Algal turf and macroalgae productivity from the AIMS LTMP

Renato

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```
library(tidyverse)
library(brms)
library(tidybayes)
library(patchwork)
library(PNWColors)
```

Loading the two meta-analysis models

One developed to predict algal turf productivity from depth, and the other simply as an average macroalgal productivity (no predictors)

```
macr_prodmod <- readRDS('mods/macro_prod_brms.RDS')
turf_prodmod <- readRDS('mods/turf_prod_brms.RDS')
```

And loading the AIMS LTMP data for which they will be predicted

```
ltmp_cover <- read.csv('data/AIMS_LTMP_cover.csv') %>%
  mutate(cover=total_cover/100) %>%
    select(-X,-total_cover)

ltmp_depth <- read.csv('data/AIMS_LTMP_depths.csv') %>%
  mutate(REEF_NAME=tolower(gsub(' ','_', REEF_NAME))) %>%
  group_by(REEF_NAME, SITE_NO, REPORT_YEAR, TRANSECT_NO) %>%
  summarise(depth=mean(START_DEPTH), .groups='drop_last')

names(ltmp_depth) <- tolower(names(ltmp_depth))


ltmp <- left_join(
  ltmp_cover,
  ltmp_depth,
  by=c('reef_name','site_no','transect_no','report_year')
) %>%
  pivot_wider(names_from='group_code',
              values_from='cover') %>%
  rename(algal_turf = ta, macroalgae = ma)
```

Turf prediction coming

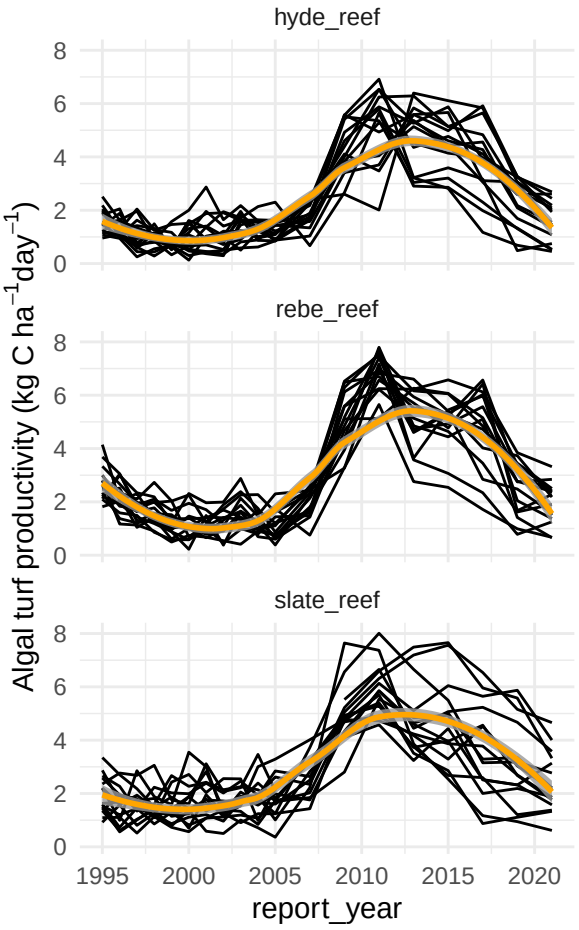
```
pred_val <- posterior_epred(turf_prodmod,
      newdata=ltmp %>% mutate(se_prod=0.1), ndraws=1000)

tot_turf_prod <- ((ltmp$algal_turf * t(pred_val)) * 10000)/1000
## in kg C ha day-1


# aggregating

ltmp_pred <- cbind(ltmp,
      turf_prod_kghaday_med=apply(tot_turf_prod,1,median),
      turf_prod_kghaday_lhd=apply(tot_turf_prod,1,function(x) median_hdci(x)$ymin),
      turf_prod_kghaday_uhd=apply(tot_turf_prod,1,function(x) median_hdci(x)$ymax))
```

But also macroalgae

```
pred_val2 <- posterior_epred(macr_prodmod,
      newdata=ltmp %>% mutate(se_prod=0.1), ndraws=1000)

tot_macr_prod <- ((ltmp$macroalgae * t(pred_val2)) * 10000)/1000
## in kg C ha day-1


# aggregating

ltmp_pred <- cbind(ltmp_pred,
      macr_prod_kghaday_med=apply(tot_macr_prod,1,median),
      macr_prod_kghaday_lhd=apply(tot_macr_prod,1,function(x) median_hdci(x)$ymin),
      macr_prod_kghaday_uhd=apply(tot_macr_prod,1,function(x) median_hdci(x)$ymax))
```

First the time series of turf productivity over time in Moorea

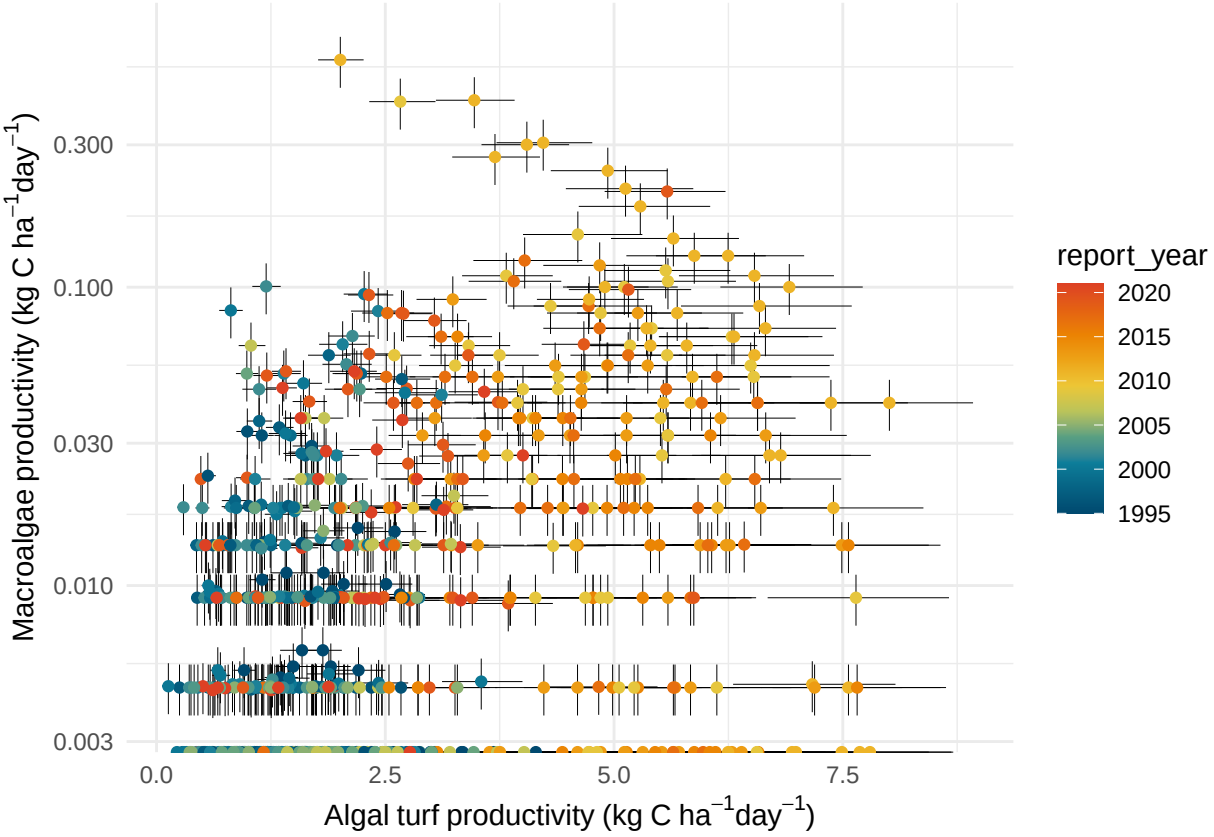
```
ggplot(data=ltmp_pred) +
  geom_line(aes(x=report_year,y=turf_prod_kghaday_med,group=interaction(transect_no,site_no))) +
  geom_smooth(aes(x=report_year,y=turf_prod_kghaday_med),
              method = 'loess', formula = y ~ x,
              colour='orange', alpha=0.8) +
  #scale_x_continuous(breaks=c(2005,2009,2013,2017)) +
  facet_wrap(~reef_name,nrow=3) +
  ylab(expression(Algal~turf~productivity~'('*kg~C~ha^-1*day^-1*')')) +
  theme_minimal()
```



How to they relate to each other?

```
ggplot(ltmp_pred) +
  geom_linerange(
    aes(xmin=turf_prod_kghaday_lhd,
        xmax=turf_prod_kghaday_uhd,
        y=macr_prod_kghaday_med),
    size=0.1) +
  geom_linerange(
    aes(ymin=macr_prod_kghaday_lhd,
        ymax=macr_prod_kghaday_uhd,
        x=turf_prod_kghaday_med),
    size=0.1) +
  geom_point(
    aes(x=turf_prod_kghaday_med,
        y=macr_prod_kghaday_med,
        colour=report_year)) +
  scale_colour_gradientn(colours=pnw_palette("Bay",10)) +
  scale_y_log10() +
  labs(x=expression(Algal~turf~productivity~'('*kg~C~ha^-1*day^-1*')'),
```

```
      y=expression(Macroalgae~productivity~'('*kg~C~ha^-1*day^-1*')')) +
  theme_minimal()
```



Saving

```
saveRDS(ltmp_pred,'preds/LTMP_TurfMacroalgaeProd_preds.RDS')
```