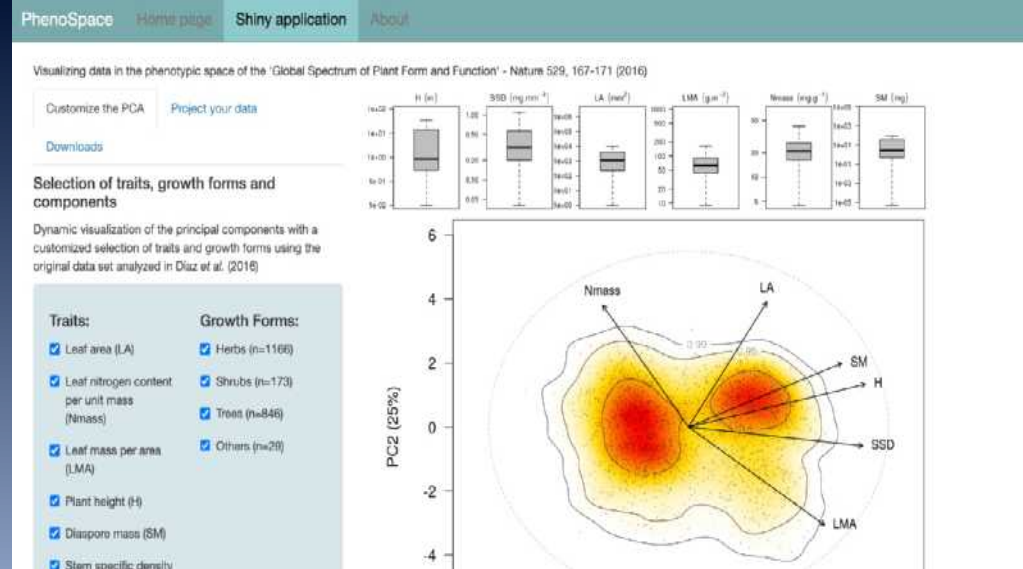
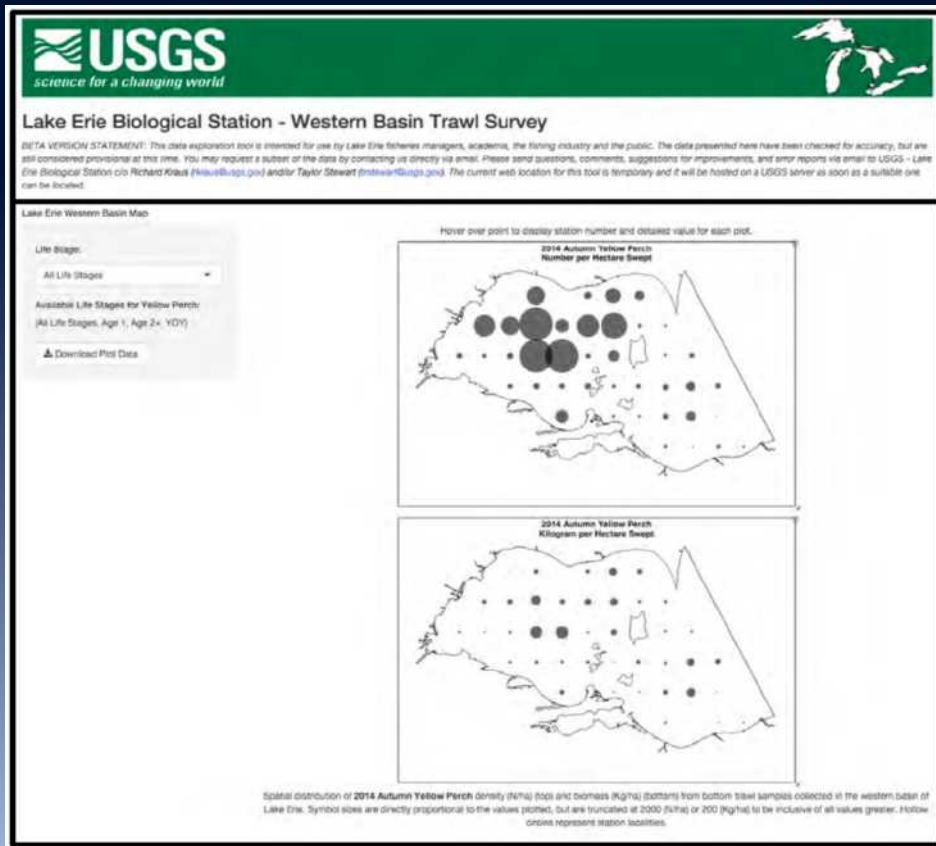
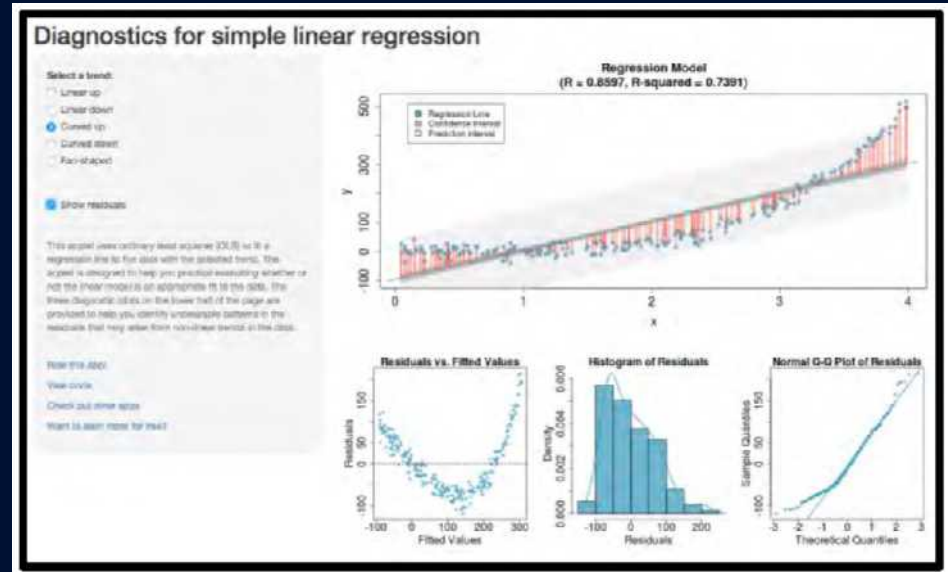
You are working with a conservation group to try to protect a population of green sea turtles off the coast of *Fernando de Noronha, Brazil*. The conservation group only has so much money, so they want to figure out how best to use their money to protect the turtles. Which management action helps the population size increase the most for the same amount of money? For information about actual green sea turtle preservation efforts in Fernando de Noronha, Brazil, check out Projeto TAMAR's page: <http://www.tamar.org.br/> and in U.S waters, NOAA page: <https://www.noaa.gov/education/resource-collections/marine-life/sea-turtles>



[https://fcaltabellotta.shinyapps.io/Marine-Science-Day-2021/#\\_w\\_4678a55f9ab-2482-2](https://fcaltabellotta.shinyapps.io/Marine-Science-Day-2021/#_w_4678a55f9ab-2482-2)

<https://fcaltabellotta.shinyapps.io/Marine-Science-Day-2021/>





# Pros (Benefits)

- **Interactive and engaging scientific products with existing skillsets and expertise (no HTML, Javascript)**
- **Stakeholders, managers, policy makers can explore and engage with scientific products without having to also be technical experts or install/acquire special software**
- **Public access to research results**
- **Interaction allows better science and better management**

ABSI



**Oyster  
Decision  
Support-tool**

[https://fcaltabellotta.shinyapps.io/Oyster\\_Decision\\_Tool/](https://fcaltabellotta.shinyapps.io/Oyster_Decision_Tool/)

# Next Steps

- **Implementation of Pre-Survey?**
- **Update the UI**
- **Update the Simulation Model**
- **Implementation of Pos-Survey?**



Thank you!

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