Choosing the Right Model

Contents

This script tests the difference in spatial distribution data (5x5 or 1x1 cells) and catch reporting (count or count and metric tonnes converted t ocount) among the RFMOs to determine which model might be the most appropriate.

Raw Data Summary

Below represents the breakdown of reported bycatch data (number of rows) in each combination of categories: 5x5 reporting resolution, 1x1 reporting resolution, metric tonnes, and count.

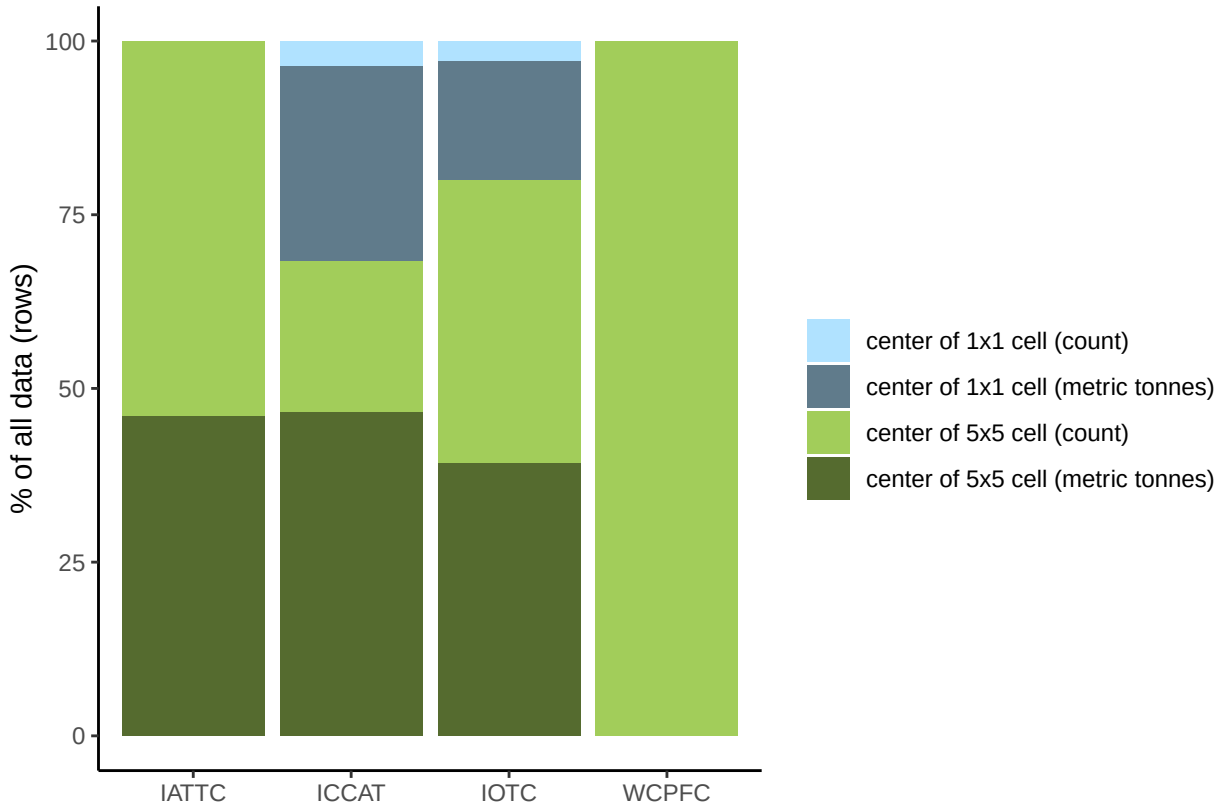

Figure 1: RFMO data breakdowns.

IATTC

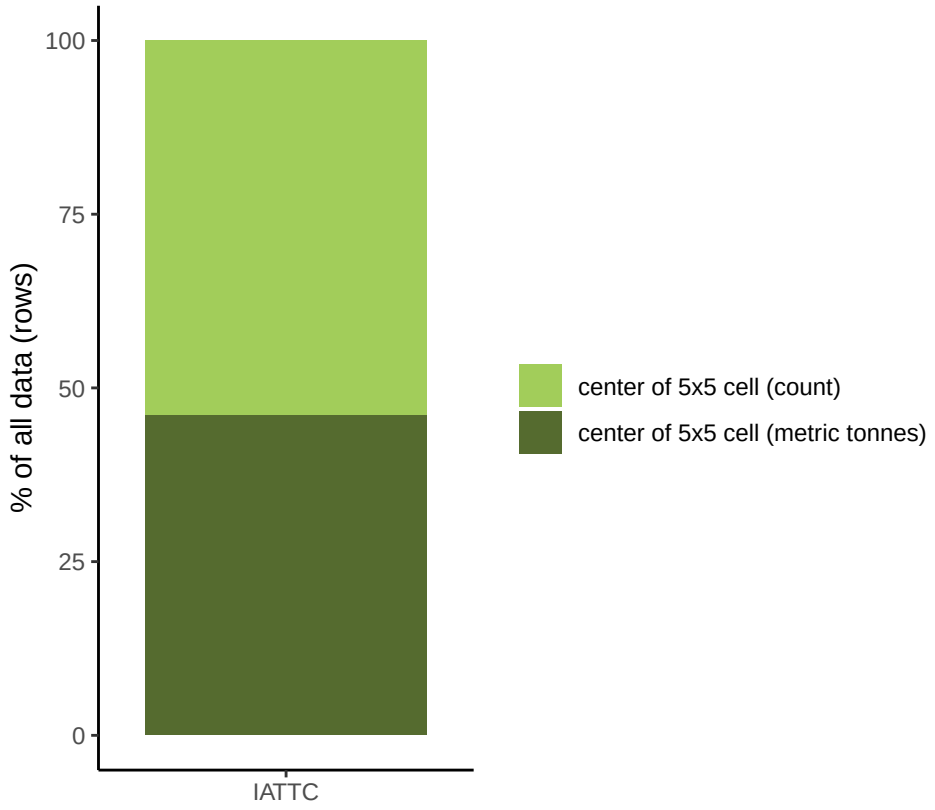

Figure 2: IATTC data breakdown.

All bycatch data from IATTC were reported at a 5x5 degree grid as counts or metric tonnes.

We ran four models:

1. IATTC data used in its native resolution (5x5 degree) for count only.
2. IATTC data used in its native resolution (5x5 degree) for count and metric tonnes (converted to count using weight-length relationships).
3. IATTC data re-distributed to a finer resolution (1x1 degree) for count only by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.
4. IATTC data re-distributed to a finer resolution (1x1 degree) for count and metric tonnes (converted to count using weight-length relationships) by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.

Table 1: IATTC Model Results

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	count and metric tonnes converted to count	237.690	0.140	65.768
1x1 degree cells	count only	13.016	0.121	2.843
1x1 degree cells	count and metric tonnes converted to count	14.611	0.111	2.997

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	count only	235.978	0.103	67.099

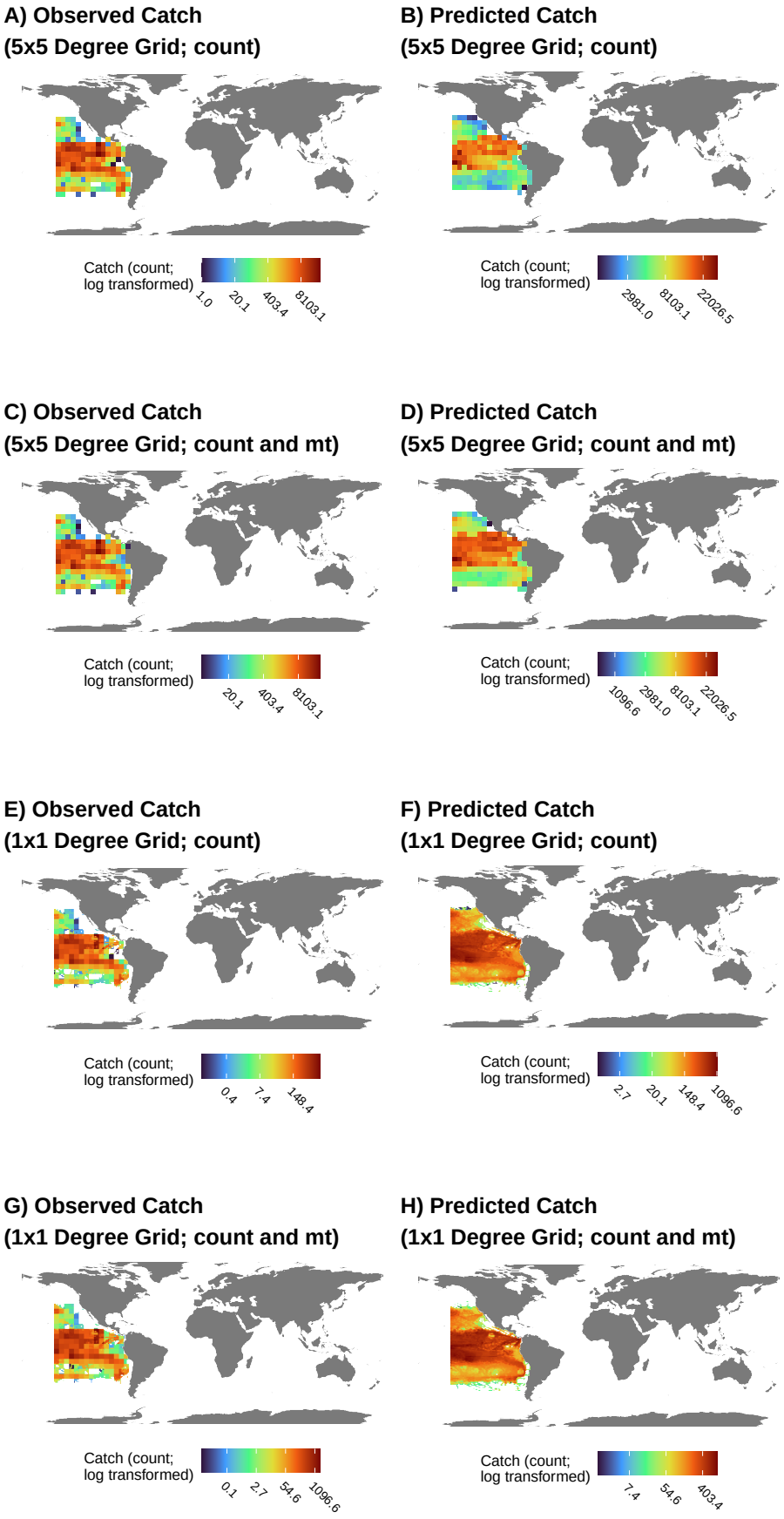

Figure 3: IATTC Model Results.

ICCAT

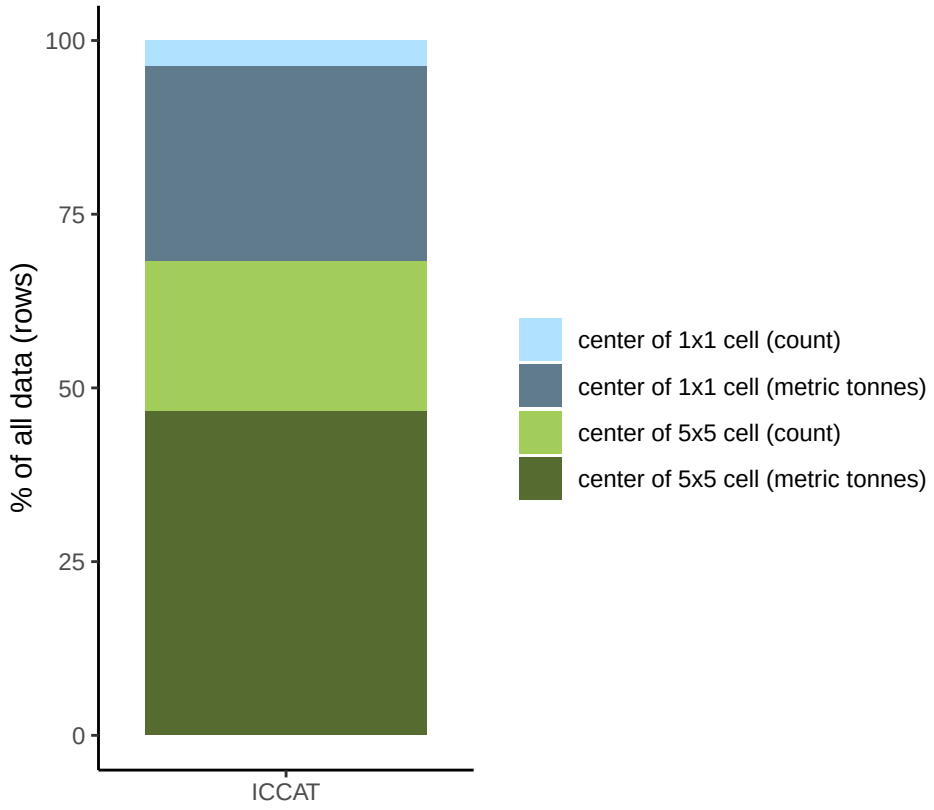

Figure 4: ICCAT data breakdown.

All bycatch data from ICCAT were reported at a 5x5 degree grid and a 1x1 degree grid as counts or metric tonnes. Most bycatch data was reported at a 5x5 degree grid as metric tonnes.

We ran four models:

1. ICCAT data at a 5x5 resolution for count only.
2. ICCAT data at a 5x5 resolution for count and metric tonnes (converted to count using weight-length relationships).
3. ICCAT data at a 1x1 resolution, with data originally in a 5x5 resolution re-distributed to a finer resolution (1x1 degree) for count only by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.
4. ICCAT data at a 1x1 resolution, with data originally in a 5x5 resolution re-distributed to a finer resolution (1x1 degree) for count and metric tonnes (converted to count using weight-length relationships) by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.

Table 2: ICCAT Model Results

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
1x1 degree cells	count and metric tonnes converted to count	18.546	0.194	2.909
5x5 degree cells	count and metric tonnes converted to count	459.524	0.157	65.905

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	count only	476.983	0.155	78.967
1x1 degree cells	count only	21.730	0.108	4.272

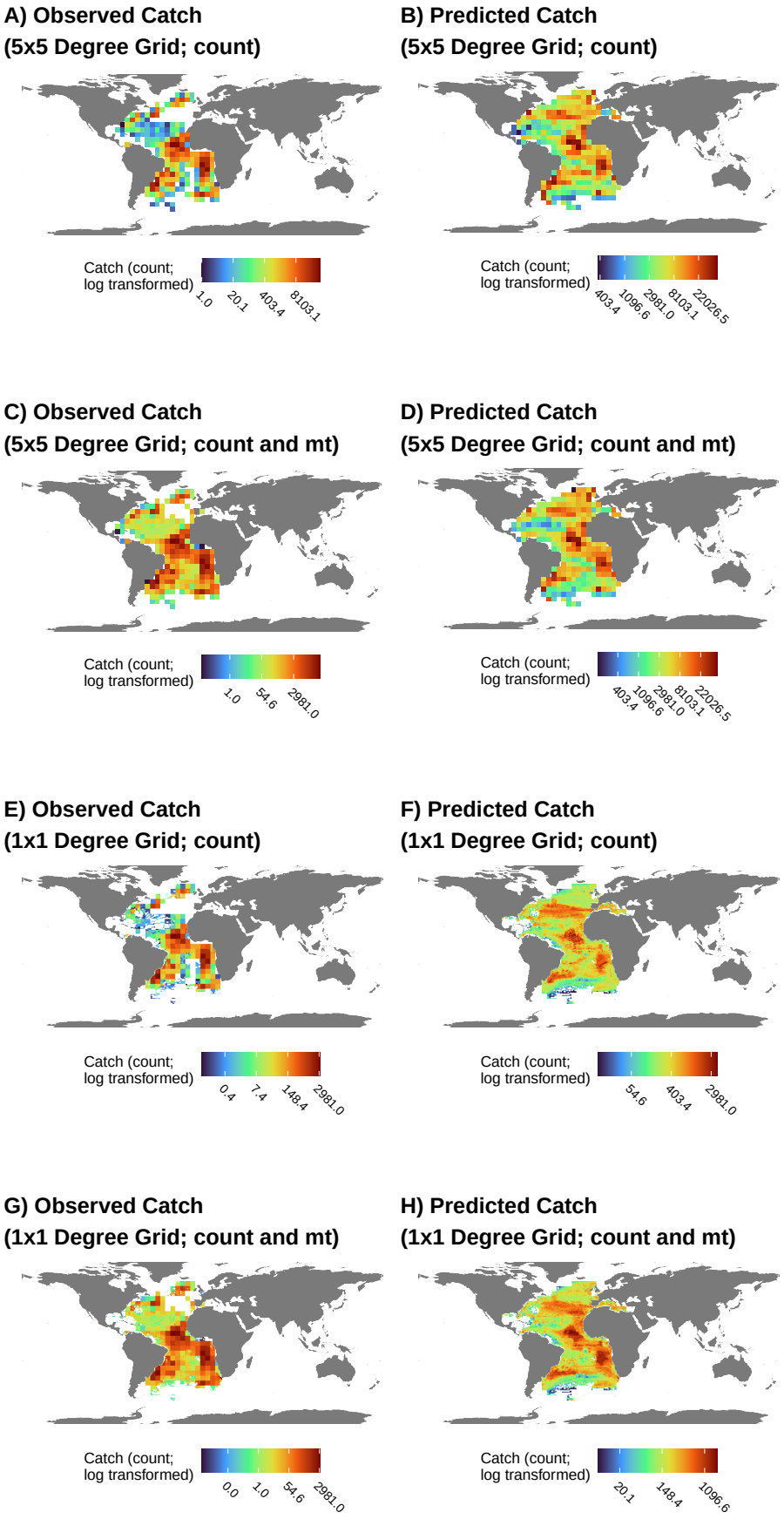

Figure 5: ICCAT Model Results.

IOTC

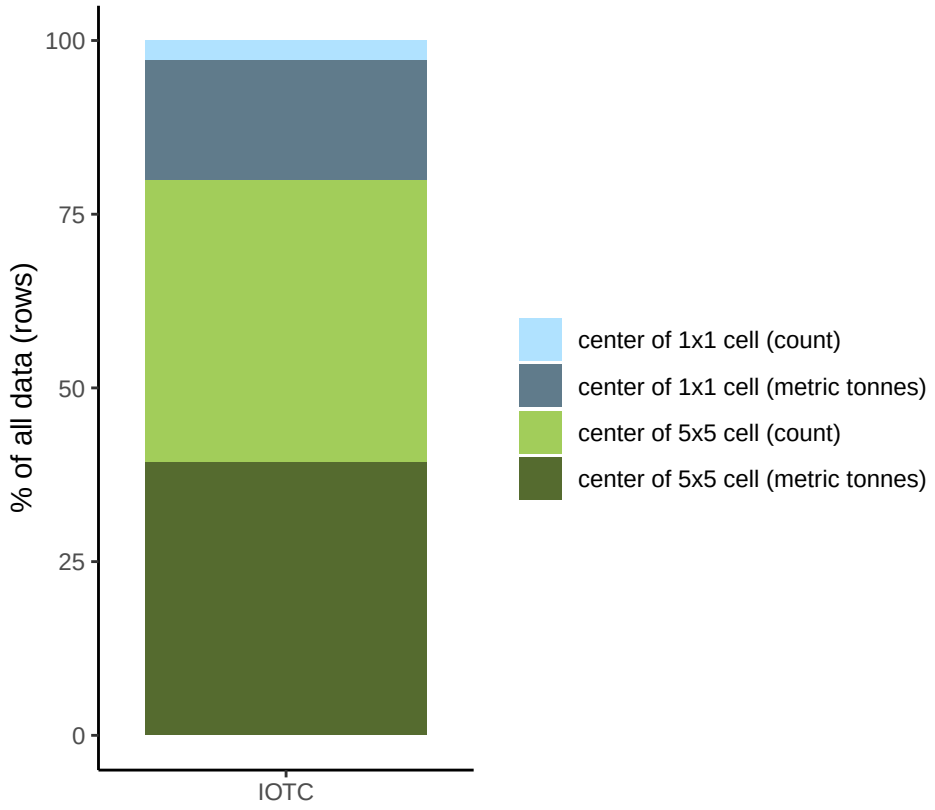

Figure 6: IOTC data breakdown.

All bycatch data from IOTC were reported at a 5x5 degree grid and a 1x1 degree grid as counts or metric tonnes. Most bycatch data was reported at a 5x5 degree grid.

We ran four models:

1. IOTC data at a 5x5 resolution for count only.
2. IOTC data at a 5x5 resolution for count and metric tonnes (converted to count using weight-length relationships).
3. IOTC data at a 1x1 resolution, with data originally in a 5x5 resolution re-distributed to a finer resolution (1x1 degree) for count only by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.
4. IOTC data at a 1x1 resolution, with data originally in a 5x5 resolution re-distributed to a finer resolution (1x1 degree) for count and metric tonnes (converted to count using weight-length relationships) by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.

Table 3: IOTC Model Results

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
1x1 degree cells	count and metric tonnes converted to count	11.858	0.308	2.778
5x5 degree cells	count and metric tonnes converted to count	264.438	0.273	73.200

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	count only	245.532	0.256	69.522
1x1 degree cells	count only	11.366	0.226	3.253

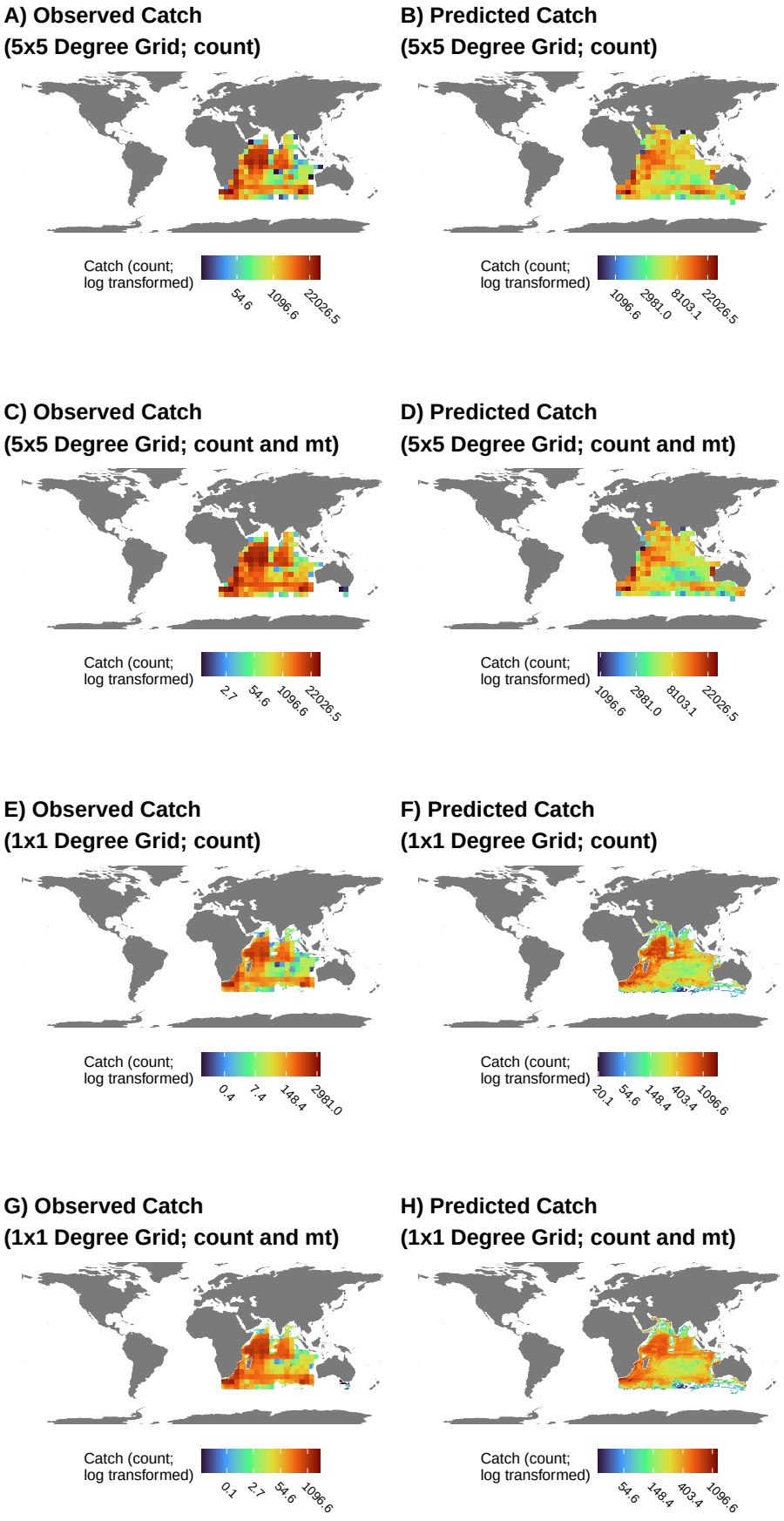

Figure 7: IOTC Model Results.

WCPFC

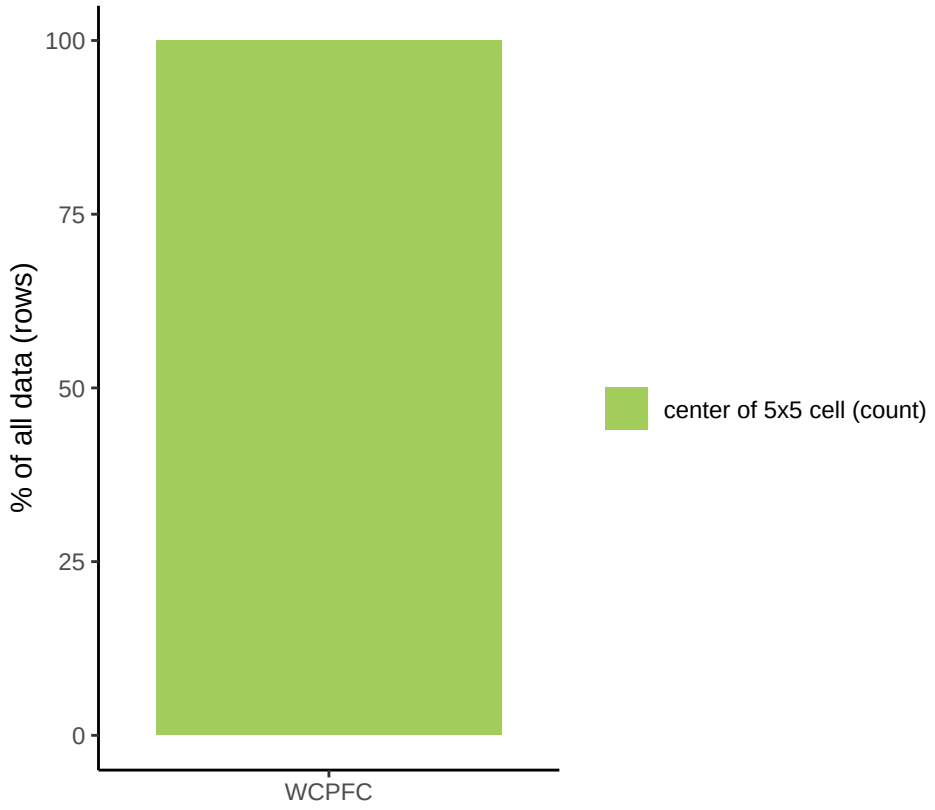

Figure 8: WCPFC data breakdown.

All bycatch data from WCPFC were reported at a 5x5 degree grid as counts.

We ran two models:

1. WCPFC data used in its native resolution (5x5 degrees) for count.
2. WCPFC data re-distributed to a finer resolution (1x1 degree) by equally distributing the catch into 25 smaller cells. For example, if 100 blue sharks were caught in a 5x5 cell, each smaller 1x1 cell within the larger area will have a catch of $100/25 = 4$ blue sharks.

Table 4: WCPFC Model Results

Spatial Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	125.352	0.263	14.442
1x1 degree cells	5.978	0.112	1.066

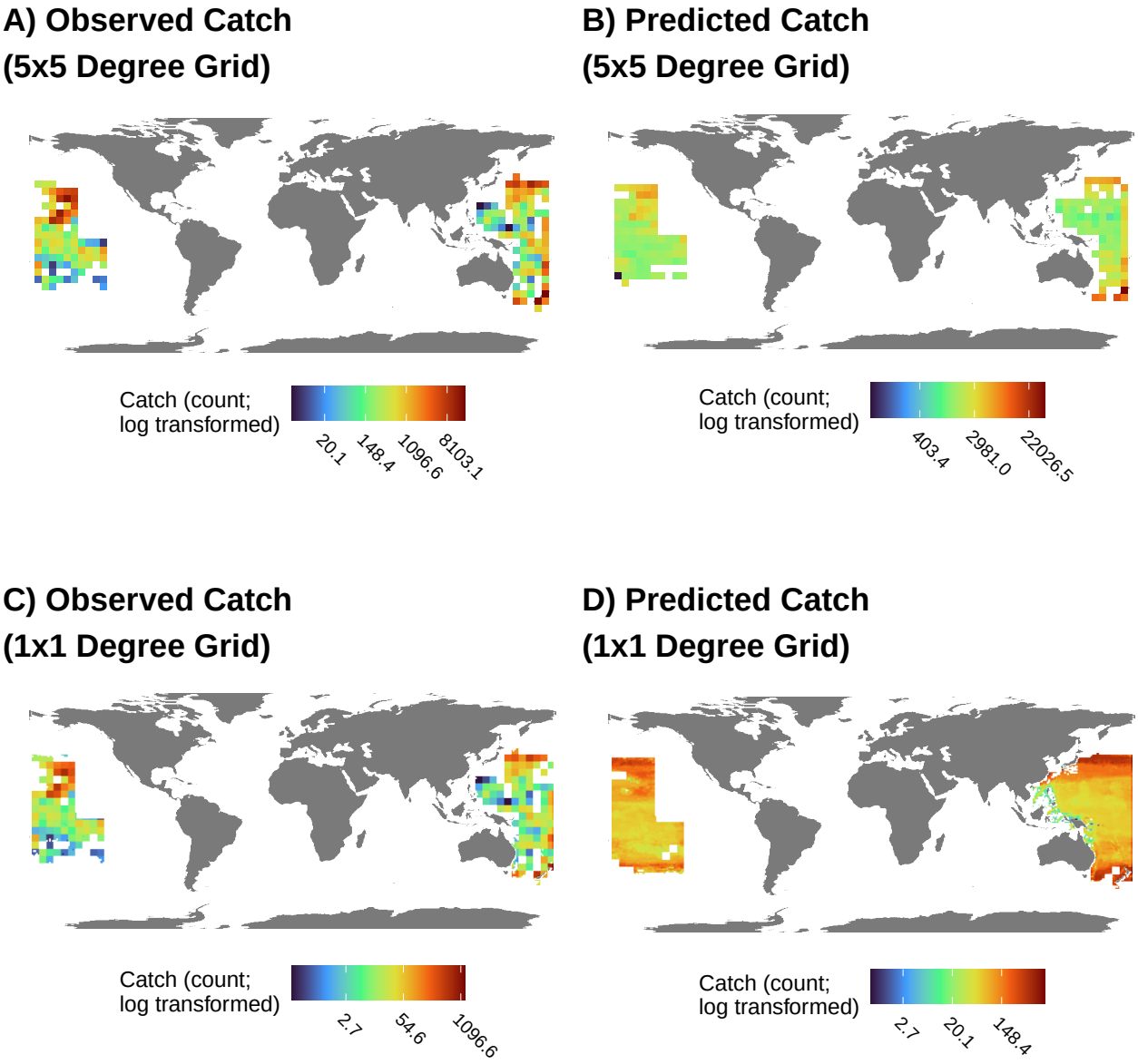

Figure 9: WCPFC Model Results.