Fish In Hot Water: Made for Chart Challenge

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Set up

Load libraries

```
# Load libraries
library(tidyverse)
library(readr)
library(scales)
```

Load files

Copy-pasted data from paper to a csv. Paper is here: https://afspubs.onlinelibrary.wiley.com/doi/full/10.1002/mcf2.10076

```
fish_data <- read_csv("in/fish_data.csv")
```

```
## Rows: 12 Columns: 11
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (3): species, period, variable
## dbl (8): RCP_26, RCP_26_CI, RCP_45, RCP_45_CI, RCP_60, RCP_60_CI, RCP_85, RC...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
fish_data_origin_dates <- read_csv("in/fish_data_origin_dates.csv")
```

```
## Rows: 4 Columns: 6
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (6): species, variable, RCP_26, RCP_45, RCP_60, RCP_85
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

This extra data came from the author in personal communications 04/03/2023

I modified the spreadsheet to be more R friendly

It's a time series record spanning 1950-2099 of fish spawning onset and cessation dates (modeled values)

Maybe we can use this later to make a probability of spawning on the y axis. for now, we don't need it.

Get data ready for plotting

```
# change to factors
fish_data <- fish_data |>
  mutate(species = factor(species, levels = c("American Shad", "Striped Bass")),
         variable = factor(variable, levels = c("Onset", "Cessation", "Duration")),
         period = factor(period, levels = c("Historical", "Future")))

# take out duration and confidence intervals
fish_data <- fish_data[fish_data$variable %in% c("Onset", "Cessation"), ]
fish_data_uncertainty <- select(fish_data, -c("RCP_26", "RCP_45", "RCP_60", "RCP_85")) # save this to b
fish_data <- select(fish_data, -c("RCP_26_CI", "RCP_45_CI", "RCP_60_CI", "RCP_85_CI"))


# prep origin dates
fish_data_origin_dates <- gather(fish_data_origin_dates, condition, origin_date, RCP_26:RCP_85)
fish_data_origin_dates$origin_date <- as.Date(fish_data_origin_dates$origin_date, format = "%m/%d/%Y")

# add in origin dates
fish_data_long <- gather(fish_data, condition, value, RCP_26:RCP_85)
fish_data_long <- full_join(fish_data_long, fish_data_origin_dates, by = c("species", "variable", "condi
fish_data_long$end_date <- fish_data_long$origin_date + fish_data_long$value

# bring in uncertainty
fish_data_uncertainty_long <- gather(fish_data_uncertainty, condition, confidence_interval, RCP_26_CI:RC
fish_data_uncertainty_long$condition <- substr(fish_data_uncertainty_long$condition, 1, 6)
```

Set up main plot

Theme:

```
theme_usgs <- function(legend.position = "right"){
  theme(
    plot.title = element_text(vjust = 3, size = 14, face = "bold", family="sans"),
    plot.subtitle = element_text(vjust = 3, size = 12,family="sans"),
    panel.border = element_rect(colour = "black", fill = NA, linewidth = 0.1),
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    panel.background = element_rect(fill = "white"),
    legend.background = element_blank(),
    legend.justification=c(0, 0),
    legend.position = legend.position,
    legend.key = element_blank(),
    legend.title = element_blank(),
    legend.text = element_text(size = 10),
    axis.title.x = element_text(size = 10, family="sans"),
    axis.title.y = element_text(vjust = 1, angle = 90, size = 9, family="sans"),
    axis.text.x = element_text(size = 10, vjust = -0.25, colour = "black",
                               family="sans", margin=margin(10,5,20,5,"pt")),
    axis.text.y = element_text(size = 10, hjust = 1, colour = "black",
                               family="sans", margin=margin(5,10,10,5,"pt")),
    axis.ticks = element_line(colour = "black", linewidth = 0.1),
```

```
    axis.ticks.length = unit(-0.25 , "cm")
  )
}
```

Prep data for plot:

```
# make into wide format for plot
fish_data_long <- fish_data_long |>
  select(-c(origin_date, value))
fish_data_wide <- spread(fish_data_long, variable, end_date)
names(fish_data_wide)[names(fish_data_wide)=="Onset"] <- "onset"
names(fish_data_wide)[names(fish_data_wide)=="Cessation"] <- "cessation"

# bring in uncertainty
fish_data_uncertainty_wide <- spread(fish_data_uncertainty_long, variable, confidence_interval)
names(fish_data_uncertainty_wide)[names(fish_data_uncertainty_wide)=="Onset"] <- "onset_ci"
names(fish_data_uncertainty_wide)[names(fish_data_uncertainty_wide)=="Cessation"] <- "cessation_ci"

fish_data_wide <- full_join(fish_data_wide, fish_data_uncertainty_wide, by = c("species", "period", "co

# add in y location for segment plot
y_location <- tibble(condition = c("RCP_26", "RCP_45", "RCP_60", "RCP_85"),
                     y = rep(c(1:4)*2 + 5))
fish_data_wide <- full_join(fish_data_wide, y_location, by = c("condition"))

# offset the y locations and mess with spacing for historical vs. future so they slightly overlap but d
fish_data_wide <- fish_data_wide |>
  mutate(y_offset = ifelse(period == "Historical", y - 0.5, y))
```

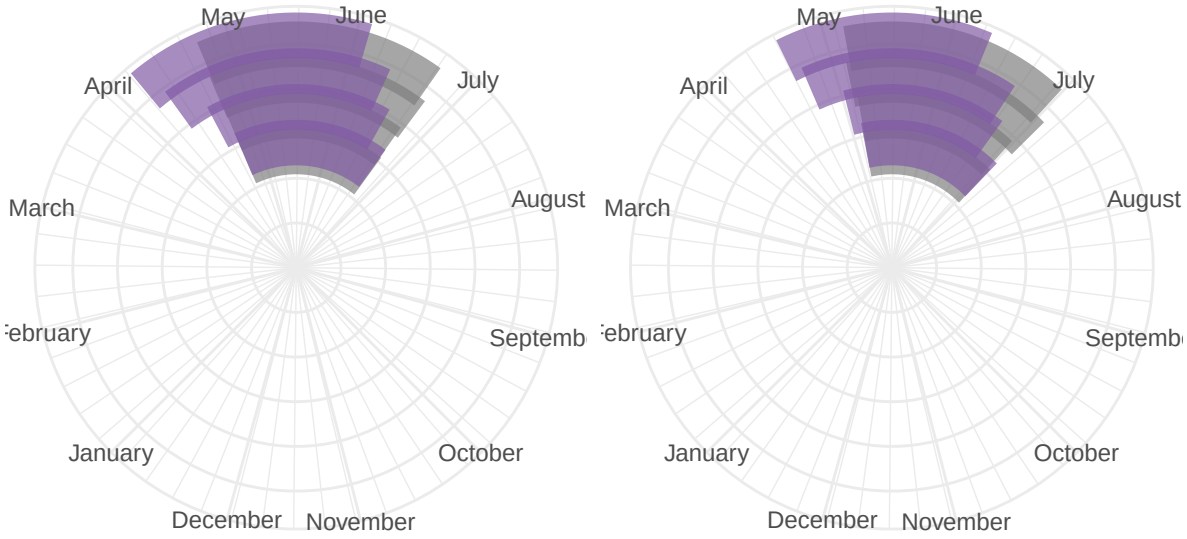
Produce plots

```
# Main base plot
ggplot(data = fish_data_wide) +
  # geom_segment(data = fish_data_long_2, aes(x = min_onset, xend = max_end, y = y, yend = y), col = "g
  # geom_segment(data = fish_data_long_2, aes(x = min_onset, xend = max_end, y = y, yend = y), col = "#
  geom_segment(aes(x = onset, xend = cessation, y = y_offset, yend = y_offset, col = period, alpha = pe
  scale_color_manual(values = c("grey50", "#815aa5")) +
  scale_alpha_manual(values = c(0.7, 0.7)) + # use alpha = 1 to take out historical
  scale_x_date(limits = c(as.Date("2015-01-01"), as.Date("2015-12-31")), date_breaks = "1 month", date_
  scale_y_continuous(limits = c(0, 13)) +
  coord_polar(theta = "x", direction = 1, start = -1.57*1.5) + # start is in radians, 90 Deg is Jan
  facet_wrap(~species) +
  labs(x = "",
       y = "",
       title = "FISH IN HOT WATER",
       subtitle = "Under projected climate change scenarios, the American Shad and Striped Bass of the
       # caption = "Data Source: Nack, C. et. al. (2019). https://doi.org/10.1002/mcf2.10076
       # Plot made by Ellie White, ewhite@usgs.gov 04/02/2023"
       ) +
  theme_bw()+
  theme(plot.title = element_text(vjust = 3, size = 14, face = "bold", family="sans"),
```

```
        plot.subtitle = element_text(vjust = 3, size = 12,family="sans"),
        axis.text.y = element_blank(),
        axis.ticks = element_blank(),
        panel.border = element_blank(),
        strip.background = element_blank(),
        strip.text.x = element_blank())
```

FISH IN HOT WATER

Under projected climate change scenarios, the American Shad and Striped Bass of t




```
ggsave("out/11_circular_ewhite_base.png", width = 16, height = 9, units = "in", dpi = 1200)
```

Supporting information

Key takeaways of this viz (1-2 sentences each)

1. The American Shad and the Striped Bass are migratory species needing both freshwater and marine habitats to complete their life cycle. This makes them particularly vulnerable to human activities. The Hudson River Shad has declined in stock so much that all its fisheries were closed in 2010. The Striped Bass, while declining in relative abundance, still remains the most important game fish in the Hudson River.

Data source(s)

Paper is here: https://afspubs.onlinelibrary.wiley.com/doi/full/10.1002/mcf2.10076

Citation: Nack, C. C., Swaney, D. P., & Limburg, K. E. (2019). Historical and projected changes in spawning Phenologies of American Shad and Striped bass in the Hudson River Estuary. Marine and Coastal Fisheries, 11(3), 271-284.

DOI: https://doi.org/10.1002/mcf2.10076

Process

1) produced `out/[day]_ewhite_base.png` with ggplot
2) made markups in powerpoint
3) final plot is called `out/[day]_ewhite_final.png`