Technical Indicator Assembly Document for NOAA NaMES

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Overview

The National Marine Ecosystem Status web portal provides the status of marine ecosystems across the U.S. and access to NOAA ecosystem indicator information and data. This website is designed to document the data sources and methods used to create the indicators displayed on the site.

0.1 Definition of Indicators

Ecosystem indicators are quantitative and/or qualitative measures of key components of the ecosystem. Marine ecosystems provide food, jobs, security, well-being, and other services to millions of people across the U.S. Yet, marine ecosystems and the people that rely on them are facing increasingly complex challenges. Tracking the status and trends of ocean and coastal ecosystems is critically important to understand how these ecosystems are changing and identify potential issues.

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Chapter 5

Seabirds

Seabirds are a vital part of marine ecosystems and valuable indicators of an ecosystem's status. Seabirds are attracted to fishing vessels and frequently get hooked or entangled in fishing gear, especially longline fisheries. This is a common threat to seabirds. Depending on the geographic region, fishermen in the United States often interact with albatross, cormorants, gannet, loons, pelicans, puffins, gulls, storm-petrels, shearwaters, terns, and many other species. We track seabirds because of their importance to marine food webs, but also as an indication of efficient fishing practices. We present estimates of seabird abundance in the Alaska, California Current, Gulf of Mexico and Northeast regions.

5.1 Data

Data for Alaska, California Current, and the Gulf of Mexico were obtained from the regional NOAA Integrated Ecosystem Assessment Program teams that produce indicators and Ecosystem Status Report. The links for each of the datasets can be found here:

Alaska: https://apps-afsc.fisheries.noaa.gov/refm/reem/ecoweb/csv/table/Seabird.csv

California Current: https://oceanview.pfeg.noaa.gov/erddap/tabledap/cciea_B_AS_DENS.csv?time,density_anomaly&species_cohort=%22Cassins%20auklet%20(So%20CC,%20Spring)%22

Gulf of Mexico: https://github.com/mandykarnauskas/GoM-Ecosystem-Status-Report/blob/master/data/bird_standardized_abundancesFINAL.csv

Seabird count and transect length data for the Northeast are extracted from the Atlantic Marine Assessment Program for Protected Species (AMAPPS) annual reports. Counts are summed and divided by the sum of the transect length in nautical miles. For more information see https://www.nefsc.noaa.gov/psb/AMAPPS/

5.2 Methods

5.2.1 Alaska

The Multivariate Breeding Index variable from the Eastern Bering Sea Ecosystem Status Report is currently used to represent seabirds for the NaMES Alaska Region. That data can be downloaded manually by clicking https://apps-afsc.fisheries.noaa.gov/refm/reem/ecoweb/csv/table/Seabird.csv.

5.2.2 California Current

The Density Anomaly for Cassin's Auklets in the Southern California Current (Spring) are used to represent the seabird indicator for the NaMES California Current region. Because this is an anomaly variable, the values for previous years will change every year - therefore, the entire dataset must be downloaded and replaced each year. The data can be downloaded manually by clicking https://oceanview.pfeg.noaa.gov/erddap/tabledap/cciea_B_AS_DENS.csv?time,density_anomaly&species_cohort=%22Cassins%20auklet%20(So%20CC,%20Spring)%22

5.2.3 Gulf of Mexico

The GoA IEA team produces a standardized seabird relative abundance variable that is stored at https://github.com/mandykarnauskas/GoM-Ecosystem-Status-Report/blob/master/data/bird_standardized_abundancesFINAL.csv. As of this writing, the data had not been updated since 2020 and only go until 2015.

5.2.4 Northeast

The northeast seabirds indicator is compiled using the AMAPPS Annual report each year. This indicator is compiled completely manually. The reports can be found at https://www.nefsc.noaa.gov/psb/AMAPPS/. To calculate the indicator score for each year, one must go to the Seabirds -> Results section of a corresponding year's report and identify the paragraphs containing the "Total seabirds seen," "Total Seen in Zone," and the "Nautical Miles Surveyed" values. Then, those values for each cruise should be input into this google sheet (https://docs.google.com/spreadsheets/d/1-g_d9eMWUchbm2xojlRG8Q_y7xzbtcyU1bHriW2ua4U/edit#gid=0). Finally, using the google sheet, the total number of seabirds observed for the entire year should be divided by the total nautical miles surveyed. That result produces the indicator score and should be manually input into the data file.

Chapter 6

Overfished Stocks

Fish play an important role in marine ecosystems, supporting the ecological structure of many marine food webs. Caught by recreational and commercial fisheries, fish support significant parts of coastal economies, and can play an important cultural role in many regions. To understand the health of fish populations - as well as their abundance and distribution, we regularly assess fish stocks - stock assessments. Assessments let us know if a stock is experiencing overfishing or if it is overfished i.e. how much catch is sustainable while maintaining a healthy stock. And, if a stock becomes depleted, stock assessments can help determine what steps may be taken to rebuild it to sustainable levels. Understanding stock assessments helps measure how well we're managing and recovering fish stocks over time.

We present the number of overfished stocks by year in all regions.

6.1 Data

Data are obtained from the NOAA Fisheries Fishery Stock Status website https://www.fisheries.noaa.gov/national/population-assessments/fishery-stock-status-updates. Stocks that meet the criteria for overfished status are summed by year for each region. The status of stocks are available in report form and graphically.

6.2 Methods

This indicator is compiled manually.

After traveling to https://www.fisheries.noaa.gov/national/population-assessments/fishery-stock-status-updates, identify the most up to date status report. The reports should be available in two formats - through a report and through a visual.

The easiest way to compile the data are using the visual, which should be named "Stocks on the Overfished and Overfishing Lists by Region." After opening the visual (example below), overfished stocks will be displayed by sqaures and sorted spatially by region. We are only counting the "Overfished" stocks - do not count stocks that are only on the "Overfishing" list.

```
knitr::include_graphics(rep("overfished.png"))
```

North Pacific corresponds to the Alaska Region, Pacific corresponds to the California Current, Western Pacific corresponds to Hawaii (but be sure not to count the pacific island specific complexes), and New England corresponds to North Atlantic.

For more information, contact Willem Klajbor (willem.klajbor@noaa.gov) or Stephanie Oakes (stephanie.oakes@noaa.gov).

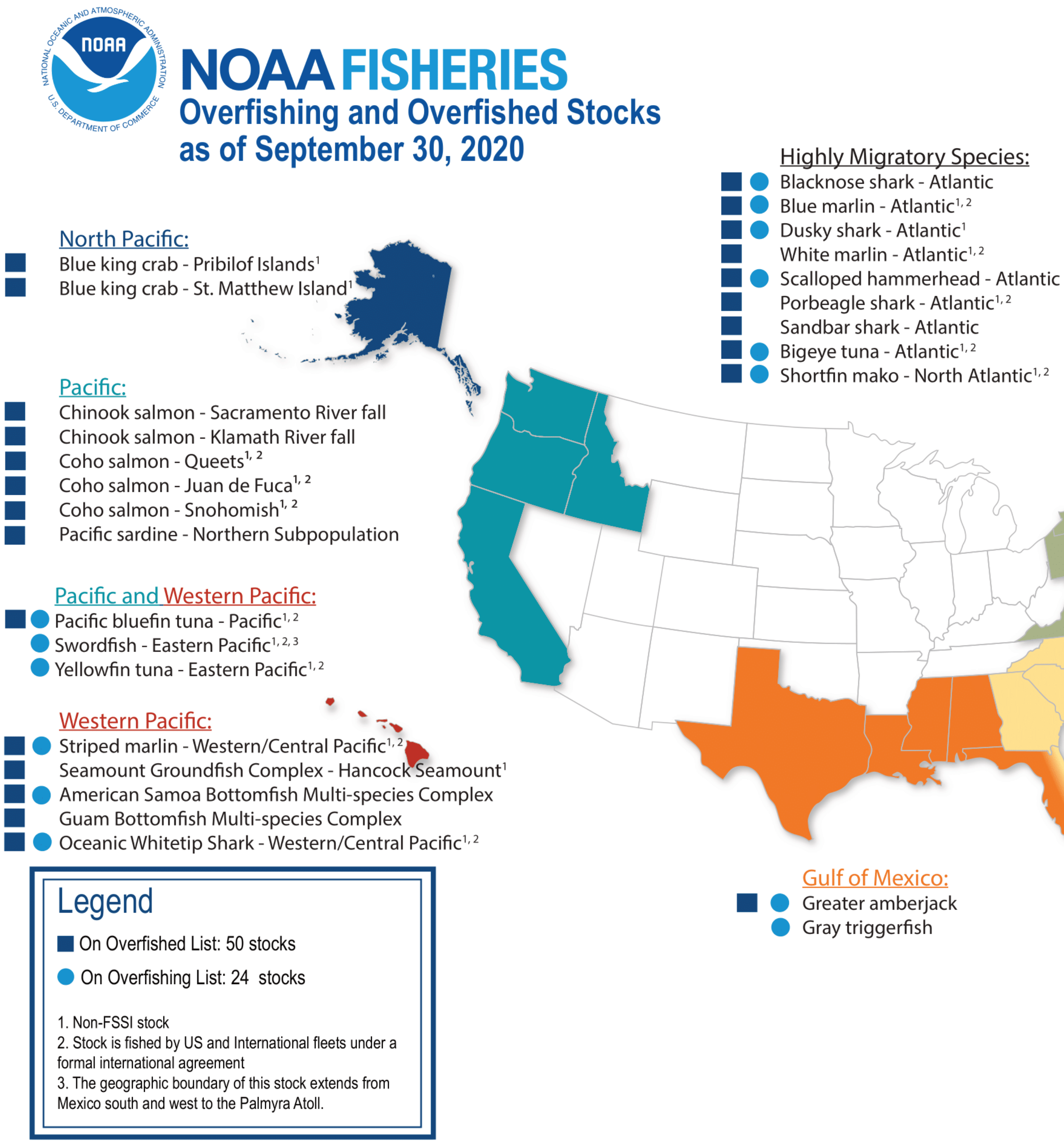

Figure 6.1: NOAA Fisheries 2020 Q4 Stock Status Map

Chapter 7

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7.2 MMPA

7.2.1 Data

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Chapter 9

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Chapter 11

Sea Ice

Unlike icebergs, glaciers, ice sheets, and ice shelves, which originate on land, sea ice forms, expands, and melts in the ocean. Sea ice influences global climate by reflecting sunlight back into space. Because this solar energy is not absorbed into the ocean, temperatures nearer the poles remain cool. When sea ice melts, the surface area reflecting sunlight decreases, allowing more solar energy to be absorbed by the ocean, causing temperatures to rise. This creates a positive feedback loop. Warmer water temperatures delay ice growth in the autumn and winter, and the ice melts faster the following spring, exposing dark ocean waters for longer periods the following summer.

Sea ice affects the movement of ocean waters. When sea ice forms, ocean salts are left behind. As the seawater gets saltier, its density increases, and it sinks. Surface water is pulled in to replace the sinking water, which in turn becomes cold and salty and sinks. This initiates deep-ocean currents driving the global ocean conveyor belt.

Sea ice is an important element of the Arctic system. It provides an important habitat for biological activity, i.e. algae grows on the bottom of sea ice, forming the basis of the Arctic food web, and it plays a critical role in the life cycle of many marine mammals - seals and polar bears. Sea ice also serves a critical role in supporting Indigenous communities culture and survival. We present the annual sea ice extent in millions of Kilometers for the Arctic region.

11.1 Data

Sea ice data was accessed from the NOAA National Centers for Environmental Information, https://www.ncdc.noaa.gov/snow-and-ice/extent/ , with the data pulled from here: https://www.ncdc.noaa.gov/snow-and-ice/extent/sea-ice/N/3/data.csv. The data are plotted in units of million square km.

11.2 Methods

To download the current sea ice data, you can either:

1) Copy/paste the following url into your web browser: https://www.ncdc.noaa.gov/snow-and-ice/extent/sea-ice/N/3/data.csv

or

2) Use the following R code to download the data and import it into your RStudio environment

```
url <-"https://www.ncdc.noaa.gov/snow-and-ice/extent/sea-ice/N/3/data.csv"
# Specify destination where file should be saved
destfile <- "C:/Users/ ... Your Path ... /my folder/output.csv"
#Apply download.file function in R
download.file(url, destfile)
```

Data were restructured and gauge values were calculated manually.

For more information, contact Willem Klajbor (willem.klajbor@noaa.gov) or Scott Cross (scott.cross@noaa.gov).

Chapter 12

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Chapter 19

Billion Dollar Disasters

In the United States the number of weather and climate-related disasters exceeding 1 billion dollars has been increasing since 1980. These events have significant impacts to coastal economies and communities. The Billion Dollar Disaster indicator provides information on the frequency and the total estimated costs of major weather and climate events that occur in the United States. This indicator compiles the annual number of weather and climate-related disasters across seven event types. Events are included if they are estimated to cause more than one billion U.S. dollars in direct losses. The cost estimates of these events are adjusted for inflation using the Consumer Price Index (CPI) and are based on costs documented in several Federal and private-sector databases. We present the total annual number of disaster events for all regions.

19.1 Data

Billion dollar disaster event frequency data are taken from NOAA's National Centers for Environmental Information (https://www.ncdc.noaa.gov/billions/). The number of disasters within each region were summed for every year of available data. Although the number is the count of unique disaster events within a region, the same disaster can impact multiple regions, meaning a sum across regions will overestimate the unique number of disasters.

19.2 Methods

The Billion Dollar Event Frequency Data displayed on the website were compiled using the following code:

```
PKG <- c("foreign","stringr","data.table")

for (p in PKG) {
  if(!require(p,character.only = TRUE)) {
    install.packages(p)
    require(p,character.only = TRUE)}
}

#states <- c("AK","AL","AR","AZ","CA","CO","CT","DE","FL","GA","HI",
#             "IA","ID","IL","IN","KS","KY","LA","MA","MD","ME","MI",
#             "MN","MO","MS","MT","NC","ND","NE","NH","NJ","NM","NV",
#             "NY","OH","OK","OR","PA","RI","SC","SD","TN","TX","UT",
#            "VA","VT","WA","WI","WV","WY")

states <- c("AK","AL","CA","CT","DE","FL","GA","HI",
            "LA","MA","MD","ME",
            "MS","NC","NH","NJ",
            "NY","OR","PA","RI","SC","TX",
            "VA","WA","PR","VI")

#Update Year in URL (2021)
Billion_Storm <- NULL
for (x in states) {
  temp <- tempfile()
  temp.connect <- url(paste0("https://www.ncdc.noaa.gov/billions/events-",x,"-1980-202
  temp <- data.table(read.delim(temp.connect, header=TRUE,fill=FALSE, stringsAsFactors=
  temp$State <- x
  Billion_Storm <- rbind(Billion_Storm,temp)
  unlink(temp)
  rm(temp)
}

Billion_Storm$Begin.Date <- as.character(Billion_Storm$Begin.Date)
Billion_Storm$Begin.Year <-  substr(Billion_Storm$Begin.Date,1,4)
Billion_Storm$Begin.Date <- as.Date(Billion_Storm$Begin.Date,"%Y %m %d")
Billion_Storm$End.Date <- as.character(Billion_Storm$End.Date)
Billion_Storm$End.Year <-  substr(Billion_Storm$End.Date,1,4)
Billion_Storm$End.Date <- as.Date(Billion_Storm$End.Date,"%Y %m %d")

Gulf.of.Mexico <- c("FL","AL","LA","MS","TX")
Northeast <- c("NC","VA","MD","DE","PA","NJ","NY","CT","RI",
               "MA","NH","ME")
Southeast <- c("SC","GA","FL")
California.Current <- c("CA","OR","WA")
Alaska<- c("AK")
```

```
Hawaii <- c("HI")
Caribbean <- c("PR","VI")

Storm_Freq <- NULL
for (x in c("Gulf.of.Mexico","Northeast","Southeast","California.Current","Alaska","Hawaii","Cari
  TEMP <- Billion_Storm[which(Billion_Storm$State%in%get(x)),]
  TEMP$Disaster <- TEMP$Begin.Date <- TEMP$End.Date <- TEMP$Deaths <- TEMP$State <- TEMP$Begin.Ye
  TEMP <- unique(TEMP)
  colnames(TEMP)<- c('Name','Frequency','End.Year')
  TEMP <- aggregate(Frequency~End.Year, data=TEMP, FUN=length)
  TEMP$Region <- x
  assign(paste0(x,"_Data", sep=""),TEMP)
  Storm_Freq <- rbind(Storm_Freq,TEMP)
  rm(TEMP)
}

Storm_Freq_F <- spread(Storm_Freq,Region,Frequency)

write.csv(Storm_Freq_F,file="C:/Users/... your path.../Billion_Dollar_Storms_1980_Present.csv")
rm(list=ls())
```

Gauge values counted manually.

For more information, please contact Willem Klajbor (willem.klajbor@noaa.gov) or Kate Quigley (kate.quigley@noaa.gov).

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Beach Closures

20.1 Data

Under Construction

20.2 Methods

Under construction

Chapter 21

Marine Species Distribution

21.1 Data

Under Construction

21.2 Methods

Under construction