File S1. R-script for the statistical analyses of bigeye and yellowfin tunas in the Indian Ocean. Information about the script (not run) are preceded by a hash symbol (#) and shaded in grey.

```
# Loading the packages into R environment
library(zoo)
library(tidyverse)
library(ggplot2)
library(mgcv)

# Set the working Directory
setwd("E:/1_Paper/IOD Paper/Data/use std cpue/")

#As the original DMI data is monthly, covert the data to quarterly to match the CPUE data
DMI<- read.csv ("DMI.csv", header = T, sep=",")

ym <- as.yearmon(paste(DMI$year, DMI$month), "%Y %m")
DMI$yq <- as.yearqtr(ym)

DMI_qtr <- DMI %>%
        group_by(yq) %>%
        summarise_all(mean)

write.table(DMI_qtr," DMI_qtr.csv",sep=",")

# Read data of bigeye and yellowfin tuna. Data include the CPUE and DMI.

Bigeye_IO<- read.csv("BET_IO.csv", header=T, sep=",")
Bigeye_R1<- read.csv("BET_R1.csv", header=T, sep=",")
Bigeye_R2<- read.csv("BET_R2.csv", header=T, sep=",")
Bigeye_R3<- read.csv("BET_R3.csv", header=T, sep=",")

Yellowfin_IO<- read.csv("YFT_IO.csv", header=T, sep=",")
Yellowfin_R1<- read.csv("YFT_R1.csv", header=T, sep=",")
Yellowfin_R2<- read.csv("YFT_R2.csv", header=T, sep=",")
Yellowfin_R3<- read.csv("YFT_R3.csv", header=T, sep=",")
Yellowfin_R4<- read.csv("YFT_R4.csv", header=T, sep=",")

# Run linear regression models

lm_bigeye_IO <- lm(CPUE ~ DMI, data = Bigeye_IO)
summary(lm_bigeye_IO)
```

```
lm_bigeye_R1 <- lm(CPUE ~ DMI, data = Bigeye_R1)
summary(lm_bigeye_R1)

lm_bigeye_R2<- lm(CPUE ~ DMI, data = Bigeye_R2)
summary(lm_bigeye_R2)

lm_bigeye_R3 <- lm(CPUE ~ DMI, data = Bigeye_R3)
summary(lm_bigeye_R3)

lm_yellowfin_IO <- lm(CPUE ~ DMI, data = Yellowfin _IO)
summary(lm_yellowfin_IO)

lm_yellowfin_R1 <- lm(CPUE ~ DMI, data = Yellowfin _R1)
summary(lm_yellowfin_R1)

lm_yellowfin_R2<- lm(CPUE ~ DMI, data = Yellowfin _R2)
summary(lm_yellowfin_R2)

lm_yellowfin_R3 <- lm(CPUE ~ DMI, data = Yellowfin _R3)
summary(lm_yellowfin_R3)

lm_yellowfin_R4 <- lm(CPUE ~ DMI, data = Yellowfin _R4)
summary(lm_yellowfin_R4)

#Plot results by ggplot2

p_bigeye_IO <- ggplot(Bigeye_IO, aes(x = DMI, y = CPUE)) +
    geom_point()+geom_smooth(method = "lm")+ggtitle("BET_IO")+
    labs(x= "DMI", y= "Standardized CPUE")+
    xlim(-0.5,1.25) + ylim(0,2.5)

p_bigeye_R1 <- ggplot(Bigeye_R1, aes(x = DMI, y = CPUE)) +
    geom_point()+geom_smooth(method = "lm")+ggtitle("BET_R1")+
    labs(x= "DMI", y= "Standardized CPUE")+
    xlim(-0.5,1.25) + ylim(0,2.5)

p_bigeye_R2 <- ggplot(Bigeye_R2, aes(x = DMI, y = CPUE)) +
    geom_point()+geom_smooth(method = "lm")+ggtitle("BET_R2")+
    labs(x= "DMI", y= "Standardized CPUE")+
    xlim(-0.5,1.25) + ylim(0,2.5)
```

```
p_bigeye_R3 <- ggplot(Bigeye_R3, aes(x = DMI, y = CPUE)) +
    geom_point()+geom_smooth(method = "lm")+ggtitle("BET_R3")+
    labs(x= "DMI", y= "Standardized CPUE")+
    xlim(-0.5,1.25) + ylim(0,2.5)


p_yellowfin_IO <- ggplot(Yellowfin_IO, aes(x = DMI, y = CPUE)) +
      geom_point()+geom_smooth(method = "lm")+ggtitle("YET_IO")+
      labs(x= "DMI", y= "Standardized CPUE")+
      xlim(-0.5,0.75) + ylim(0,1.75)

p_yellowfin_R1 <- ggplot(Yellowfin_R1, aes(x = DMI, y = CPUE)) +
      geom_point()+geom_smooth(method = "lm")+ggtitle("YET_R1")+
      labs(x= "DMI", y= "Standardized CPUE")+
      xlim(-0.5,0.75) + ylim(0,1.75)

p_yellowfin_R2 <- ggplot(Yellowfin_R2, aes(x = DMI, y = CPUE)) +
      geom_point()+geom_smooth(method = "lm")+ggtitle("YET_R2")+
      labs(x= "DMI", y= "Standardized CPUE")+
      xlim(-0.5,0.75) + ylim(0,1.75)

p_yellowfin_R3 <- ggplot(Yellowfin_R3, aes(x = DMI, y = CPUE)) +
      geom_point()+geom_smooth(method = "lm")+ggtitle("YET_R3")+
      labs(x= "DMI", y= "Standardized CPUE")+
      xlim(-0.5,0.75) + ylim(0,1.75)

p_yellowfin_R4 <- ggplot(Yellowfin_R4, aes(x = DMI, y = CPUE)) +
      geom_point()+geom_smooth(method = "lm")+ggtitle("YET_R4")+
      labs(x= "DMI", y= "Standardized CPUE")+
      xlim(-0.5,0.75) + ylim(0,1.75)

#Combine the plots

library(ggpubr)

ggarrange(p_bigeye_IO, p_bigeye_R1, p_bigeye_R2, p_bigeye_R3, ncol = 2, nrow = 2, labels = c("a","b","c","d"))

ggarrange(p_yellowfin_IO, p_ yellowfin _R1, p_ yellowfin _R2, p_ yellowfin _R3, p_ yellowfin _R4, ncol = 3, nrow = 2, labels = c("a","b","c","d","e",))
```

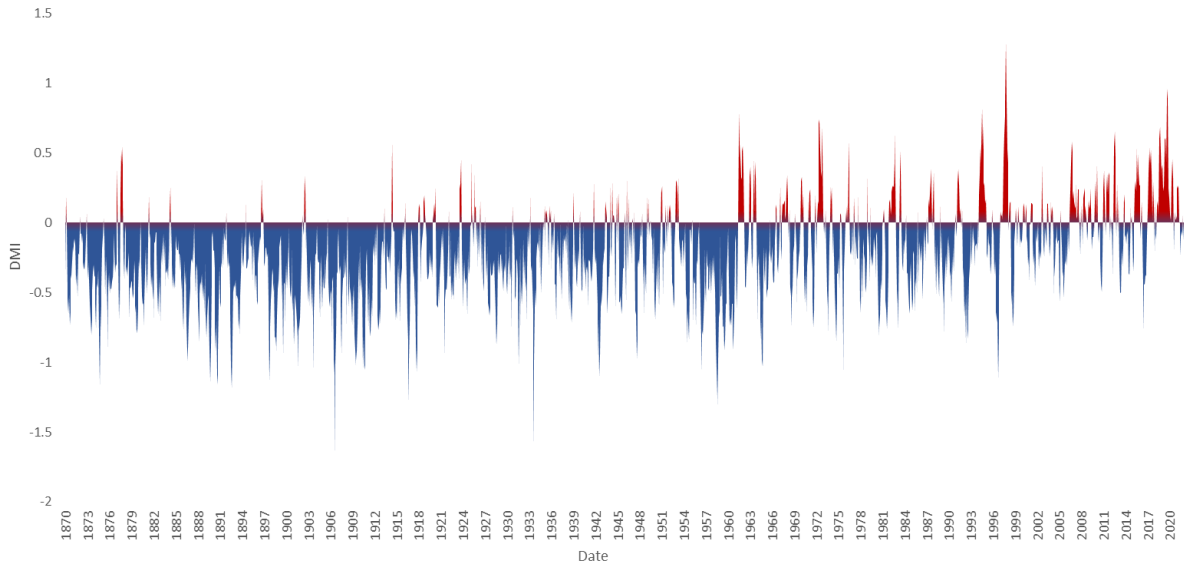

Figure S1. Distribution of DMI from 1870 to 2020. Positive DMI is referred to as positive IOD (red); negative DMI represents the negative IOD phenomenon (blue).