



# 7. Applications

R<sup>3</sup> Training

[noaa-iaea.github.io/r3-train](https://noaa-iaea.github.io/r3-train)



Ben Best  
2021-08-02

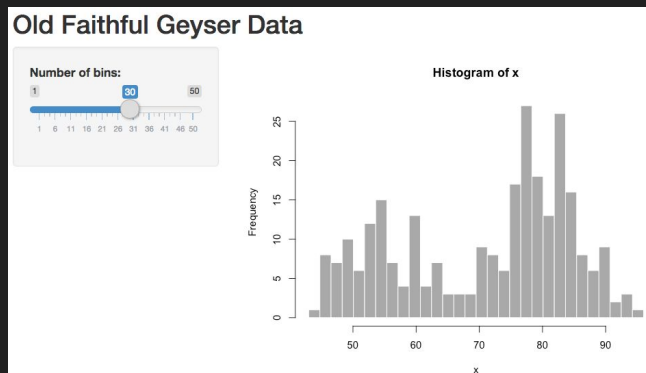
# Talk Outline

- What is Shiny?
  - Create default app
  - User interface
  - Server functions
  - Reactivity
  - Deploy
- Add functionality
  - Add inputs: slider, drop-down
  - Add output: map [leaflet]
  - Update interface [shinydashboard]
- Compare with Rmarkdown
- Resources
- Example & Contributed apps

# What is Shiny?

Shiny is a web application framework and R library providing functions to easily create a user interface that interacts with any server functions defined in R.

User interface (`ui.R`)

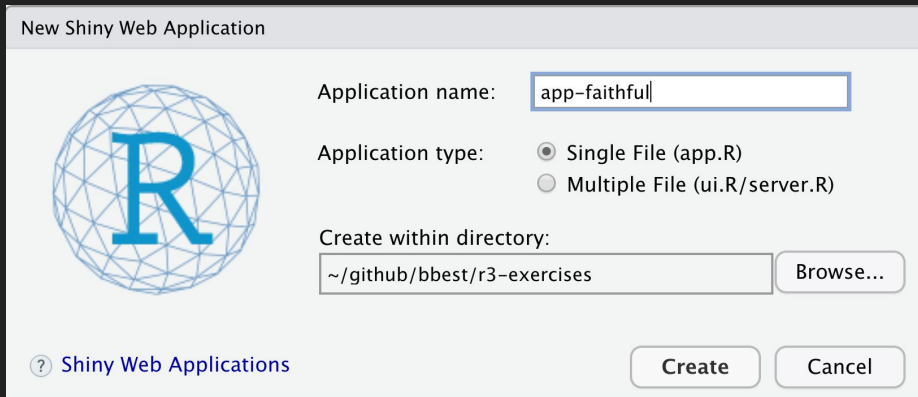



Server functions (`server.R`)



# Create your first Shiny web app

1. In RStudio: File > New File > Shiny Web App...
  - Single File (app.R)



2. Run App 
  - i.e. `shiny::runApp('app-faithful')`

# User interface

1. Reactive: plot updates in response to user input, eg moving slider
2. Shiny is an R library of functions, in `ui.R`:

```
library(shiny)
shinyUI(fluidPage(
  titlePanel(...),
  sidebarLayout(
    sidebarPanel(
      sliderInput(inputId="bins", ...)
    ),
    mainPanel(plotOutput(outputId="distPlot", ...)))
))
```

3. Use RStudio IDE, because parentheses can be your nemesis
4. Layout: automatically rearranges with browser

# Server functions

Server functions are automatically “reactive” to changing inputs (`input$`) for updating outputs (`output$`) in `server.R`:

```
library(shiny)

shinyServer(function(input, output) {
  output$distPlot <- renderPlot({
    x      <- faithful[, 2]
    bins <- seq(min(x), max(x), length.out = input$bins + 1)
    hist(x, breaks = bins, ...)
  })
})
```

# Show reactivity

- [Showcase display](#)

```
shiny::runApp('app-faithful', display.mode='showcase')
```

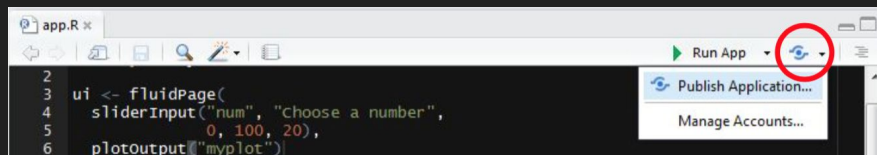
- [React log](#) ([Reactivity overview](#))

```
options(shiny.reactlog=TRUE)  
shiny::runApp('app-faithful')  
# cmd+F3
```

- More in [debugging](#) article

# Deploy apps

- Locally:  
need R & browser
  - `shiny::runApp()`
  - from Github:  
`shiny::runGithub("owner/repo")`
- Server:  
only need browser
  - Shiny Server: you host on server
    - [Open-Source](#): \$0
    - [Pro](#) (users, security): \$10K/yr



- [ShinyApps.io](#): hosted

Plan	Cost / mo	Apps	Active hrs/mo
Free	\$0	5	25
Starter	\$9	25	100
Basic/Standard/Pro	\$39/99/299	Unlimited	500/2K/10K



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  - Create default app
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  - Reactivity
  - Deploy
- Add functionality
  - Add inputs: slider, drop-down
  - Add output: map [[leaflet](#)]
  - Update interface [[shinydashboard](#)]
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# Add Inputs

[shiny.rstudio.com/gallery/widget-gallery.html](https://shiny.rstudio.com/gallery/widget-gallery.html)

- Select box
- Checkbox
- Radio
- Slider
- Text
- Date
- Button
- ...

The screenshot displays a grid of Shiny widget examples. Each widget is presented in a light gray box with a title, a visual representation of the input, and a 'See Code' button.

- Action button**: Shows a button labeled 'Action'. The current value is a list: `[1] # "c:1:1:1"` and `[2] "integer"`. The text "shinytest::shinytest::shinytest" is displayed below.
- Single checkbox**: Shows a checkbox labeled 'Choice A'. The current value is `[1] TRUE`.
- Checkbox group**: Shows a group of checkboxes labeled 'Choice 1', 'Choice 2', and 'Choice 3'. The current value is `[1] "1"`.
- Date input**: Shows a date input field with the value '2018-01-01'. The current value is `[1] "2018-01-01"`.
- Date range**: Shows a date range input field with the values '2018-01-01' and '2018-01-02'. The current value is `[1] "2018-01-01" "2018-01-02"`.
- File input**: Shows a file input field with the text 'Browse...' and 'No file selected'. The current value is `NULL`.
- Numeric input**: Shows a numeric input field with the value '1'. The current value is `[1] 1`.
- Radio buttons**: Shows a group of radio buttons labeled 'Choice 1', 'Choice 2', and 'Choice 3'. The current value is `[1] "1"`.
- Select box**: Shows a select box with the value 'Choice 1'. The current value is `[1] "1"`.
- Slider**: Shows a slider input field with the value '50'. The current value is `[1] 50`.
- Slider range**: Shows a slider range input field with the values '25' and '75'. The current value is `[1] 25 75`.
- Text input**: Shows a text input field with the value 'Enter text...'. The current value is `[1] "Enter text..."`.

# Live Demos

You should be able to follow along here:

[bbest.github.io/shiny-intro](https://bbest.github.io/shiny-intro)

Headers (mostly) correspond to app folders in bbest/shiny-intro [master.zip](#)

- Download
- 01\_faithful: default app
- 02\_quakes\_mag: swap to quakes dataset, adjust histogram by magnitude
- 03\_quakes\_depth: add depth slider, select box for variable to histogram
- 04\_quakes\_map: add leaflet map
- 05\_quakes\_dashboard: enhance ui with shinydashboard
- Rmarkdown using Crosstalk

# Live Demos

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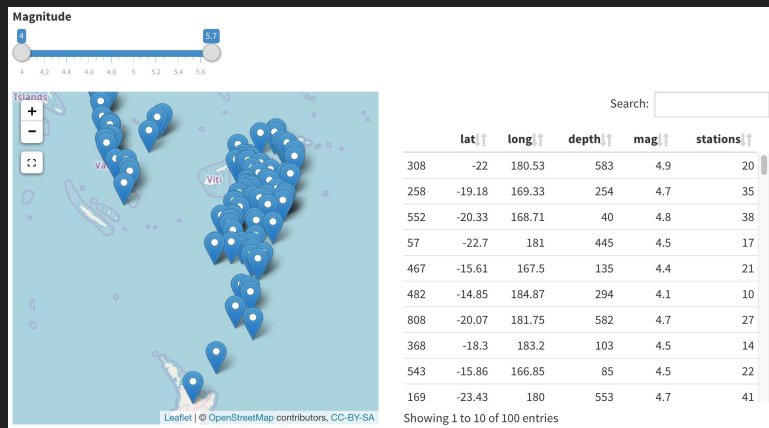
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- Rmarkdown using Crosstalk

# Compare with Rmarkdown

- Rmarkdown to HTML may be sufficient
- Take advantage of [htmlwidgets](#)
- With [crosstalk](#), you can even:
  - Add widgets (select box, slider) to filter (rows only)
  - Apply to map (leaflet), table (DT) and plots (plotly)



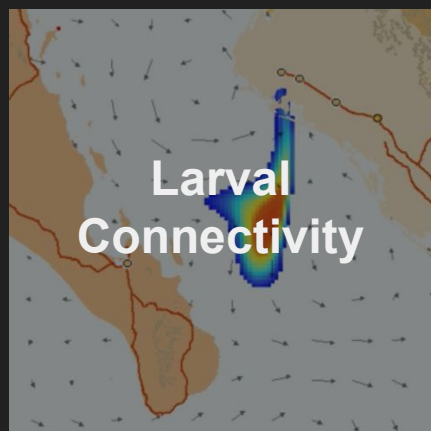
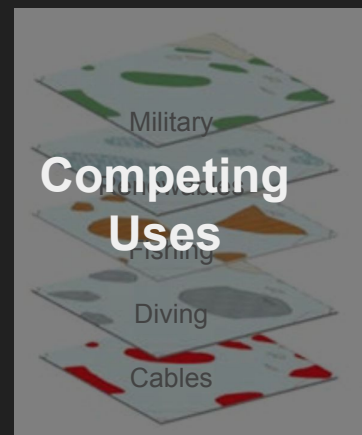
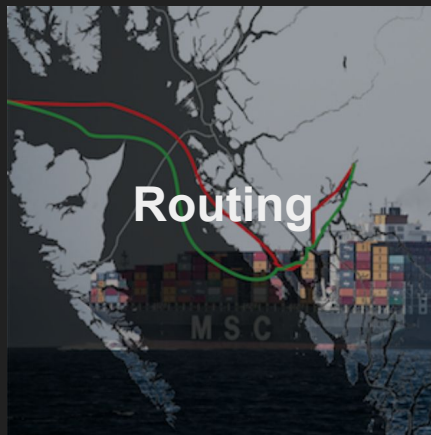
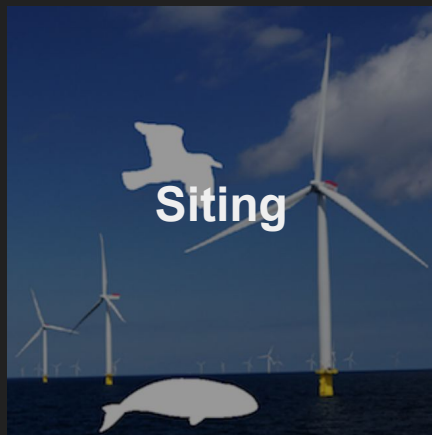
# Resources

- [Gallery](#)
- [Cheatsheet](#)
- [Tutorials](#)
- [Articles](#)

Articles			
Start	> Build	> Improve	> Share
<a href="#">Your first Shiny app</a>	Structure	Refactor	Deployment
<a href="#">Help</a>	Standalone apps	Code quality	Distribution
	Interactive documents	Testing	Bookmarking
	Dashboards	Modules	
	Gadgets	Scale	
	Backend	Measure usage	
	Reactivity	Performance	
	Data	Profiling	
	Frontend	Tuning	
	User interface		
	Graphics & visualization		
	Shiny extensions		
	Customizing Shiny		

- [Reactivity](#): [isolate\(\)](#), [session\\$clientData](#), [observeEvent\(\)](#) / [observe\(\)](#) with buttons
- [Debugging](#), eg with [profvis](#)
- UI: [layout guide](#)
  - Styling of [apps](#) / [shinydashboard](#)
  - [Bootstrap 3](#): CSS, JS, [modal dialogs](#)
  - [build a JS htmlwidget](#)
- Data: [upload files](#), [downloadable reports](#), [bookmarking state](#), [dplyr](#) and [pool](#) to query a [database](#)
- Helper packages: [shinydashboard](#)

# Example Apps





## Commonalities

- Interactive
- Online
- Open-source
- R, Shiny

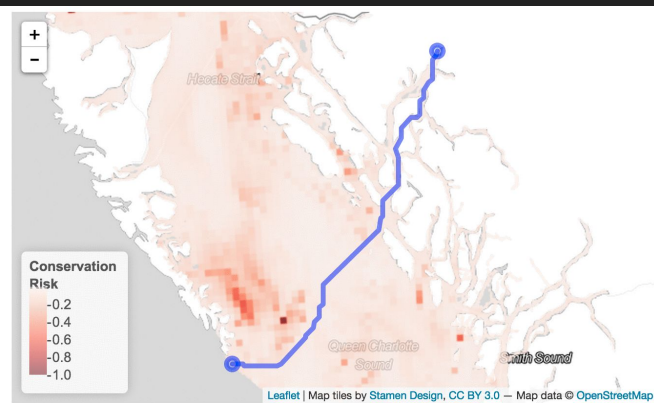
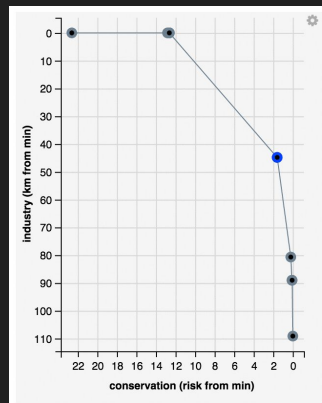
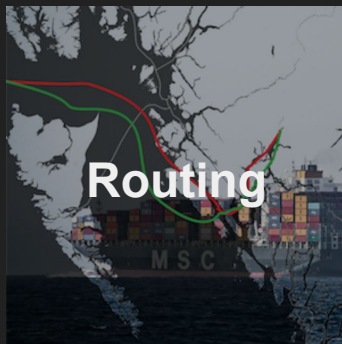
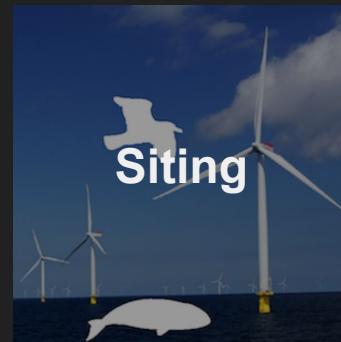
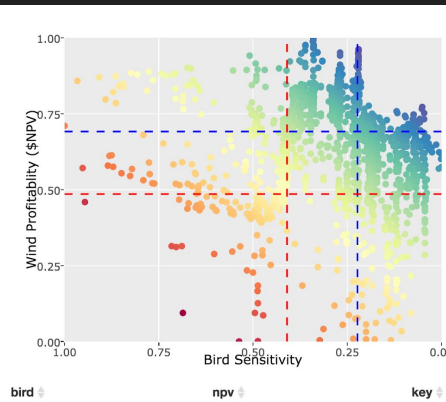
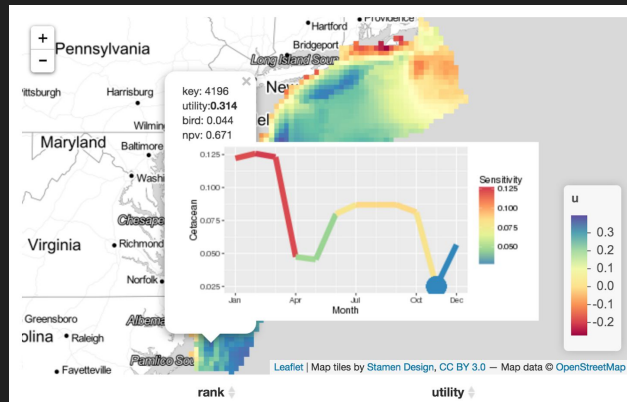
## Themes

- Decision support
- Dimensional
- Reductionist
- Tradeoffs
- Storytelling
- Reporting

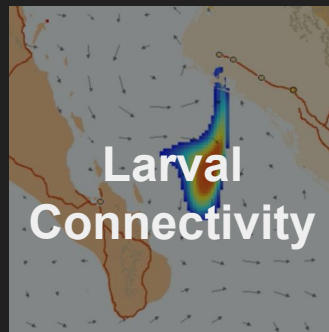
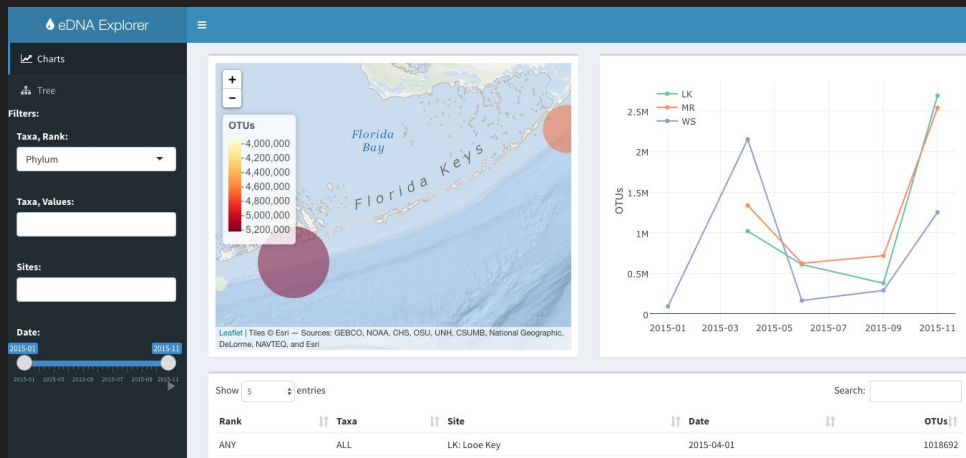
# Tradeoffs



Marine  
Geospatial  
Ecology Lab •  
Duke University



# Dimensional



## Larval Connectivity Explorer

Direction

Import

Sanctuary

Monterey Bay

Year

Normal (2009)

Pelagic larval duration (days)

10

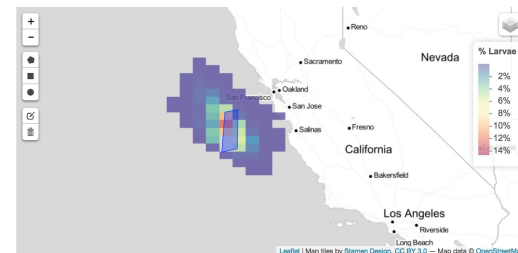
Radius Extent/Cell Size (km)

300/27

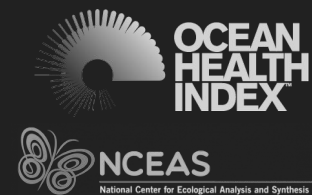
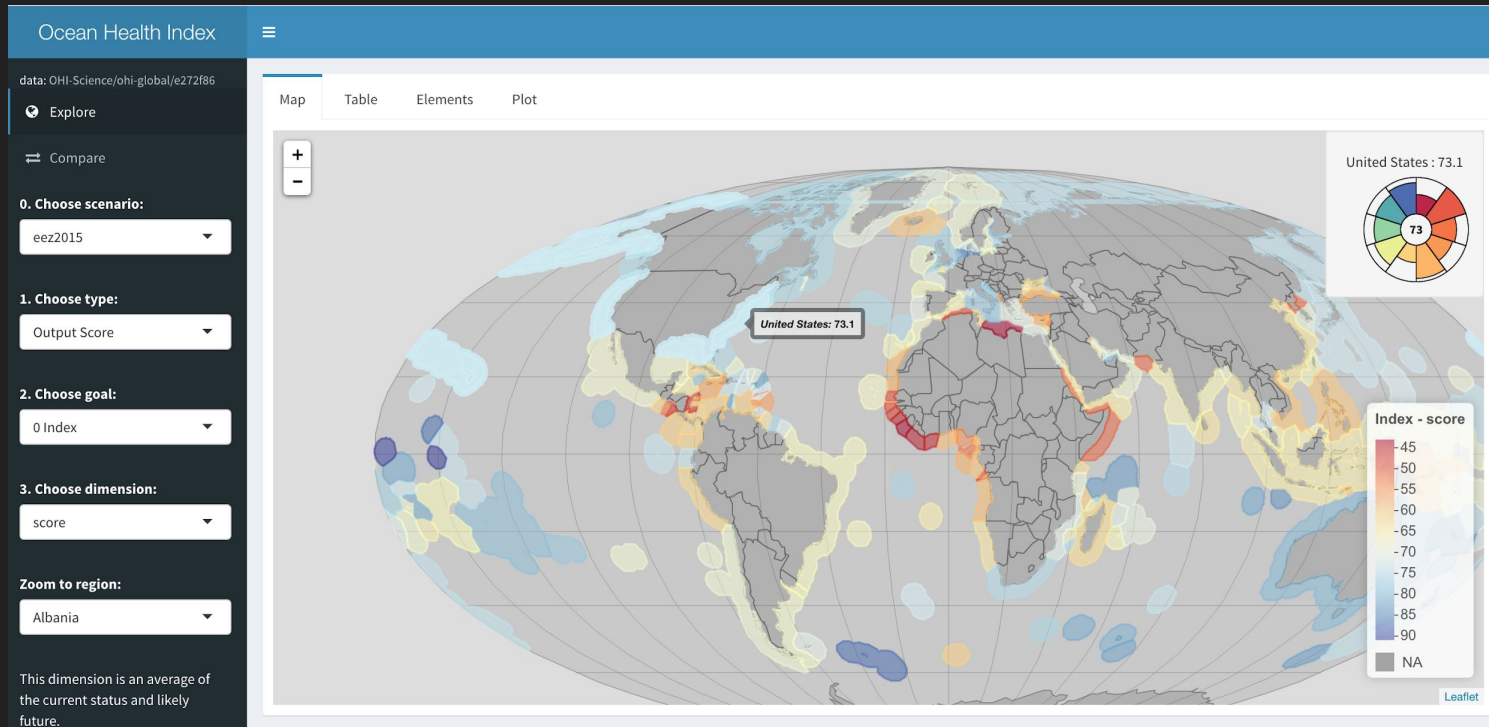
Date

01\_25\_2009

☒ Self-recruitment



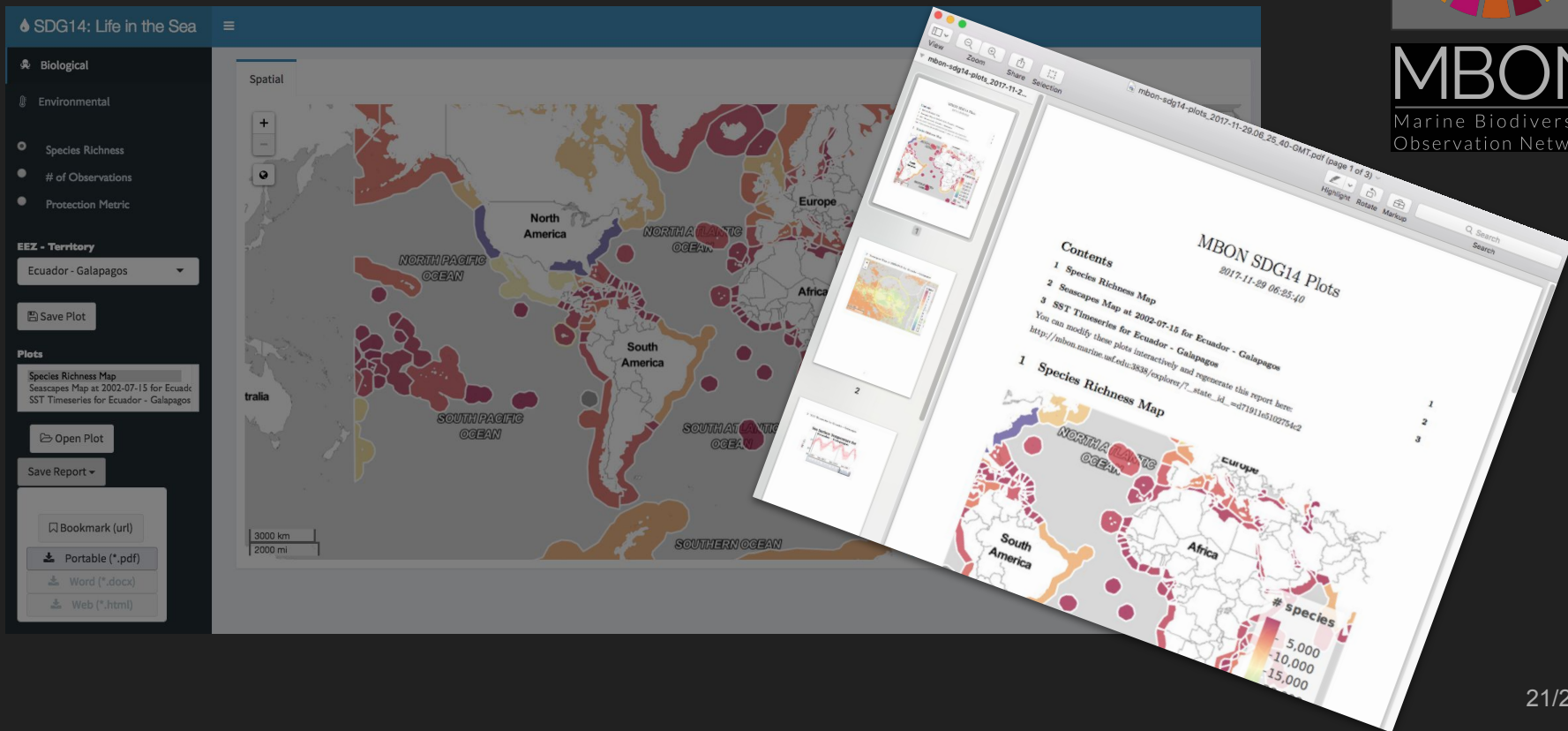
# Reductionist



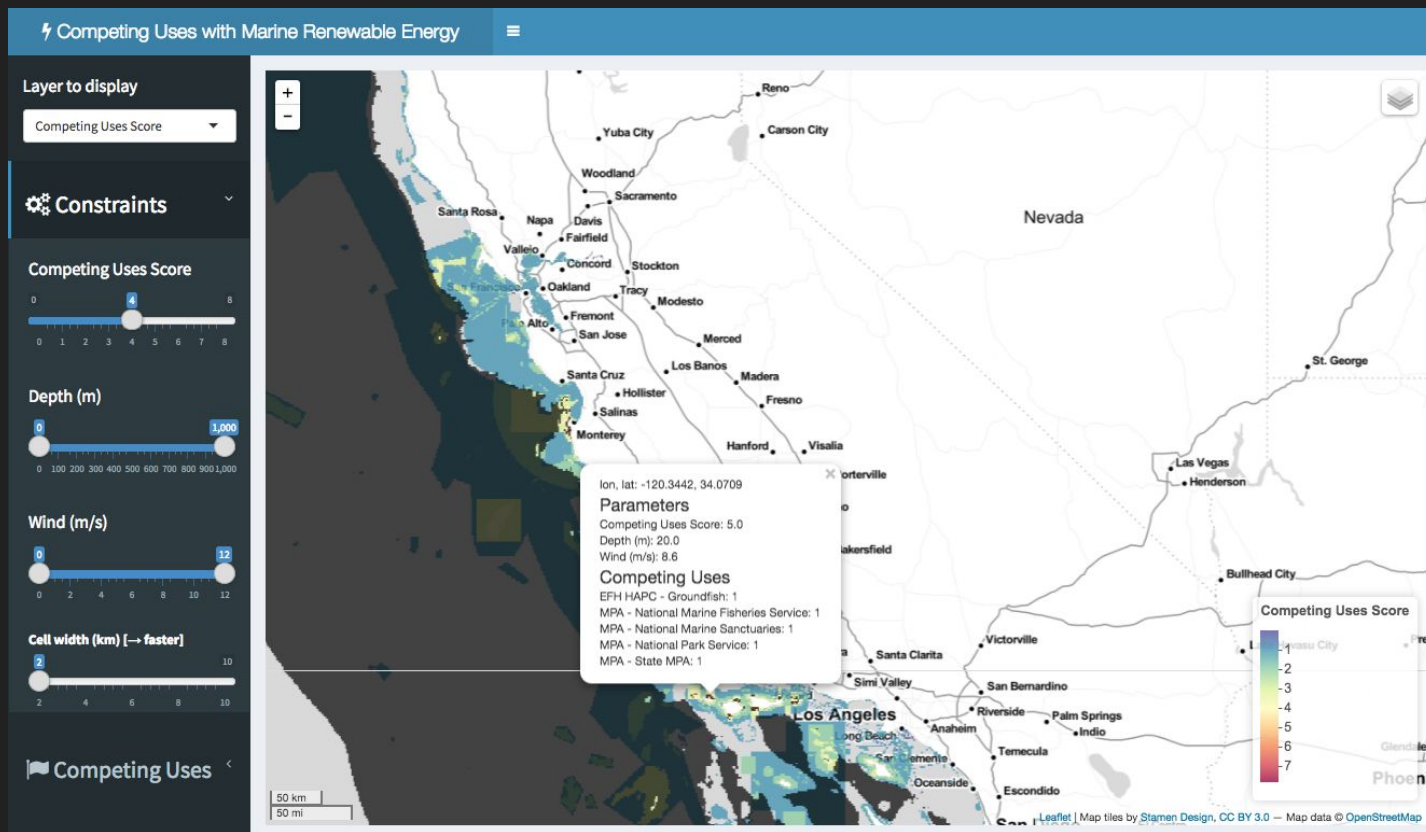
# Reporting



**MBON**  
Marine Biodiversity  
Observation Network



# Decision Support



# Links

- Siting

- App: [shiny.env.duke.edu/bbest/siting](https://shiny.env.duke.edu/bbest/siting)
- Code: [github.com/bbest/siting](https://github.com/bbest/siting)

- Routing

- App: [shiny.env.duke.edu/bbest/routing](https://shiny.env.duke.edu/bbest/routing)
- Code: [github.com/bbest/routing](https://github.com/bbest/routing)

- Ocean Health

- App: [ecoquants.shinyapps.io/ohi-global](https://ecoquants.shinyapps.io/ohi-global)
- Code: [github.com/bbest/ohi-global/tree/app](https://github.com/bbest/ohi-global/tree/app)

- Competing Uses

- App: [ecoquants.shinyapps.io/nrel-uses](https://ecoquants.shinyapps.io/nrel-uses)
- Code: [github.com/ecoquants/nrel-uses/tree/master/app](https://github.com/ecoquants/nrel-uses/tree/master/app)

- eDNA

- App: [ecoquants.shinyapps.io/edna-vis](https://ecoquants.shinyapps.io/edna-vis)
- Code: [github.com/marinebon/edna-vis](https://github.com/marinebon/edna-vis)

- Larval Connectivity

- App: [mbon.marine.usf.edu:3838/conn](https://mbon.marine.usf.edu:3838/conn)
- Code: [github.com/marinebon/sdg14-shiny/tree/master/conn](https://github.com/marinebon/sdg14-shiny/tree/master/conn)

- Infographics

- App: [mbon.marine.usf.edu](https://mbon.marine.usf.edu)
- Code: [github.com/marinebon/infographiq](https://github.com/marinebon/infographiq)

- Explorer

- App: [mbon.marine.usf.edu:3838/explorer](https://mbon.marine.usf.edu:3838/explorer)
- Code: [github.com/marinebon/sdg14-shiny/tree/master/explorer](https://github.com/marinebon/sdg14-shiny/tree/master/explorer)