


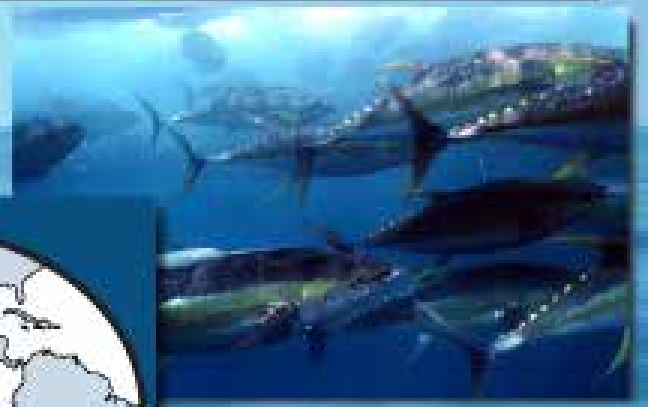

Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

POTENTIAL BIAS ON THE 2020 AND 2021 TROPICAL TUNA CATCH ESTIMATES RESULTING FROM COVID-19: UPDATE

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Outline

- Background
- Results
- Conclusions
- Future work

Background

The problem

- The COVID-19 pandemic hindered collection of port-sampling data in 2020-2021.
- Some of the ports most affected were where bigeye tuna (BET) catch is unloaded.
- Port-sampling data are used to estimate the tropical tuna catch composition of the purse-seine fleet.
- Thus, there is concern that the Best Scientific Estimates (BSE) of catch may be biased, particularly for bigeye tuna.

Background

One possible solution

- Develop new statistical methodology that is less vulnerable to bias caused by pandemic-related data loss.

- As part of this new methodology, use other data sources for catch composition, in addition to port-sampling data.

- Require the new methodology to produce estimates as similar as possible to pre-pandemic BSEs (2010 – 2019).

- Modeling focused on developing new methodology for floating-object (OBJ) sets.

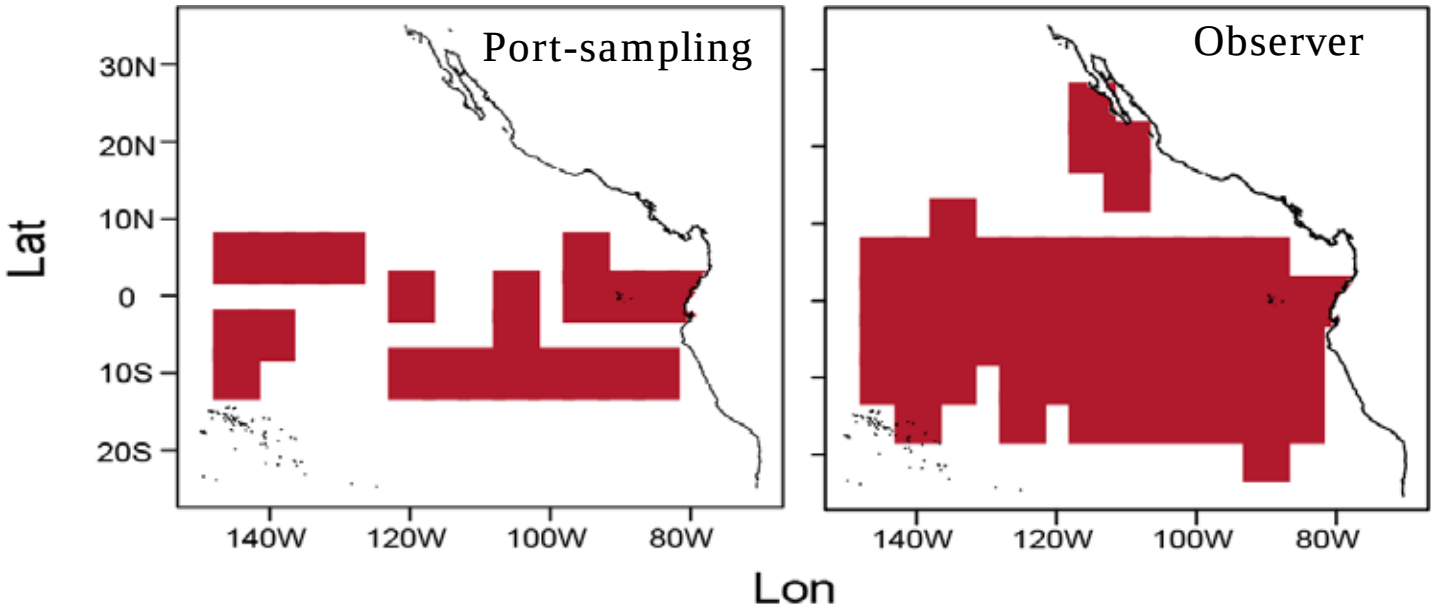
Background

A modeling challenge

- There are four primary data sources available for estimating catch composition:
  - Observer
  - Logbook
  - Cannery
  - Port-sampling

- These data sources differ in terms of:
  - Fleet coverage
  - Spatial and temporal resolution
  - Potential biases (catch amounts, species identifications)
  - Extent of data pandemic-related loss in 2020 – 2021

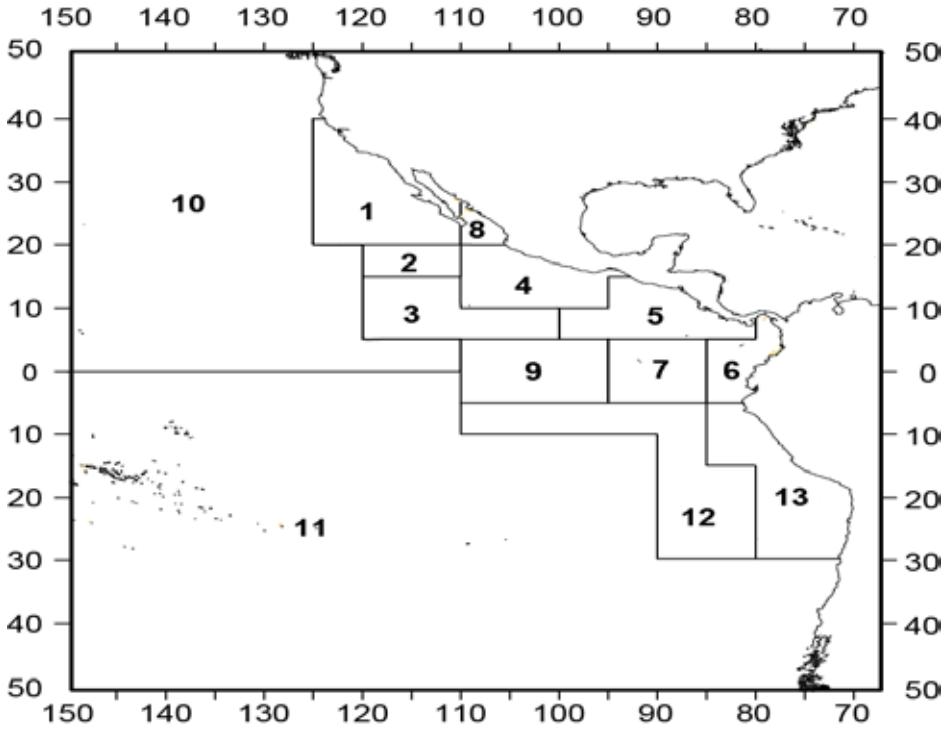
Spatio-temporal Model



The 5° areas shown in red denote positive catch of any of the tropical tuna species

- Data sparsity is a problem.
- Data aggregated in space and time to compensate for low sample sizes.
- Spatio-temporal Conditionally Auto Regressive (CAR) model used.
- By incorporating data from multiple time periods into one model, take advantage of spatial pattern evolving in a correlated manner through time to help mitigate pandemic-related data loss.

Spatio-temporal model: data aggregation



- Spatial aggregation reduces variance – leading to better fitting models.
- Models with various spatio-temporal resolutions considered (SAC-13-05 appendices):
  - 5 ° grids x month x vessel size class category
  - 13 areas x quarter x vessel size class category
  - 13 areas x year x vessel size class category

- Why these 13 areas?
  - They are the sampling areas used in the BSE methodology.
  - One of the modeling goals: produce estimates as similar as possible to the BSEs for 2010-2019.

Spatio-temporal Model: performance measures

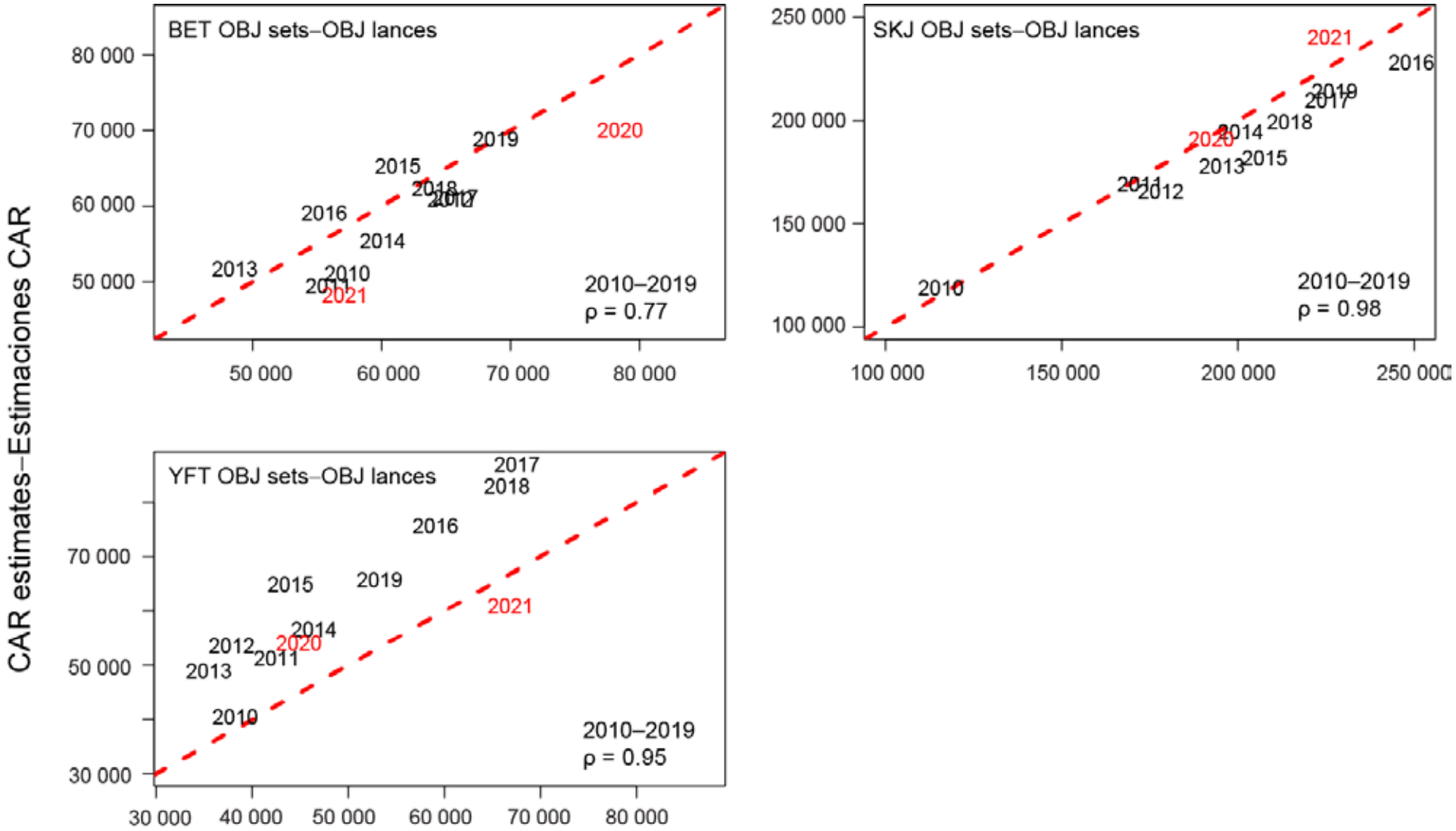
- Three model performance measures were used:
  - Normalized prediction sum of squared errors
  - Percent variation explained by the model
  - Correlation with the BSE for 2010-2019

- Based on these measures, the best model fit was obtained for data aggregated at the coarsest resolution (13 areas x year x vessel size class category).

Spatio-temporal model: catch estimation

- Estimate of total BET catch in OBJ sets
  - Species proportions estimates were obtained from the CAR model, by stratum.
  - These proportions were multiplied by the total fleet catch of tropical tunas to obtain the stratum estimates of BET.
  - Total BET is the sum of the stratum estimates.
- Similar CAR modeling and estimation was done for skipjack tuna (SKJ).
- Yellowfin tuna (YFT) catch was estimated by subtracting the sum of the SKJ and BET estimates from the total fleet catch of tropical tunas.

Results: comparison of CAR to BSE

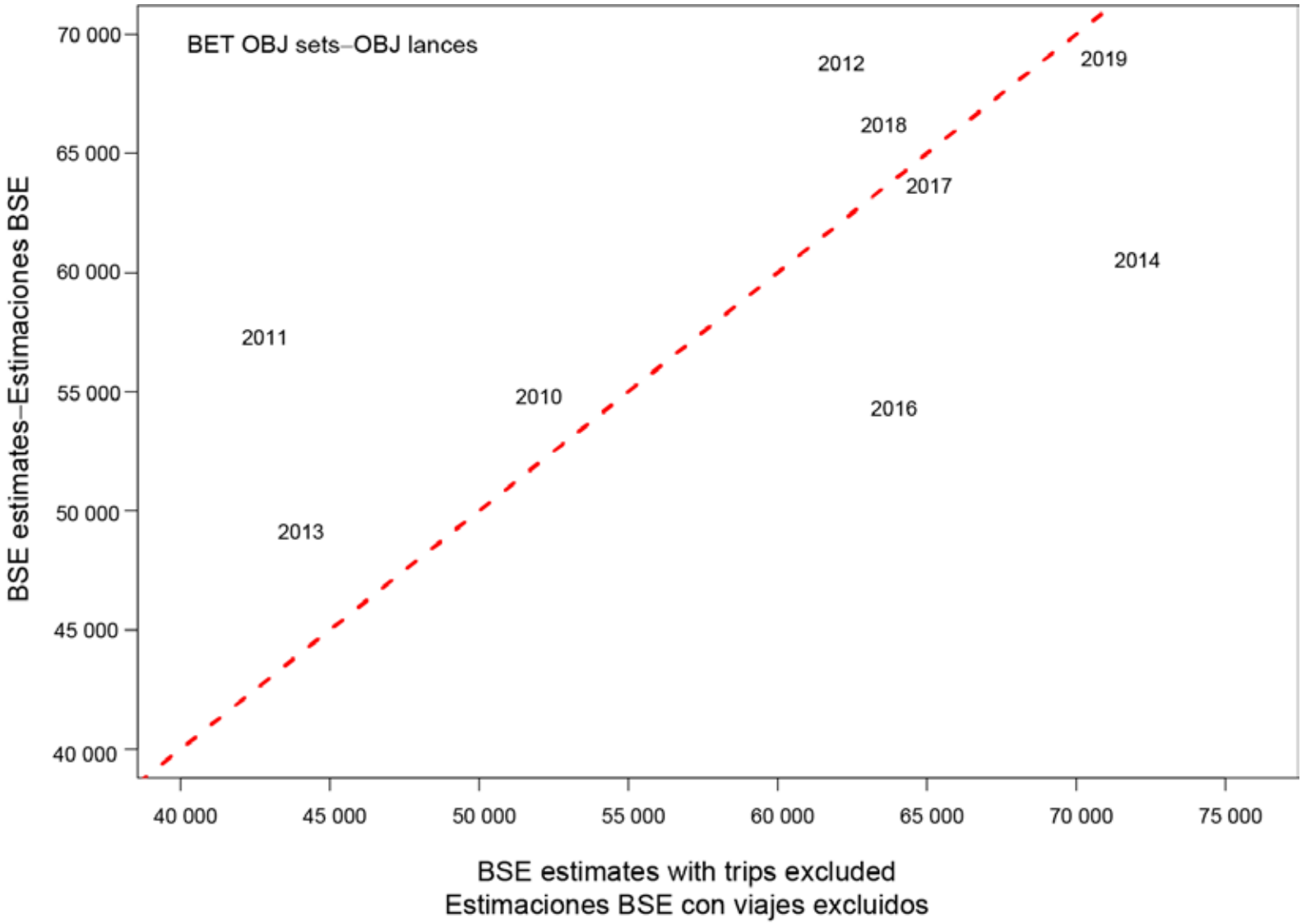


Results: estimated catch and difference for OBJ sets

Estimated values	2020 CAR	2020 BSE	2020 Difference	2021 CAR	2021 BSE	2021 Difference
BET	69 901 t	78 208 t	8 307 t (11.9%)	48 087 t	57,391 t	9 304 t (19.3%)
SKJ	190 243 t	191 399 t	1 156 t (0.6%)	239 692 t	227 028 t	- 12 664 t (-5.3%)
YFT	53 924 t	44 461 t	- 9 463 t (-17.5%)	60 701 t	66542 t	5 841 t (9.6%)

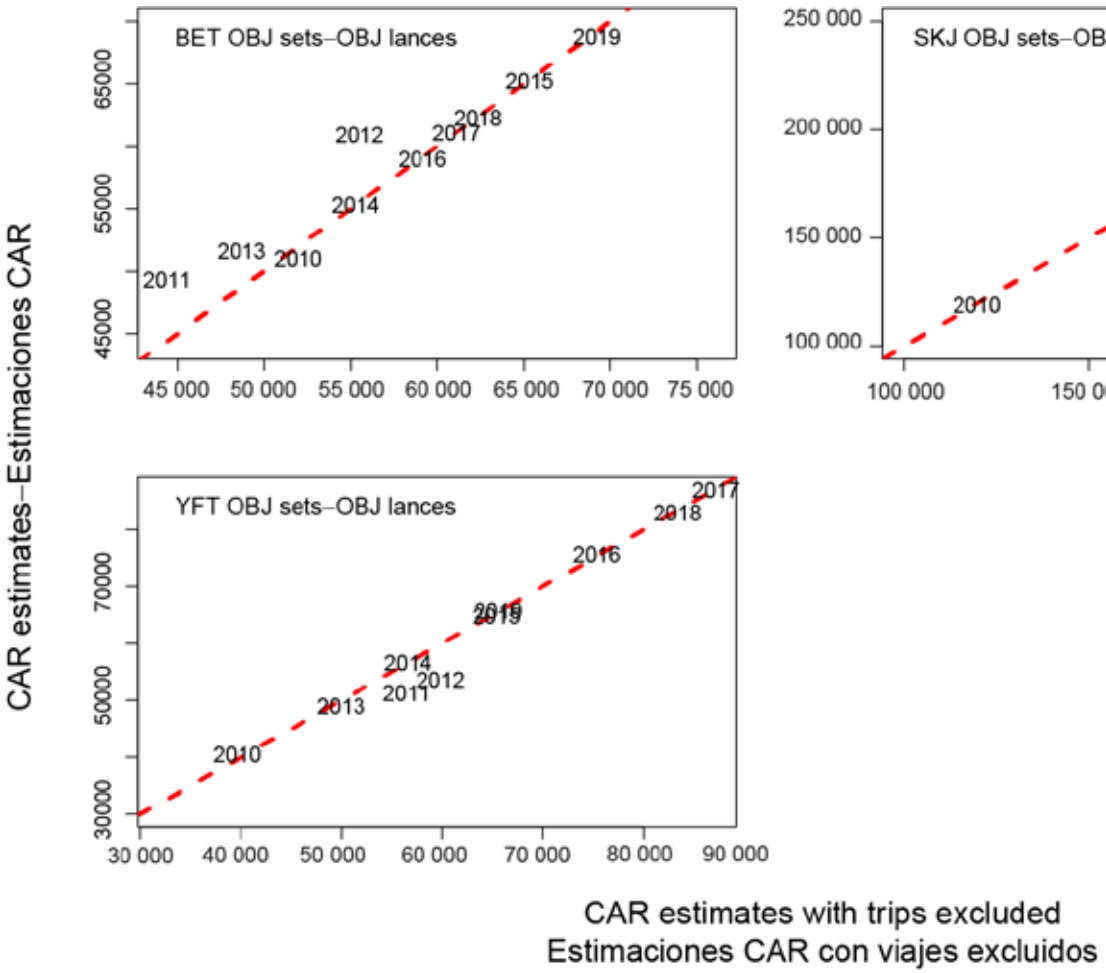
- % Difference = [BSE estimate - CAR estimate]/CAR estimate

Results: performance of BSE for BET in OBJ sets 2020



- BSE estimates were made for 2010-2019, excluding data to mimic the pandemic-related data loss in 2020 (see SAC-13 INF-L).

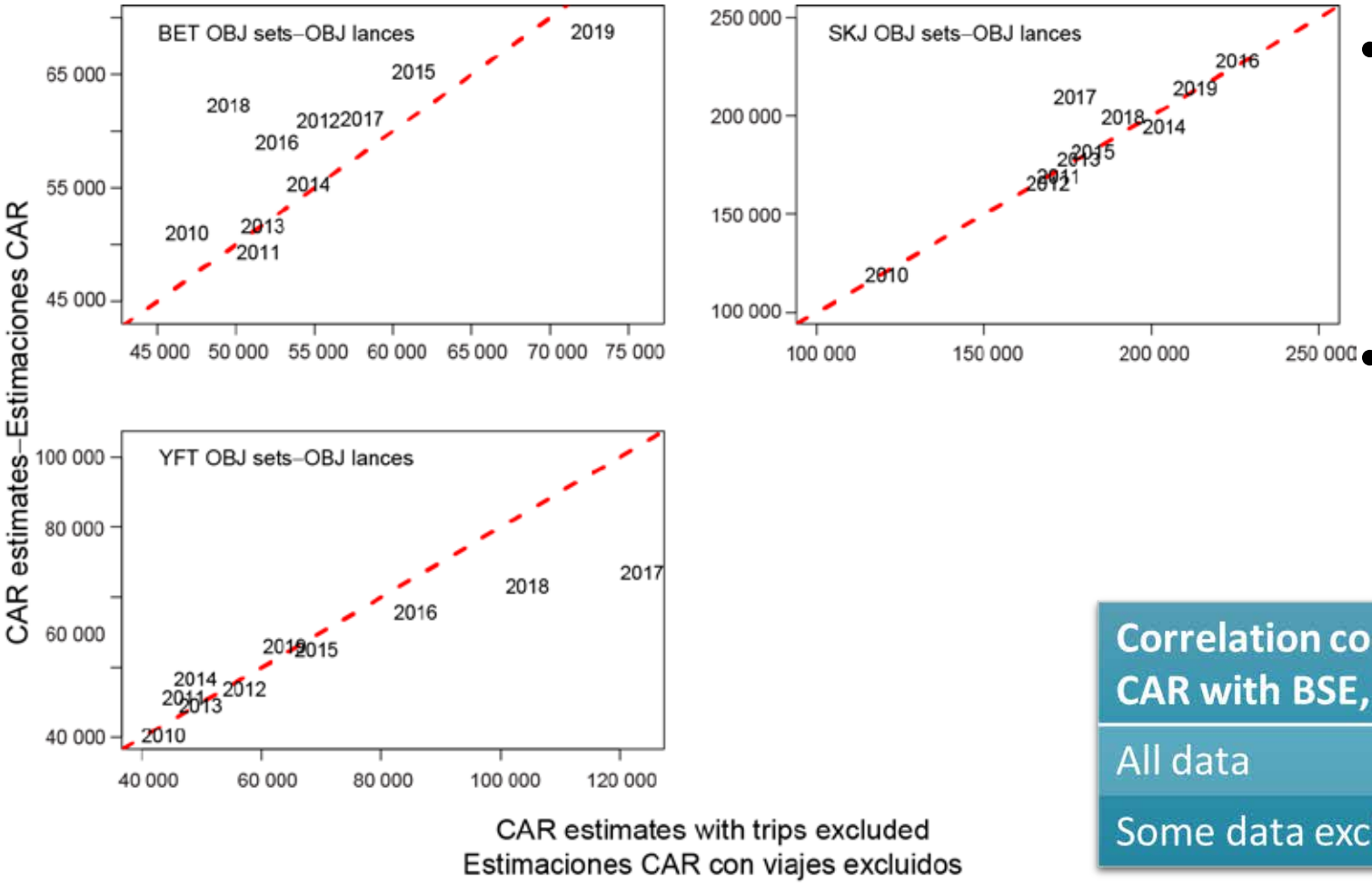
Results: performance of CAR (mimic 2020 pandemic-related data loss)



- CAR estimates were made for 2010-2019, excluding data to mimic the pandemic-related data loss in 2020 (see SAC-13 INF-L).
- These estimates were compared to the CAR estimates based on complete data.

Correlation coefficients, CAR with BSE, 2010 - 2019	BET	SKJ	YFT
All data	0.78	0.98	0.95
Some data excluded	0.73	0.98	0.92

Results: performance of CAR (mimic 2020-2021 pandemic-related data loss)



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Correlation coefficients, CAR with BSE, 2010 - 2019	BET	SKJ	YFT
All data	0.78	0.98	0.95
Some data excluded	0.61	0.91	0.91

Conclusions

- The COVID-19 pandemic limited the ability of port samplers to take samples, resulting in a reduction in OBJ-set samples for 2020 and 2021 of 66% and 35%, respectively, compared to 2019. For vessel size class 6 this reduction was 17% and -5% respectively.
- The port sampling data are used to calculate the species and size composition of the catch, and therefore play a very important role in the BSE catch estimation methodology.
- Port-sampling data collection was disrupted by the pandemic in some ports more than others and this cause bias in the BSE because some fleet segments preferentially unload in specific ports (SAC-13 INF-L).

Conclusions

- Spatio-temporal (CAR) models to estimate port-sampling species proportions from observer (logbook) data with overall good performance were developed.
- Simulation results suggest the CAR model performance is robust to the type of systematic data loss that occurred in 2020, less robust to the type of systematic data loss that occurred in 2020-2021.
- As compared to the CAR estimates, the OBJ-set BSEs for BET in 2020 and 2021 represent a difference of about 11.9%, 19.3% catch.

Future work

- Development of fine-scale spatio-temporal models (e.g., 5 ° - month or 5 ° - quarter) will be undertaken because the stock assessment models have a quarterly time step, and the fisheries definitions differ from the 13 areas used in this analysis.

- Development of fine-scale models that are not constrained to be highly correlated with the BSE will also be undertaken.

Thank you! Questions?