Technical Note Accompanying the 2023 COD-PS Update in Mozambique

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1. Background

In recent years, Mozambique has experienced a series of severe droughts, heavy flooding, rising sea levels, intense cyclones and an intense armed conflict in the northern province of Cabo Delgado. As of September, 2023, UNHCR reported approximately 30,000 refugees and asylum seekers in Mozambique and an additional 850,599 internally displaced persons due to the conflict in the north or the impact of recent climate crisis shocks. These multiple intersecting crises make the updating of baseline subnational population projections (disaggregated by age and sex) challenging - especially given that the last census was conducted in 2017. Yet, updated population projections (by age and sex, and at the lowest administrative level possible) are crucial for short-term humanitarian operational response as well as long-term social, economic and community reconstruction.

2. Objective

The 2023 Common Operational Dataset on Population Statistics (COD-PS)[1] update for Mozambique uses the 2017 population and housing census data as a baseline population and projects the population forward to August, 2023 using empirical mortality and fertility patterns derived from the census and mobility data from UNHCR and IOM on refugee, internal displacement and returnee movements. This COD-PS update is produced to support the upcoming 2023 Humanitarian Needs Overview (HNO) and Humanitarian Response Plan (HRP) rounds. The 2023 COD-PS update for Mozambique comprises ADM-2 level estimates of population size by sex and standard 5-year demographic age groups.[2]

[1] The Common Operational Dataset on Population Statistics (COD-PS) is a set of up-to-date (i.e. reference date within the last year) subnational population projections, disaggregated by sex and age (standard 5-year demographic age groups) to the lowest geographic administrative level possible. The COD-PS is constructed according to “best available humanitarian data” standards and designed to support short-term humanitarian decision-making. The COD-PS is one of 3 mandatory common operational datasets, alongside common operational datasets on administrative boundaries and humanitarian caseloads, that are required in all operational humanitarian response countries by the United Nations. Ensuring the availability, quality and usability of the COD-PS is an institutional responsibility of the United Nations Population Fund (UNFPA) within the United Nations humanitarian system.

[2] The official administrative regions in Mozambique are as follows: ADM-0 is the country level (defined as the official international borders of Mozambique, as recognized by the United Nations); ADM-1 consists of

3. Data Sources

For Mozambique, we reviewed an array of data sources on baseline population and population change due to fertility, mortality and internal and international migration. These data sources were assessed based on their availability and usability for the 2023 COD-PS update.

Sources of information on the baseline population include:

1. official 2017 census estimates from the Instituto Nacional de Estatística (INE), available at the ADM-2 level;
2. official 2017-2050 projections and other published estimates from the INE (available at the ADM-1 level); and
3. population estimates and projections from other institutions such as the US Census Bureau (2000-2025, at ADM-3).

Fertility and mortality data from the Mozambican civil registration system, 2017 population and housing census, multiple rounds of the Demographic and Health Surveys, the Manhiça Health and Demographic Surveillance System (HDSS); and Chókwè HDSS were examined. Also, data from the Countrywide Mortality Surveillance for Action Mozambique (COMSA) were also reviewed. Due to data access and/or coverage limitations, our fertility and mortality estimates and projections were developed based on the 2017 census and DHS data.

In contrast to the other components of population change, most information on population mobility in this context is available from humanitarian rather than official sources. For estimates of baseline migration, a key source is the INE-UNFPA thematic analysis report on migration, based on data from the 2017 Census, and comparable to the thematic reports on mortality and fertility noted above.

Information on internal displacement is available from several IOM DTM assessments, each with varying geographic coverage, sampling strategies, and purposes. Key among these are the

1. Mozambique Mobility Tracking Assessments (previously called Area Baseline Assessments) (Rounds 12-19 publicly available, Rounds 4-11 shared by IOM with UNFPA), which uses a key-informant network to collect estimates of populations of IDPs at the ADM-2 and location-specific levels. While most rounds have focused on Northern Mozambique, Round 19 includes provinces in both Northern and Central Mozambique, and all 17 districts of Cabo Delgado;
2. The Northern Mozambique Multi-Sectoral Location Assessment (Rounds 2-11 publicly available), which surveys selected sites hosting IDPs in Northern Mozambique; and

11 provinces; ADM-2 consists of 159 districts; and ADM-2 areas consist of 411 postos. These are reflected in the Common Operational Dataset on Administrative Boundaries, as updated by OCHA. For details, please see https://data.humdata.org/dataset/cod-ab-moz. Four uninhabited COD-AB features do not have any accompanying population estimates: Ilha Licom [MZ0804] and Ilha Risunodo [MZ0805], which are islands in Lake Niassa; Lago Niassa [MZ0807], or Lake Niassa; and Maquival [MZ1112], an Indian Ocean shoreline feature.

3. Other Area Baseline Assessments, including those relating to natural disasters such as Cyclone Idai, Cyclone Kenneth, and Cyclone Eloise. For the most part, these estimates are available at the ADM-3 or site-specific level, with some disaggregation by age and sex.

Information on forcibly displaced populations (including refugees, asylum-seekers, IDPs of concern to UNHCR, and others in need of international protection), both within and originating from Mozambique, is available from UNHCR (United Nations High Commissioner for Refugees, 2023). A key data source for this COD-PS update was UNHCR June 2023 population counts of refugees and asylum seekers with Mozambique as a country of asylum. This data, which was shared with UNFPA by UNHCR, is disaggregated by current ADM-1 location, age group, and sex.

4. Overview of population projection methodology

Our projection approach for Mozambique follows a cohort-component approach, with an initial projection from 2017-2023 at ADM-1. We then disaggregate these estimates to the ADM-2 level using Iterative Proportional Fitting (IPF), in line with our reference date of August 1, 2023 (Norman, 1999; Hunsinger, 2009; Deming and Stephan, 1940).

Baseline Population

Our projections use the 2017 census of Mozambique as a baseline, after the following adjustments, in line with those carried out by the United Nations Population Division (Johnson et al., 2022):

1. Accounting for under-enumeration, using provincial undercount estimates from the Post-Enumeration Survey carried out by the Government of Mozambique;
2. Accounting for age heaping, using standard demographic age-group smoothing techniques; and
3. Accounting for additional under-enumeration of children that may not be reflected in the Post-Enumeration Survey. This is carried out using the BASEPOP approach (Arriaga et al., 1994), which was initially implemented by the United States Census Bureau and is now available through the DemoTools R package (Riffe et al., 2019). This method adjusts counts of children below age 10 using previous fertility and mortality estimates, along with female population counts.

Fertility

Our estimates of fertility are based on data from recent Demographic and Health Surveys and censuses in Mozambique. To construct the annual time series of the Total Fertility Rate (TFR), we computed single year estimates of fertility using the last three rounds of the Demographic and Health Surveys in Mozambique (2011, 2003 and 1997) as well as from the last three censuses (2017, 2007 and 1997). Weighted Loess regression was used to smooth the data, with logistic interpolation applied to the point estimates from the last three censuses to estimate

fertility rates for each province from 2000-2017. To project total fertility forward, we applied an autoregressive integrated moving average (ARIMA) to model the annual time series from 2000-2017 and then project forward to 2022. Age patterns of fertility rates in Mozambique were estimated using a Gompertz relational model, with province-specific age-specific fertility rates (ASFRs) from the 2017 population census used to derive age patterns of fertility for each province from total fertility levels in 2000-2022.

Mortality

Mortality was estimated based partly on analysis carried out as part of the INE-UNFPA thematic study on mortality from the 2017 Population Census, which estimated completeness of death registration and adjusted deaths for all provinces. These estimates were used to calculate provincial-level transformed life tables, in line with the Brass relational model (Stewart, 2011). Life expectancy at birth estimates were also calculated by sex at the provincial level. This incorporated a variety of models and adjustments, including the UN WPP 2022 BayesPop approach of accounting for uncertainty in national-level mortality change (Ševčíková et al., 2016), and adjustments to account for the high HIV/AIDS prevalence in Mozambique and estimated impacts of the COVID-19 pandemic. The final provincial age and sex-specific life table estimates are based on these projected life expectancy at birth estimates, as well as national-level age-specific mortality rates projected using the Lee-Carter method of mortality forecasting (Lee and Carter, 1992).

Mobility

Our estimates of mobility in the 2017-2023 period account for the following types of mobility across international borders and within Mozambique:

1. Internal displacement at the ADM-2 level, in terms of locations of origin and displacement. This is based on estimates of internally displaced populations from the IOM Displacement Tracking Matrix (DTM) Mobility Tracking Assessment Round 19 for Northern and Central Mozambique.

   IOM Mobility Tracking Assessments provide highly spatially disaggregated estimates of internally displaced persons and, in some rounds, returnees in sites sampled based on a key-informant network. These estimates are provided for single time points, with a potentially different set of sites sampled each round. Since our estimates focus on the cumulative balance of mobility, rather than mobility at specific time points within the projection interval, we use the latest Mobility Tracking Assessment Round available that is within the reference date. This approach assumes that data from the latest round will provide a representative estimate of the total population of internally displaced persons at the time point considered. A single snapshot of mobility is unlikely to fully reflect ADM-2 mobility since 2017, given that some individuals may have been displaced multiple times or may not be included in a particular round. However, in the absence of more detailed data on migration flows by age, sex, and geographical location over time, this approach represents the best available method, given the current data landscape.

These estimates rely on IOM DTM Mobility Tracking Assessment Round 19, the most recent dataset available, with a reference date of September 2023. This includes information on population counts of internally displaced persons by age, sex, and locations of origin and displacement, for individuals internally displaced within Northern and Central Mozambique.

2. Refugee and asylum seeker in-mobility, for individuals with Mozambique as a country of asylum. This was based on UNHCR estimates of refugees and asylum seekers within Mozambique by age, sex, and current ADM-1 location. In the absence of available data on refugee and asylum seeker populations with Mozambique as a country of origin, we do not account directly for this component of population change.

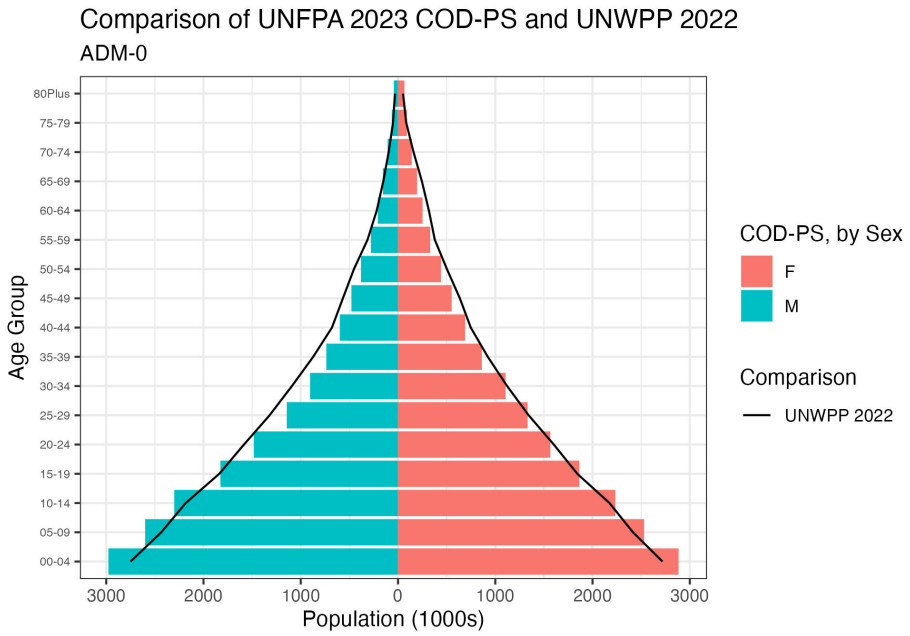
3. Other expected inter-provincial migration, based on intercensal migration rates in the 2012-2017 period, as per the INE-UNFPA thematic report on migration. Given that interprovincial mobility dynamics to and from provinces in Northern Mozambique have likely changed significantly since the start of the conflict in 2017, we instead use IOM DTM Round 19 for estimating ADM-1 mobility dynamics in these provinces. Estimates for children aged 0-4 are based on migration rates for women of reproductive age, in line with standard demographic techniques.

4. Other international migration, based on estimates of the annual net migration balance from the United Nations World Population Prospects (2022 revision) and international in-migration at the provincial level from the UNFPA thematic report on migration. In the absence of further available data on ADM-1 places of origin or the age-sex distribution of individuals emigrating from Mozambique, this approach attempts to account for additional international migration not reflected in other data sources, using the best available data for this component of demographic change.

5. Comparison and validation with other sources

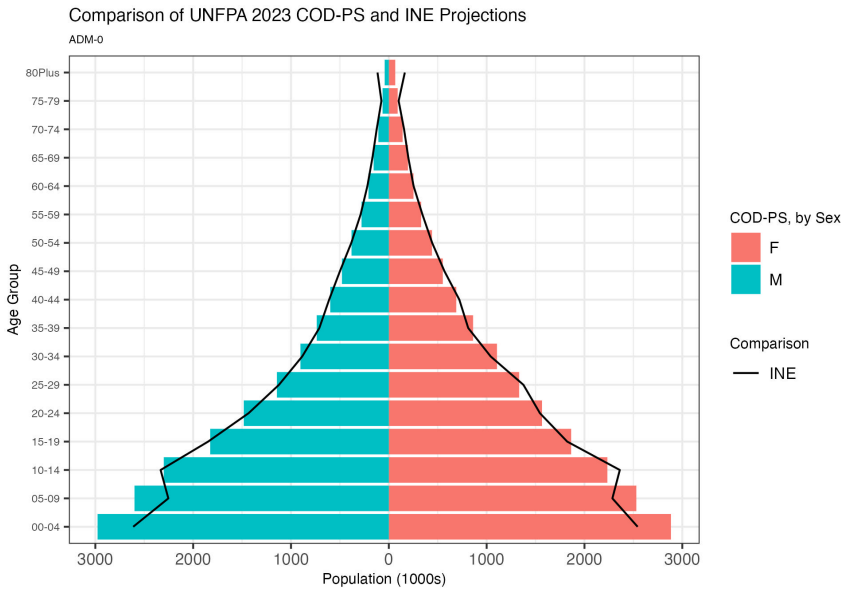
In order to provide context on these estimates, we compare them to other published sources:

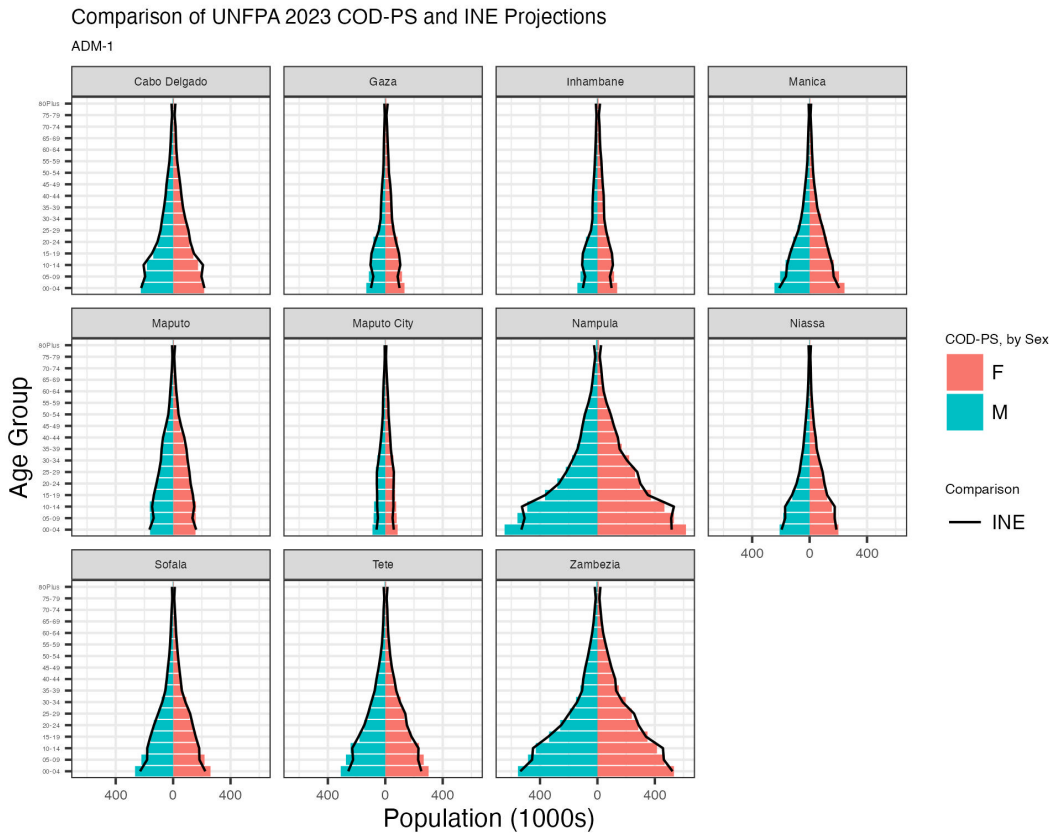
1. At the ADM-0 level, to the UN WPP 2022 revision;



Estimates from the two projections are relatively consistent at the ADM-0 level, with differences likely shaped by the population baselines used, as well as estimates of international migration.

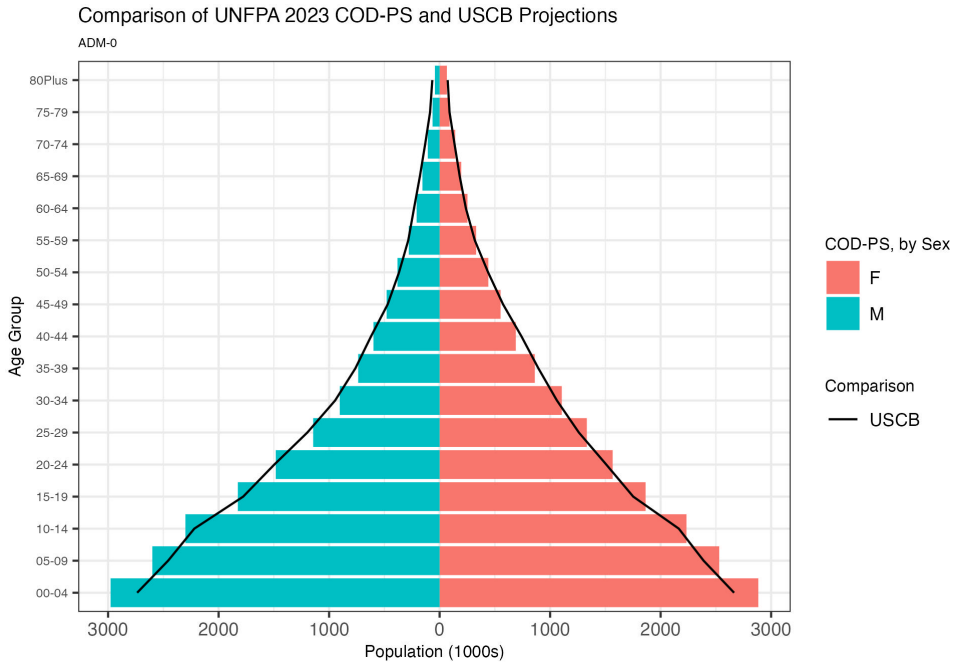
2. At the ADM-0 and ADM-1 levels, to those developed by the Instituto Nacional de Estatística (INE); and

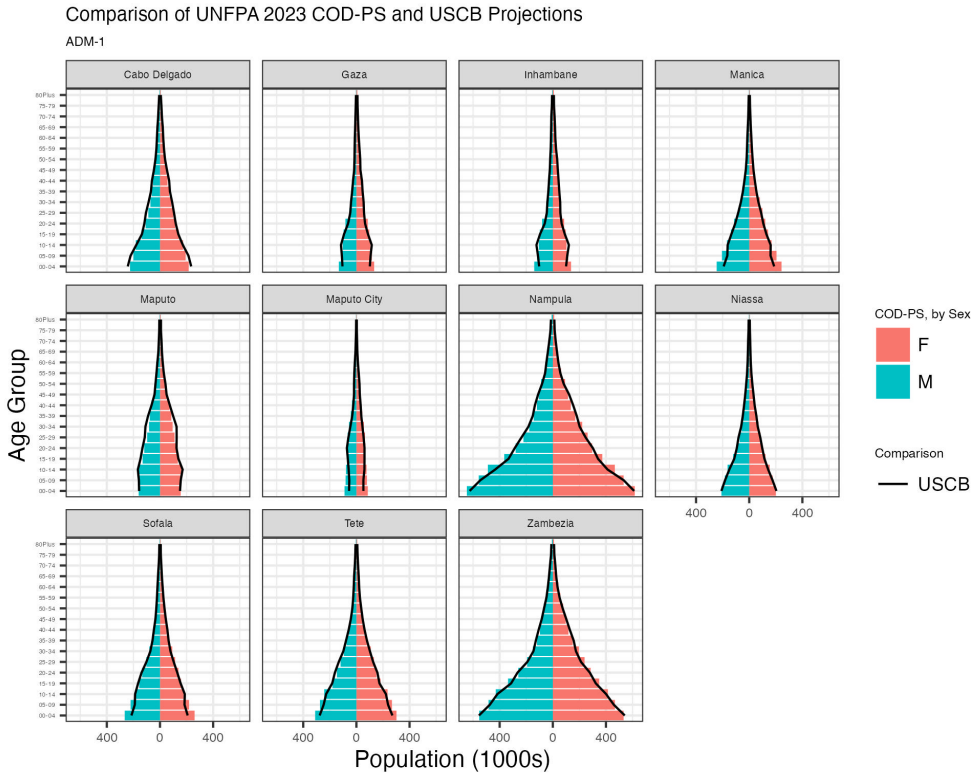




Estimates from the two projections are relatively consistent at the ADM-0 and ADM-1 levels, with differences likely shaped by population baseline adjustments used, and other projection specifications for components of demographic change.

3. At the ADM-0 and ADM-1 levels, to those developed by the United States Census Bureau's International Programs Center.





Estimates from the two projections are relatively consistent at the ADM-0 and ADM-1 levels, with differences likely shaped by the population baseline, and differences in methods used for projecting growth rates for subnational areas.

6. Acknowledgements

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UNFPA expresses special gratitude:

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- To the INE and INGD for constructive technical discussions on population estimates and projections as well as the humanitarian data ecosystem in Mozambique,
- To the United Nations Population Division for guidance and support in modeling and adjusting for under-enumeration of children in the 2017 population and housing census in Mozambique.
- To the United States Census Bureau's International Programs Center for constructive consultations about their subnational population projection methods and results for Mozambique.
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