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# PRASC



Project for the Regional  
Advancement of Statistics  
in the Caribbean

Projet régional pour  
l'avancement de la statistique  
dans les Caraïbes

Funded by the  
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# Project for the Regional Advancement of Statistics in the Caribbean

## PRASC

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**Population Estimates**  
**Component: Household Survey Infrastructure**

Funded by the  
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## **Module 5.0**

# **Postcensal Population estimates, Rebasing and Intercensal Population Estimates**

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# General Principles

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- Each Census ends and starts a population estimates cycle
- The 2011 Census ended the 2001 Cycle and started the 2011 Cycle
- The 2021 Census will end the 2011 Cycle and start the 2021 Cycle



# General Principles

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- There are two types of population estimates
- Postcensal estimates
  - When a new cycle begins, the following mid-year population estimates (MYPE) are called postcensal estimates because they are only relying on the information of one census
- Intercensal estimates
  - When the information of a new census is integrated in the population estimates system, the Postcensal MYPE between the two census are revised and relabeled Intercensal Estimates



# Postcensal Estimates

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- Estimates based on only one Census information
  - Mid-year Population Estimates (MYPE) based on the 2011 Census: 2011, 2012, 2013, ..., 2020
- These estimates are calculated using the 2011 Census as the population base
- Possible levels:
  - PP: Postcensal Preliminary
  - PU: Postcensal Updated
  - PF: Postcensal Final



# From Census Day 2011 to Census Day 2021

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- From Census Day 2011 to the June 30, 2011 (2011 MYPE)
  - A partial year
- From MYPE 2011 to MYPE 2020
  - 9 consecutive mid-year to mid-year reference periods
- From MYPE 2020 to Census Day 2021
  - A partial year



## From mid-year to mid-year (normal year)

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- In that case, the formula is directly applied

$$\begin{array}{rcl} \text{Population}_{(t+x)} & = & \text{Population}_{(t)} \\ & + & \text{Births}_{(t, t+x)} \\ & - & \text{Deaths}_{(t, t+x)} \\ & + & \text{NIM}_{(t, t+x)} \end{array}$$



## From 2011 Census Day to 2011 MYPE

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- We need to go back to records of births, deaths and migration and extract the events that occur during that fraction of year and calculate the resulting population estimates as if it was a normal year
- In the absence of information of dates of events, we have to apply a fraction to the whole 2010=2011 (see next slide)



## From 2011 Census Day to 2011 MYPE

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- In case we do not have sufficient information to extract the events occurring during the partial period, we need to apply a fraction to the 2010-2011 components to estimation the population change between 2011 Census Day and mid-year 2011

$$\begin{aligned}
 \text{Population}_{(2011\text{MYPE})} &= \text{Population}_{(2011 \text{ Census})} \\
 &+ \text{Births}_{a/365(2010-2011)} \\
 &- \text{Deaths}_{a/365(2010-2011)} \\
 &+ \text{NIM}_{a/365(2010-2011)}
 \end{aligned}$$

where

$a$  = # of days between the 2011 Census Day and mid-year 2011



## From 2020 MYPE to 2021 Census Day

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- We need to go back to records of births, deaths and migration and extract the events that occurred during that fraction of year and calculate the resulting population estimates as if it was a normal year
- In the absence of information of dates of events, we have to apply a fraction to the whole 2020-2021 (see next slide)



## From 2020 MYPE to 2021 Census Day

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- In case we do not have sufficient information to extract the events occurring during the partial period, we need to apply a fraction to the 2020-2021 components to estimate the population change between mid-year 2020 and the 2021 Census Day

$$\begin{aligned} \text{Population}_{(2021 \text{ PE\_Census Day})} &= \text{Population}_{(\text{MY PE}2020)} \\ &+ \text{Births}_{a/365(2020-2021)} \\ &- \text{Deaths}_{a/365(2020-2021)} \\ &+ \text{NIM}_{a/365(2020-2021)} \end{aligned}$$

where

$a = \#$  of days between mid-year 2020 and the 2021 Census Day



# Errors associated with Postcensal Estimates

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- Errors on components are cumulated along the way as the information is not perfect
  - In the OECS context, errors will mainly come from international migration
  - The more we are away from the starting point, the more we should be cautious with the quality of the estimates.



# Integration of a new census

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- Once a new census is available, this is an opportunity to see how well the NSO did with its postcensal estimates
- Once the 2021 Census will be available, we will be able to compare
  - The postcensal population estimate as of 2021 Census Day (Base Population 2011) to the 2021 Census *de jure* population counts
- The difference between the two numbers is called the *Error of Closure* (EC)

# Error of Closure

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- The formula to calculate the *Error of Closure* (EC) is

$$EC = \text{Pop}_{(2021 \text{ PE})} - \text{Pop}_{(2021 \text{ Census Counts})}$$

- If EC is positive, it means that the postcensal estimates have overestimated the census counts
- EC comes from two sources:
  - Errors in the estimation of the components of population change between the two censuses (intercensal period)
  - Differential coverage between the two censuses



# Error of Closure

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- Error of closure can be transformed in relative terms where:

$$EC = (\text{Pop}_{(\text{Estimates})} - \text{Pop}_{(\text{Census})}) / \text{Pop}_{(\text{Census})}$$

- Even if we know that a part of the error comes from Censuses, we are making the assumption that Census counts are the best.



# Intercensal Estimates

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- Once we have calculated the EC, we are able to calculate intercensal population estimates
- Intercensal estimates are population estimates for reference dates between two censuses.
- They are produced after each census to reconcile previous postcensal estimates with new census counts, assuring the internal consistency of the estimation system.
- Intercensal estimates are usually never revised.

# Intercensal Estimates

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- They are calculated in the following steps:
  - Calculation of the Error of closure
  - Linear distribution of the error of closure across the two censuses (intercensal period)
    - This creates a new component of population change called the residual deviation (RD)
  - Recalculate estimates starting from the first Census

$$\text{Pop}_{(t,x)} = \text{Pop}_{(t)} + B_{(t,t+x)} - D_{(t,t+x)} + \text{NIM}_{(t,t+x)} + \text{RD}_{(t,t+x)}$$

- When producing population estimates by age and sex, the EC and RD are calculated by age and sex.

# MNI Postcensal Estimates

Reference Date	Population	Pop. Change	Births	Deaths	Inter. Migr.
<b>2001 Census Day</b>	<b>4,491</b>	26	4	9	31
2001	4,517	46	57	45	34
2002	4,563	-81	38	47	-72
2003	4,482	199	48	59	210
2004	4,681	103	55	62	110
2005	4,784	-129	57	56	-130
2006	4,655	164	49	44	159
2007	4,819	56	47	40	49
2008	4,875	164	69	48	143
2009	5,039	-19	56	45	-30
2010	5,020	26	51	31	6
2011 Census Day Estimates	5,046				
<b>2011 Census Day Counts</b>	<b>4,922</b>				



# Calculation of the EC

Reference Date	Population
<b>2001 Census Day</b>	4,491
2001	4,517
2002	4,563
2003	4,482
2004	4,681
2005	4,784
2006	4,655
2007	4,819
2008	4,875
2009	5,039
2010	5,020
2011 Census Day Estimates	5,046
<b>2011 Census Day Counts</b>	4,922

**Error of closure (EC) for the 2001-11 period is:**

$$5,046 - 4,922 = 124$$

**We have to distribute the EC linearly between the two censuses using the number of days between each reference date.**



# Distribution of the EC to create a new component: the residual deviation

Reference Date	Number of days between reference dates	EC distribution		
2001 Census Day (May 12)				
30-Jun-01	49	1.66	2	2
2002	365	12.39	12	13
2003	365	12.39	12	12
2004	366	12.43	12	13
2005	365	12.39	12	12
2006	365	12.39	12	12
2007	365	12.39	12	12
2008	366	12.43	12	13
2009	365	12.39	12	12
30-Jun-10	365	12.39	12	12
2011 Census Day (May 12)	316	10.73	11	11
<b>Total</b>	<b>3,652</b>	<b>124</b>	<b>121</b>	<b>124</b>



# Adding the Residual Deviation to the Postcensal Estimates

Reference Date	Pop.	Pop. Change	Births	Deaths	Inter. Migr.	Residual Deviation
<b>2001 Census Day</b>	<b>4,491</b>	24	4	9	31	-2
30-Jun-01	4,515	33	57	45	34	-13
2002	4,548	-93	38	47	-72	-12
2003	4,455	186	48	59	210	-13
2004	4,641	91	55	62	110	-12
2005	4,732	-141	57	56	-130	-12
2006	4,591	152	49	44	159	-12
2007	4,743	43	47	40	49	-13
2008	4,786	152	69	48	143	-12
2009	4,938	-31	56	45	-30	-12
30-Jun-10	4,907	15	51	31	6	-11
<b>2011 Census Day Counts</b>	<b>4,922</b>					



# Difference between Postcensal and Intercensal Estimates

Reference Date	Postcensal Population	Intercensal Population	Difference
<b>2001 Census Day</b>	<b>4,491</b>	<b>4,491</b>	<b>0</b>
2001	4,517	4,515	2
2002	4,563	4,548	15
2003	4,482	4,455	27
2004	4,681	4,641	40
2005	4,784	4,732	52
2006	4,655	4,591	64
2007	4,819	4,743	76
2008	4,875	4,786	89
2009	5,039	4,938	101
2010	5,020	4,907	113
2011 Census Day Estimates	5,046	4,922	124
<b>2011 Census Day Counts</b>	<b>4,922</b>	<b>4,922</b>	



# General Comments

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- By integrating the information of its 2011 Census into its population estimates, SDM did rebase its estimates
- Producing intercensal estimates requires a more intense effort every 10 years. Extra time should be planned for the exercise.



# Rebasing by age and sex

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- The rebasing and the calculation of intercensal population estimates are also done by age and sex
- As the Excel system could not be prepared in time for this workshop, the intercensal estimates by age and sex is not in the scope of the present workshop.



# Thank you!

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