Choosing the Right Model

Contents

This script tests the difference in spatial distribution data (5x5 or 1x1 cells) 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.
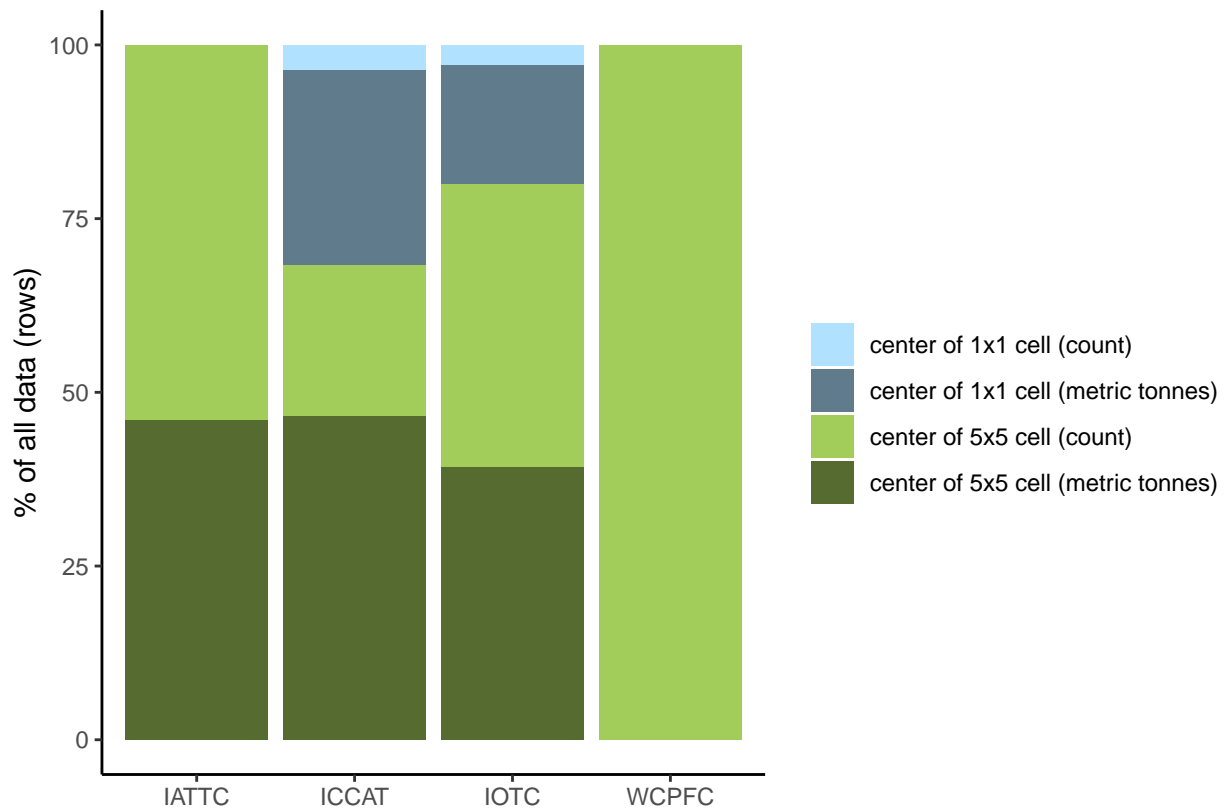
IATTC

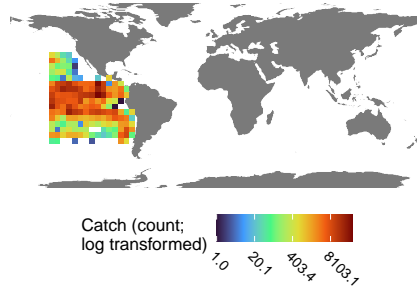All bycatch data from IATTC were reported at a 5x5 degree grid as counts or metric tonnes.

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
5x5 degree cells	count only	235.978	0.103	67.099
1x1 degree cells	count and metric tonnes converted to count	11.276	0.093	2.854
1x1 degree cells	count only	10.916	0.078	2.857

A) Observed Catch
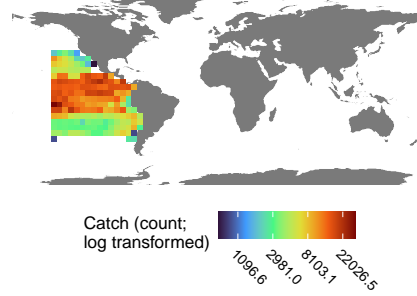**(5x5 Degree Grid; count)**
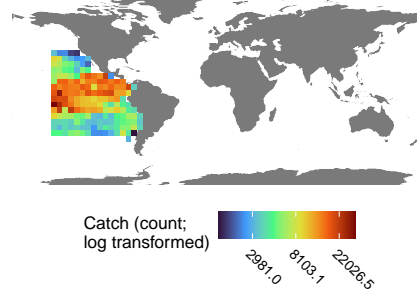
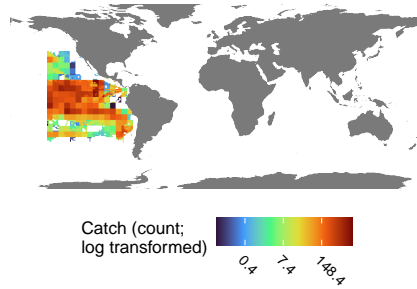**B) Predicted Catch**
(5x5 Degree Grid; count)

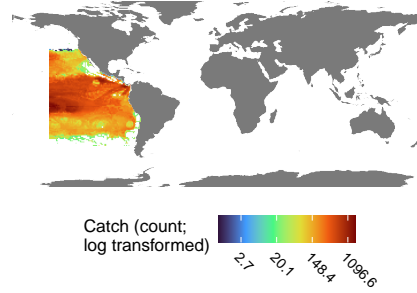**C) Observed Catch**
(5x5 Degree Grid; count and mt)
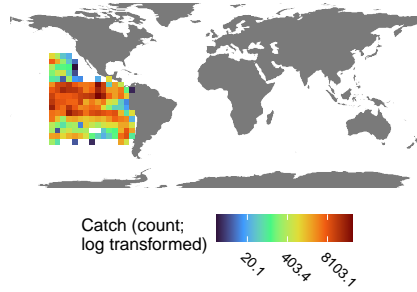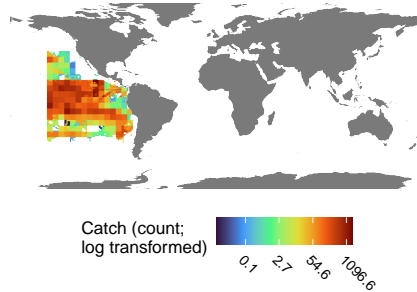
D) Predicted Catch
(5x5 Degree Grid; count and mt)

E) Observed Catch
(1x1 Degree Grid; count)

F) Predicted Catch
(1x1 Degree Grid; count)

G) Observed Catch
(1x1 Degree Grid; count and mt)

H) Predicted Catch
(1x1 Degree Grid; count and mt)

Figure 1: IATTC Model Results.

ICCAT

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
5x5 degree cells	count and metric tonnes converted to count	459.524	0.157	65.905
5x5 degree cells	count only	476.983	0.155	78.967
1x1 degree cells	count and metric tonnes converted to count	19.447	0.147	3.064
1x1 degree cells	count only	23.445	0.083	4.736

A) Observed Catch (5x5 Degree Grid; count)

B) Predicted Catch (5x5 Degree Grid; count)

C) Observed Catch (5x5 Degree Grid; count and mt)

D) Predicted Catch (5x5 Degree Grid; count and mt)

E) Observed Catch (1x1 Degree Grid; count)

F) Predicted Catch (1x1 Degree Grid; count)

G) Observed Catch (1x1 Degree Grid; count and mt)

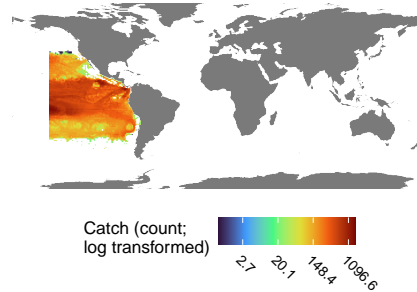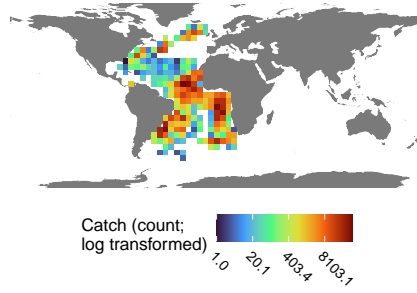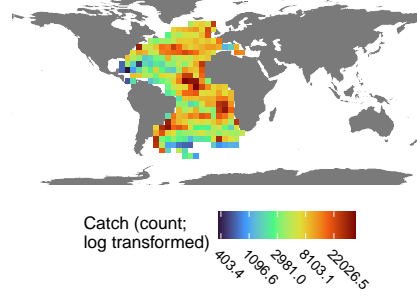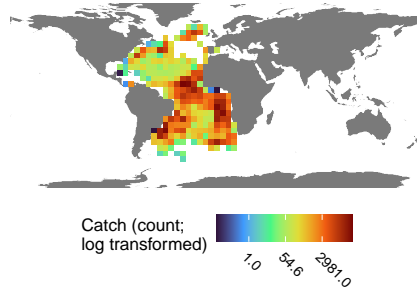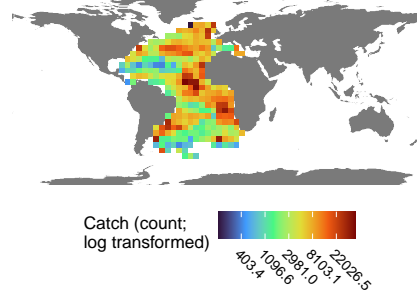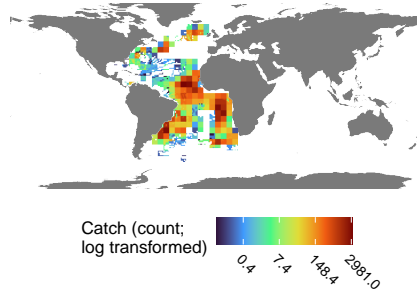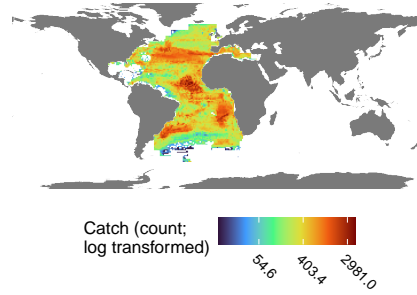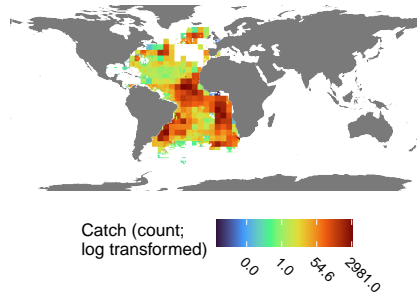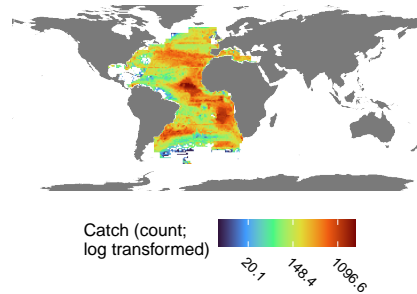**H) Predicted Catch (1x1 Degree Grid; count and mt)**

Figure 2: ICCAT Model Results.

IOTC

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.
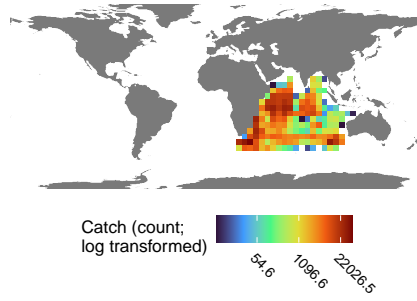
We ran four models:

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.
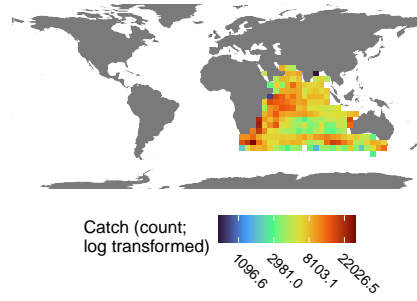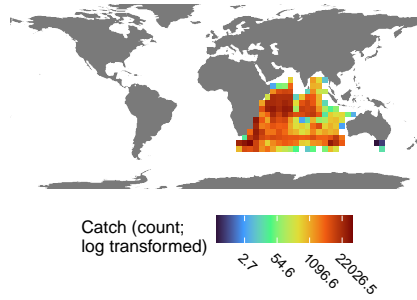
Table 3: IOTC Model Results

Spatial Resolution	Catch Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	count and metric tonnes converted to count	264.438	0.273	73.200
5x5 degree cells	count only	245.532	0.256	69.522
1x1 degree cells	count and metric tonnes converted to count	12.228	0.205	2.733
1x1 degree cells	count only	11.006	0.175	3.029

A) Observed Catch
(5x5 Degree Grid; count)
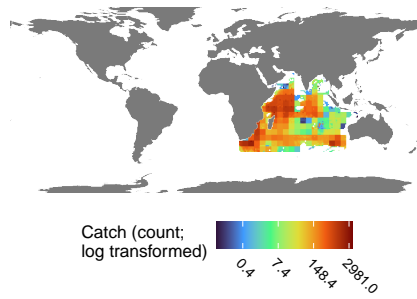
B) Predicted Catch
(5x5 Degree Grid; count)

Catch (count;
log transformed)

54.6   1096.6   22026.5

Catch (count;
log transformed)

1096.6   2981.0   8103.1   22026.5

C) Observed Catch
(5x5 Degree Grid; count and mt)

D) Predicted Catch
(5x5 Degree Grid; count and mt)

Catch (count;
log transformed)

2.7   54.6   1096.6   22026.5

Catch (count;
log transformed)

1096.6   2981.0   8103.1   22026.5

E) Observed Catch
(1x1 Degree Grid; count)

F) Predicted Catch
(1x1 Degree Grid; count)

Catch (count;
log transformed)

0.4   7.4   148.4   2981.0

Catch (count;
log transformed)

54.6   148.4   403.4   1096.6

G) Observed Catch
(1x1 Degree Grid; count and mt)

H) Predicted Catch
(1x1 Degree Grid; count and mt)

Catch (count;
log transformed)

0.1   2.7   54.6   1096.6

Catch (count;
log transformed)

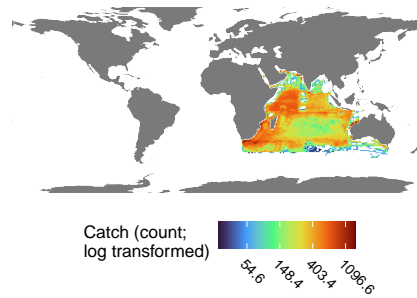54.6   148.4   403.4   1096.6
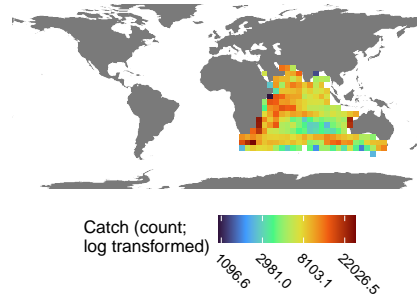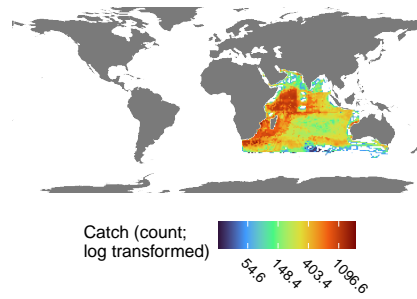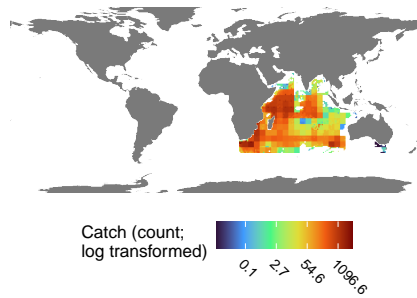
Figure 3: IOTC Model Results.

WCPFC

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

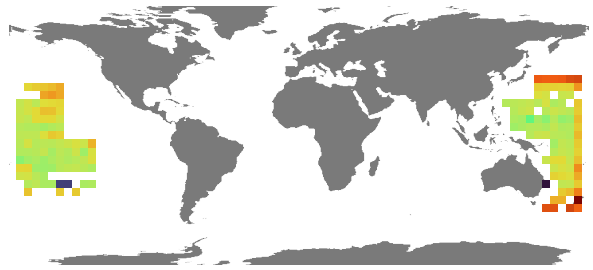| Spatial Resolution	Root Mean Squared Error	R Squared	Mean Absolute Error
5x5 degree cells	105.222	0.203	14.910
1x1 degree cells	5.222	0.117	0.941

A) Observed Catch (5x5 Degree Grid)
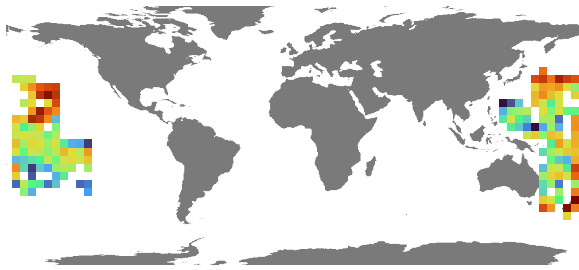
Catch (count; log transformed)
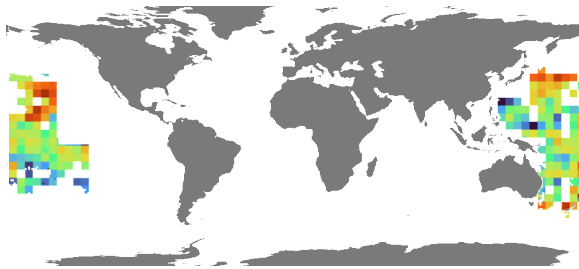20.1 148.4 1096.6 8103.1

B) Predicted Catch (5x5 Degree Grid)

Catch (count; log transformed)
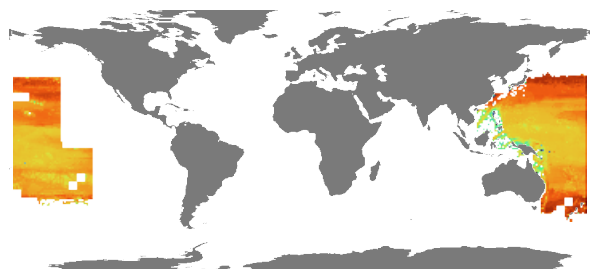148.4 1096.6 8103.1

C) Observed Catch (1x1 Degree Grid)

Catch (count; log transformed)
2.7 54.6 1096.6

D) Predicted Catch (1x1 Degree Grid)

Catch (count; log transformed)
2.7 20.1 148.4

Figure 4: WCPFC Model Results.