Contributions of native poultry to food security, wealth creation and sustainable livelihoods under resource-limited conditions

Part II Current state and production value

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SUMMARY

Part I of this publication described the main poultry species and rearing systems used by rural populations. This second part reports the current status and production value of local, small-scale poultry production worldwide. Reports from various regions (Africa, Central Asia, Eastern Asia, Southern Asia, South-eastern Asia, Central America, South America, Caribbean, Eastern Europe, Southern Europe, and Oceania) show that over 80 percent of families in rural areas of low- and lowest-income countries (LLMICs) raise poultry. The motivation for raising poultry is not limited to the production of eggs and meat for family consumption but also encompasses a wide range of other reasons, such as religious rituals, gifts for guests, entertainment and celebrations. Local breeds are therefore highly popular among the rural population, and their products achieve high prices. The status of production for various poultry species

(chickens, ducks, geese, turkeys, pigeons, and other) in different regions of the world is presented for the period from 2020 to 2024. Furthermore, aspects of genetic improvement in local breeds and their importance for the conservation of genetic resources are highlighted.

Keywords: Indigenous poultry, native poultry, food security, wealth creation, sustainable livelihoods.

Disclaimer: The views expressed in this publication are those of the author and do not necessarily reflect the views of the Food and Agriculture Organization of the United Nations.

MULTIPLE ROLES AND VALUES OF NATIVE POULTRY (NP)

The keeping of NP by local communities has been practised for many generations in low- and lower middle-income countries (LLMICs). More than 85% of rural families in sub-Saharan Africa, more than 90% of tribal families from 35 surveyed villages in the five districts of western India, 92% of the 100 surveyed respondents in Madhya Pradesh in central India, 89% of the rural households in Bangladesh and 90–95% of the households in rural Cambodia keep one or more poultry species (Guèye 2005, 2022). All ethnic groups tend to be involved in NP production (Guèye, 2005; 2022), and birds are kept for many reasons (***Table 1, Figure 1***). NP keeping has a symbolic importance within the context of many social and cultural activities (e.g. special banquets for distinguished guests, gifts, cocks as alarm clocks for the villagers) and/or religious ceremonies (e.g. cocks as offerings to the deities). Furthermore, the major role played by women, assisted in some cases by children, in NP production in LLMICs is widely recognized (Branckaert and Guèye, 2000, Guèye 2003a, 2003b, 2005, FAO, 2004, de Bruyn *et al.,* 2015; Alders *et al.,* 2018, 2022). For example, more than 70% of chicken owners in rural areas of Sub-Saharan Africa are women, while traditionally NP belong only to children (boys) (Guèye, 2003a).

Table 1. *Purposes mentioned by farmers for keeping native poultry in various regions in low- and lower middle-income countries (LLMICs).*

Native poultry species	Study areas[a]	Reported purposes[b] (%)	References
Chickens[c]	**Himalayan Region, India**		Singh *et al.* (2023)
	· Tropical climate (235)	Eg (16.2), Eg+M (83.8), C (11.5), I (6.8), C+I (81.7)	
	· Sub-tropical climate (192)	Eg (14.6), Eg+M (85.4), C (11.5), I (2.6), C+I (85.9)	
	· Sub-temperate climate (168)	Eg (10.1), Eg+M (89.9), C (8.9), I (1.8), C+I (91.1)	
Chickens	**Northwest provinces, Algeria** (160)	· Birds: C (5.0), I (91.9), C+I(3.1)	Zouaoui *et al.* (2023)
		· Eggs: C (38.1), I (5.6), C+I (56.2)	
Chickens	**North, Central, and South regions, Italy** (121 breeders)	· Meat products: C (44.7), I (31.9), C+I (23.4)	Franzoni *et al.* (2021)
		· Table eggs: C (21.4), I (14.3), I+C (64.3)	
Chickens[c]	**Ouémé, Zou, and Collines regions, Benin** (269)	C (65.1), I (97.8), S (62.5)	Adoligbe *et al.* (2020)
Chickens	**Salémata Department, Senegal** (45)	I (51.1), C (40.0), SCR (8.8)	Nahimana *et al.* (2019)
Chickens[d] + Ducks + Guinea fowl + Pigeons + Turkeys	**Eastern regions and Haute-Casamance, Senegal** (600)	I (51.6), C (38.8), LP+E+Ih (9.5)	Nahimana *et al.* (2016)
Chickens[e]	**South-Kivu province, Democratic Republic of Congo** (304)	I (42.3), C (27.9), I+C (29.8)	Mugumaarhahama *et al.* (2016)
Chickens	**Mohoba district, India** (150)	· Priority 1: I (78), C (11), SCR (7), G (4)	Rawat *et al.* (2015)
		· Priority 2: I (27), C (36), SCR (4), G (2)	
Chickens[c, f]	**Gulu and Kiryandongo districts, Northern Uganda** (121)	· Birds: I (95.0), C (99.2), EL (58.7), SCR (19.8)	Nakkazi *et al.* (2014)
		· Eggs: C (60.3), INC (99.2), I (20.7), EL (0.8)	
Chickens	**Musandam, Batinah, North Hajar, East Hajar, East Coast and Dhofar zones, Oman** (163)	C (68.9), C+I (31.3)	Al-Qamashoui *et al.* (2014)
Chickens[c]	**Rongo and Homabay Districts, Western Kenya** (120)	I (89.2), C (98.3), CP (11.7), EF (18.3), SCR (11.7)	Ochieng *et al.* (2013)
Chickens	**Haa and Mongar districts, Bhutan** (68)	C (82.9), I (15.7), CP (1.4)	Dorji and Gyeltshen (2012)
Chickens	**South Gezira District, Gezira State, Sudan** (100)	C (50.0), I (4.0), C+I (23.0)	Sayda *et al.* (2012)
Chickens[c]	**Bure district, Northwest Ethiopia** (280)	I (51.4), INC (45), C (44.3), SCR (36.4), Eg (40.7)	Moges *et al.* (2010)
Chickens[c]	**Ashanti region, Ghana** (135)	C (100.0), I (87.4), HG (72.6), UR (48.2), AV (11.9), A (1.5)	Adomako (2009)
Chickens	**Peri-urban area of Dakar, Senegal** (150)	· Birds: C (55.3), I (43.3), Gf (0.7), BS (0.7)	Guèye (2003a)
		· Eggs: INC (83.6), C (10.9), I (5.5)	

Native poultry species	Study areas[a]	Reported purposes[b] (%)	References
Chickens (86.1%) + ducks (7.0) + Guinea fowl (1.4) + Pigeons (5.5)[f]	**Kisangani town, Tshopo province, Democratic Republic of Congo** (150)	I (13.3), C (85.6), LP (1.1)	Ebwa *et al.* (2019)
Guinea fowl	**Urban Commune of Tessaoua, Maradi region, Niger** (60)	· Birds: I (45.0), LP (36.0), Gf (14.0), C (5.0)	Ousseini *et al.* (2024)
		· Eggs: INC (40.0), I (38.0), C (22.0)	
Chickens + Turkeys	**Kenifra region, Morocco** (52)	I (52), C (48)	Benabdeljelil and Arfaoui (2001)

[a] *Values in brackets are numbers of households surveyed.*

[b] *A=Alert for security, AV=Aesthetic value, BS=Breeding stock, C=Consumption, CP=Celebrations and/or parties, E=Exchange, EF=Emergencies and/or funerals, Eg=Eggs, EL=Exchange for labour, G=Game, Gf=Gifts, HG=Honouring distinguished guests, I=Income, Ih=Inheritance, INC=Incubation of eggs for replacement, LP=Leisure and/or prestige, M=Meat, S=Saving, SCR=Socio-cultural and/or religious ceremonies, UR=Use for rituals*

[c] *Non-exclusive percentages*

[d] *84,7% of native chickens (NCs)*

[e] *92.5% of NCs*

[f] *Calculated from the author's data.*

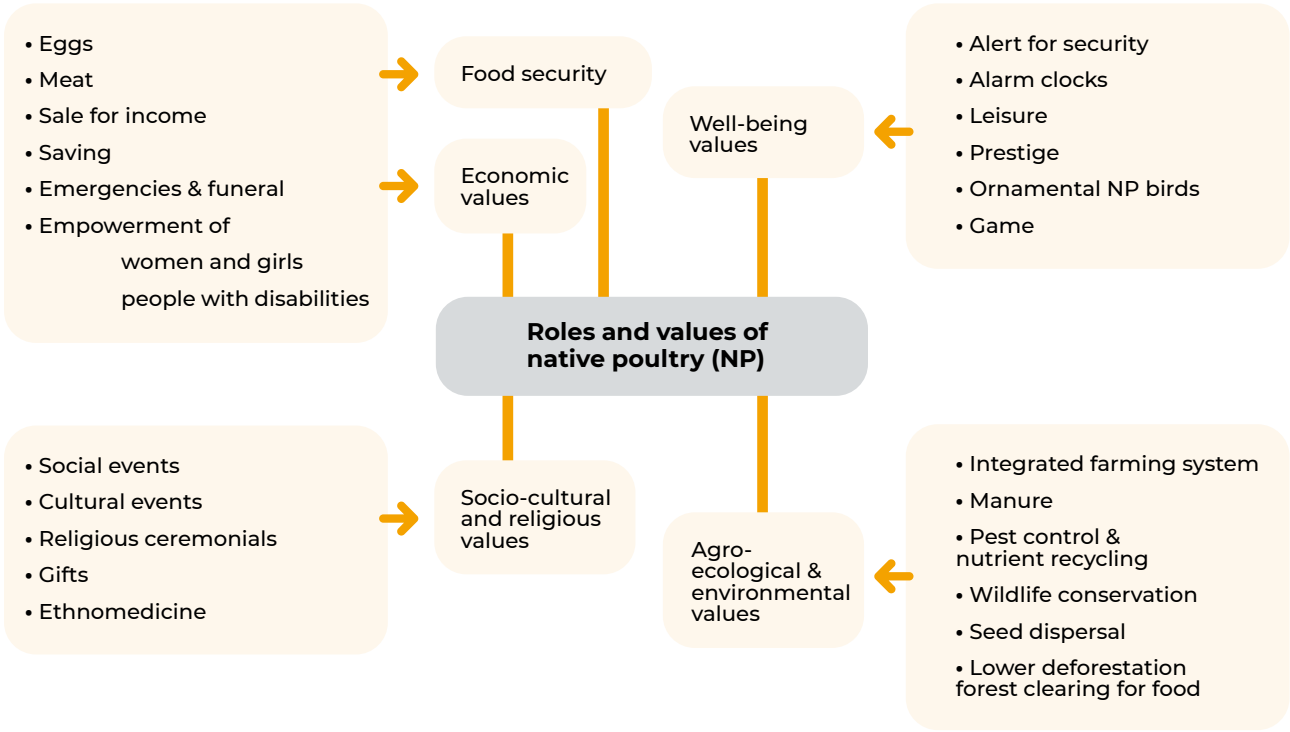

Figure 1. *Conceptual framework illustrating multiple roles and use values of native poultry in low- and lower middle-income countries (LLMICs).*

NP AS A TOOL FOR WEALTH CREATION

NP farming represents an important sector in animal production, with family flocks representing the vast majority, especially in LLMICs. In these countries, villagers raise NP to meet household food demands and as additional source of income. NP production can boost economic growth through direct contribution to rural sustainable livelihoods, food security and wealth creation, and, considering the sector's various linkages with other industries, through the multiplier effects of poultry products along the value chains (FAO, 2018). NP rearing is profitable for farmers in resource-poor areas. From a study of 100 NC-keeping women farmers, who reared at least 10 NCs each one, in Sivasagar district, Assam, India, Islam et al. (2015) reported that the benefit-cost ratio (BCR) was 2.27. In a similar study of 150 NC-keeping households in Pabna district of Bangladesh, each one owning at least 8 birds reared under backyard conditions, Sumy *et al.* (2010) reported a BCR per bird 1.61. In LLMICs, it is estimated that BCR ranges from 1.50 to 3.25 in the farming of NP flocks, composed of chickens, ducks (mallard ducks and muscovy ducks), geese, pigeons, turkeys, and guinea fowl. In the Himalayan Region of India, Singh *et al.* (2023) reported the annual income from NC to be estimated at 5,140; 4,400 and 7,340 Indian Rupies in the tropical, sub-tropical and sub-temperate climates, respectively, which contributed to the total household's incomes at 12.2, 10.5 and 18.0 % in the tropical, sub-tropical and sub-temperate climates, respectively.

Meat and eggs from NP stocks are more esteemed by LLMICs' consumers, in comparison with those from intensively raised poultry flocks. Consumers generally argue that products from NP are tastier and healthier (because synthetic drugs, such as antibiotics, are rarely used); therefore, they often fetch premium prices, more than 70-90%. For example, in Kampala city markets of Uganda, the cost of NCs was more than twice as much as imported chicken (Emuron *et al.,* 2010). Because of its low productivity, NP in LLMICs has been undervalued and is frequently considered by farmers as an insignificant occupation compared to other agricultural or trade activities. As a result, it does not receive due attention from many agricultural policy makers (including livestock specialists). Nevertheless,

NP birds and their products are a valuable asset to local populations because they are not only sources of wealth (Guèye, 2003a; Khan, 2008; Padhi, 2016; Nahimana *et al.,* 2019; Snively-Martinez and Quinlan, 2019; Adoligbe *et al.,* 2020; Singh *et al.,* 2023; Zouaoui *et al.,* 2023; Tenza *et al.,* 2024) and food (Guèye, 2003a; Pym *et al.,* 2006; Khan, 2008; Emuron *et al.,* 2010; Wong *et al.,* 2017; Alders *et al.,* 2018, 2022; Abdul-Rahman *et al.,* 2019; Nahimana *et al.,* 2019; Snively-Martinez and Quinlan, 2019; Adoligbe *et al.,* 2020; Mseleku *et al.,* 2023; Singh *et al.,* 2023; Tenza *et al.,* 2024) but are also critical to strong socio-cultural linkages in LLMICs, especially in disadvantaged groups and resource-limited areas.

CURRENT STATE AND TRENDS IN GROSS NP MEAT PRODUCTION VALUES (MPVS)

Global production of native chickens is showing an upward trend in all regions and sub-regions shown in **Figure 2**. East Asia holds a leading position in both production volume and growth rate. This is mainly attributable to the substantial output from Chinese production. Along with the USA and Brazil, China ranks among the world's largest producers of poultry meat.

Interestingly, despite the significant expansion of hybrid breeds under intensive poultry farming systems, the production of native breeds is also increasing disproportionately. The various varieties of the "Yellow Chicken" for instance, are enjoying growing popularity and have a substantial share of poultry meat consumption in China. Similar trends can be observed in native duck and goose production in EA countries. The world's gross NP meat production value (MPV) was estimated in 2022 to be US$ 288,832 million, consisting of US$ 244,725 million (84.7%) for NCs, US$ 17,646 million (6,1%) for NDs, US$ 16,677 million (5.8%) for NGs, US$ 9,731 million (3.4%) for NTs and US$ 52 million (less than 1%) for native pigeons and other birds (NPgoBs).

Out of the total world's gross NP MPV in 2022, Eastern Asia (EA) contributed 36.9%, South America (SAm) 14.1%, Southern Asia (SAs) 13.8%, South-eastern Asia (SeA) 11.2%, Eastern Europe (EE) 7.8%, Africa (Af) 6.9%, Central America (CAm) 4.4%, Southern Europe

(SE) 3.0%, Oceania (Oc) 1.3%, Caribbean (Ca) 0.3% and Central Asia (CAs) 0.3% (FAOSTAT, 2025).

The world's highest contributions to gross NP MPVs in 2022 were estimated at 20.4% for gross native chicken (NC) MPVs in EA (***Figure 2***), 85.4% for gross native ducks (ND) MPVs in EA (***Figure 3***), 98.0% for gross NG MPVs in EA (***Figure 4***), 6.8% for gross native turkeys (NT) MPVs in SE (***Figure 5***), and 99.0% for gross native pigeons and another birds (NPgoB) MPVs (FAOSTAT, 2025).

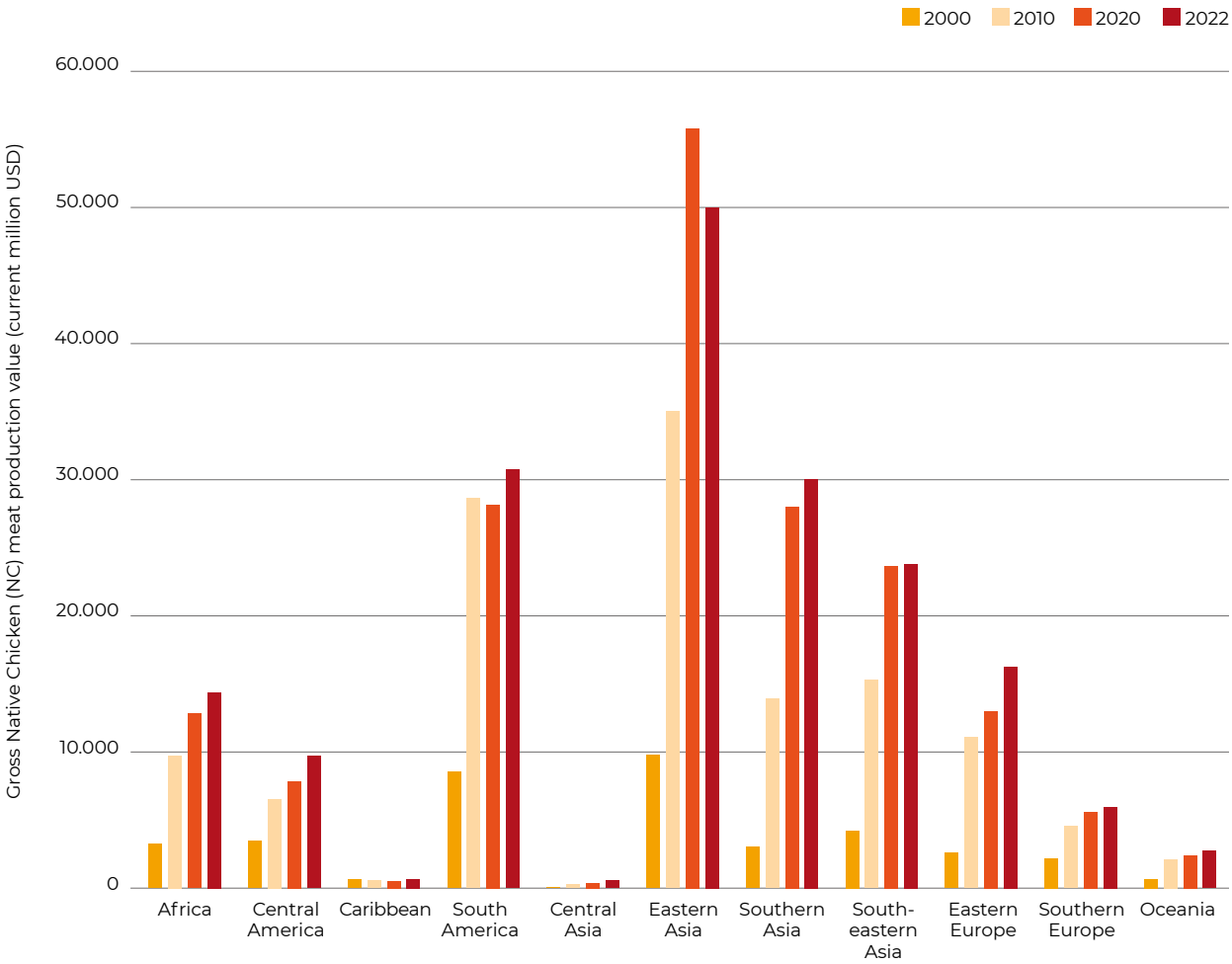

Figure 2. *Gross Native Chicken (NC) meat production value (USD) in the world and by its regions and sub-regions from year 2000 to 2022 (data from FAOSTAT, 2025)*

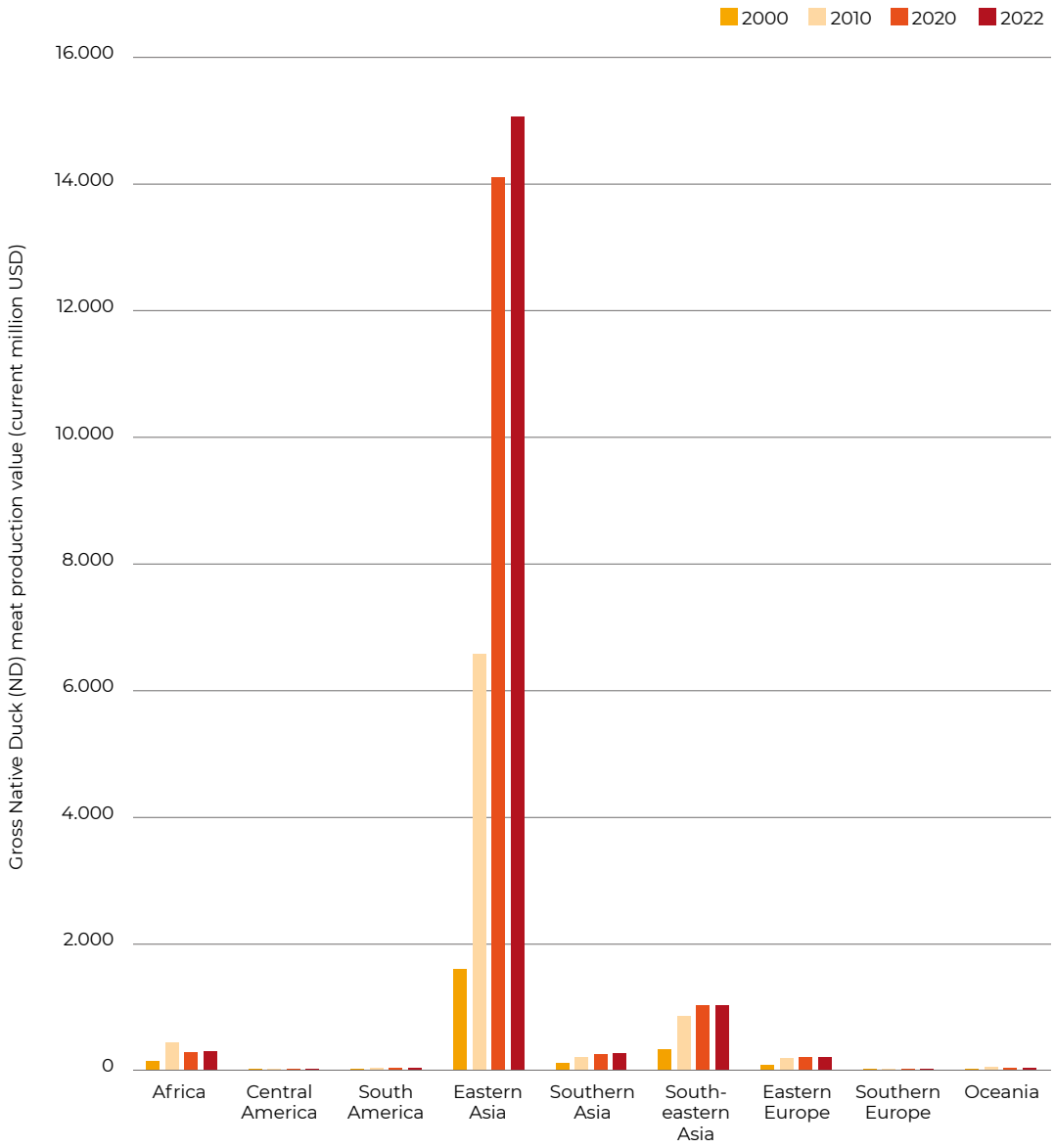

Figure 3. *Gross Native Duck (ND) meat production value (USD) in the world and by its regions and sub-regions from year 2000 to 2022 (data from FAOSTAT, 2025)*

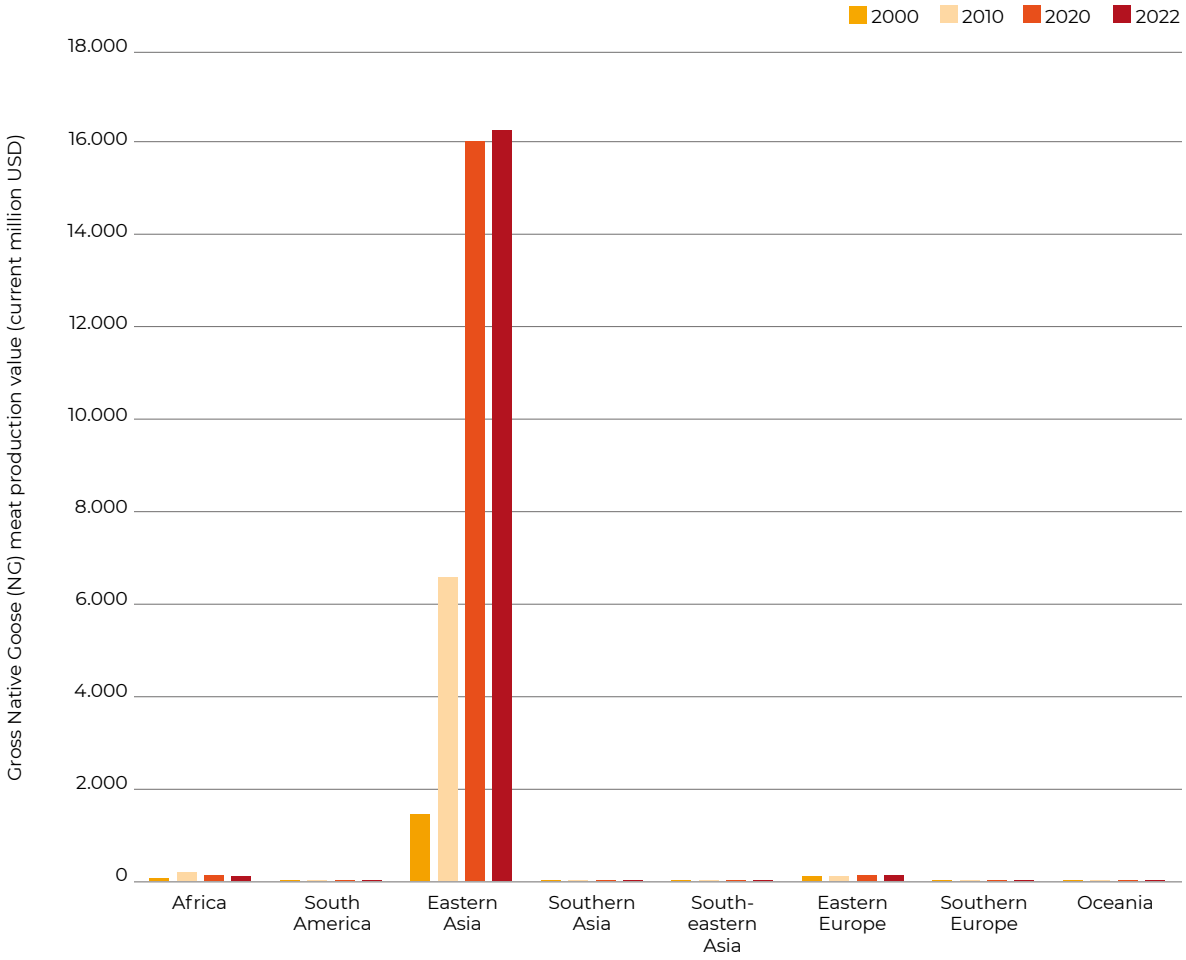

Figure 4. *Gross Native Goose (NG) meat production value (USD) in the world and by its regions and sub-regions from year 2000 to 2022 (data from FAOSTAT, 2025)*

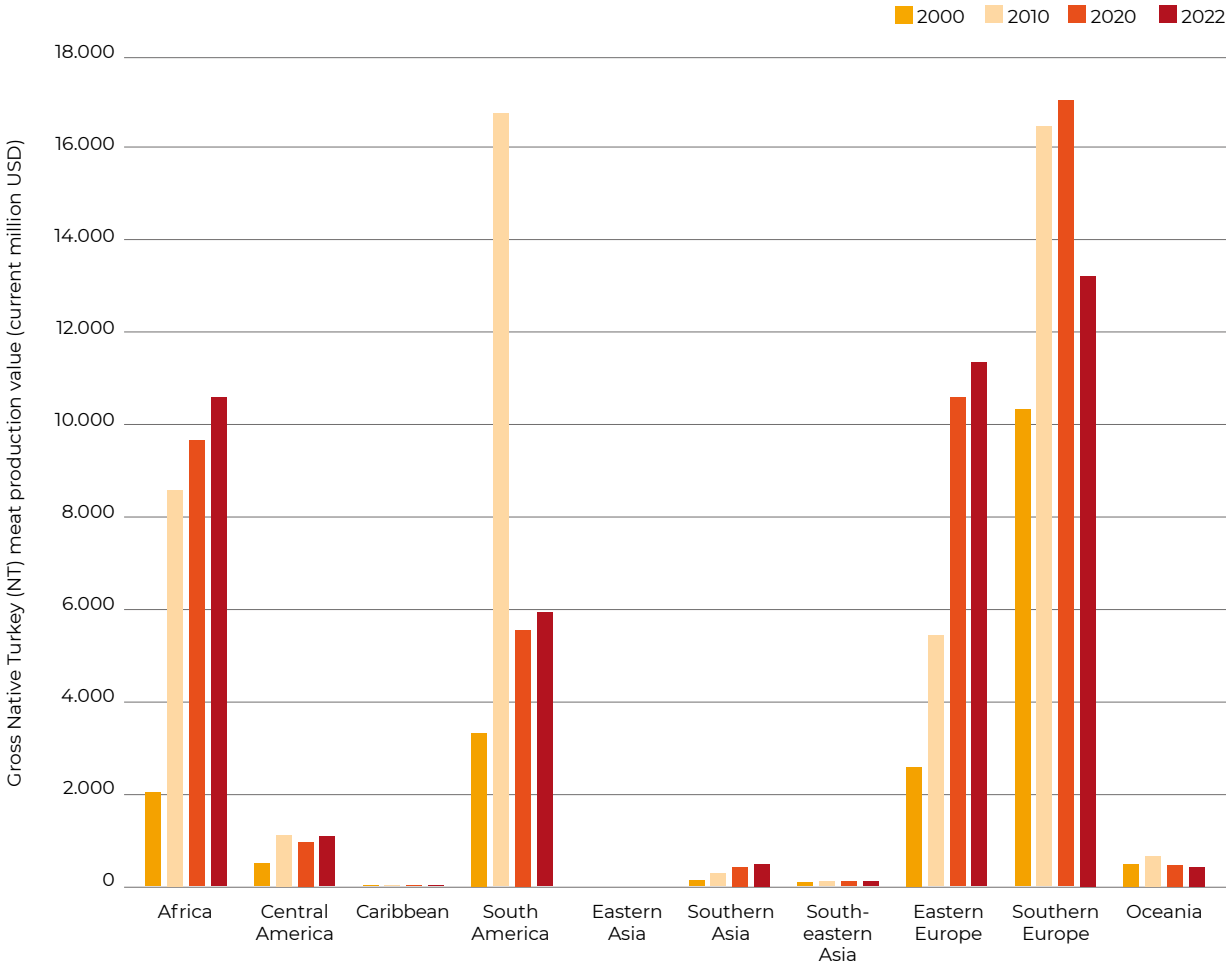

Figure 5. *Gross Native Turkey (NT) meat production value (USD) in the world and by its regions and sub-regions from year 2000 to 2022 (data from FAOSTAT, 2025)*

CURRENT STATE AND TRENDS IN GROSS NP MEAT PRODUCTION INDEX NUMBERS

The world's highest contributions to gross NP meat production index numbers (MPINs) and per capita gross NP MPINs (2014-2016=100) in 2022 were estimated at 243.9 for gross NC MPINs (***Figure 6***) and 218.6 for per capita gross NC MPINs (***Figure 7***) in EA; 843.7 for gross ND MPINs (***Figure 8***) and 851.7 for per capita gross ND MPINs (***Figure 9***); 168.4 for gross NG MPINs (***Figure 10***) and 165.2 for per capita gross NG MPINs (***Figure 11***) in EA; 219.9 for gross NT MPINs (***Figure 12***) and 223.3 for per capita gross NT MPINs (***Figure 13***) in EE; and 99.0 for gross NPgoB MPINs (***Figure 14***) and 92.5 for per capita gross NPgoB MPINs (***Figure 15***) in SeA (FAOSTAT, 2025).

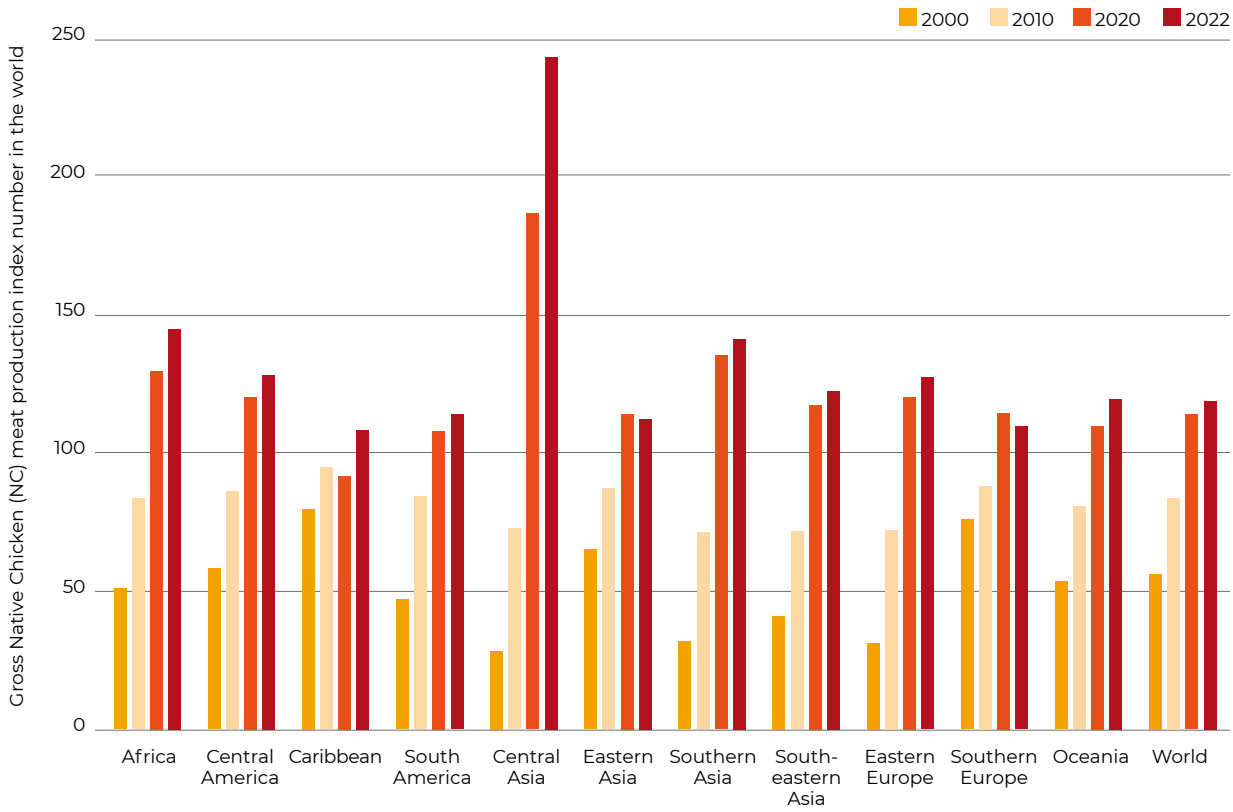

Figure 6. *Gross Native Chicken (NC) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2024 - 2026 as referenced by the FAO (data from FAOSTAT, 2025)*

From the years 2000 to 2022 the production indices for native ducks and geese, the Southeast European region stands out both in terms of magnitude and variation (***Figures 8 - 11***). This is likely attributable to the unique situation of waterfowl in the Western Balkan countries. There, native ducks are raised not only in extensive systems but also in intensive ones.

This results in relatively high indices for Gross Meat Production and Per Capita Gross Meat Production. The sharp decline in indices between 2000 and 2010 was a consequence of political systems and the associated challenges in agricultural production.

While the importance of local duck breeds rebounded in 2020 and 2022—even surpassing index values from previous years—no similar trend is discernible regarding geese. In contrast to ducks, the production of native geese in the region were predominantly raised in small groups under extensive management systems.

In the wake of the economic restructuring of the poultry sector toward intensification, geese production did not follow this trend and declined sharply.

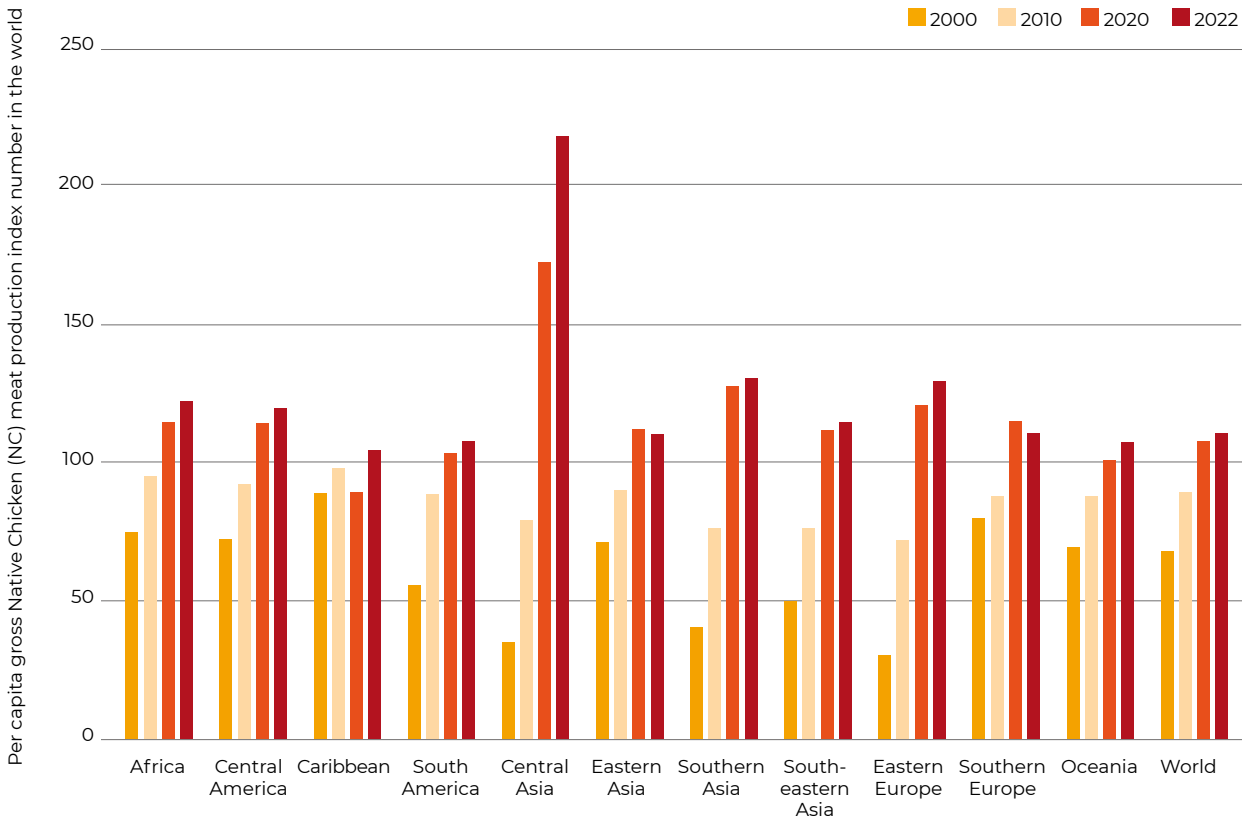

Figure 7. *Per capita gross Native Chicken (NC) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2024 - 2026 as referenced by the FAO (data from FAOSTAT, 2025)*

The outstanding Gross Native Duck meat and Gross Native Geese meat production index numbers (***Figures 8 - 11***) are likely attributable to the unique situation of waterfowl in the Western Balkan countries. There, native ducks are raised not only in extensive systems but also in intensive ones.

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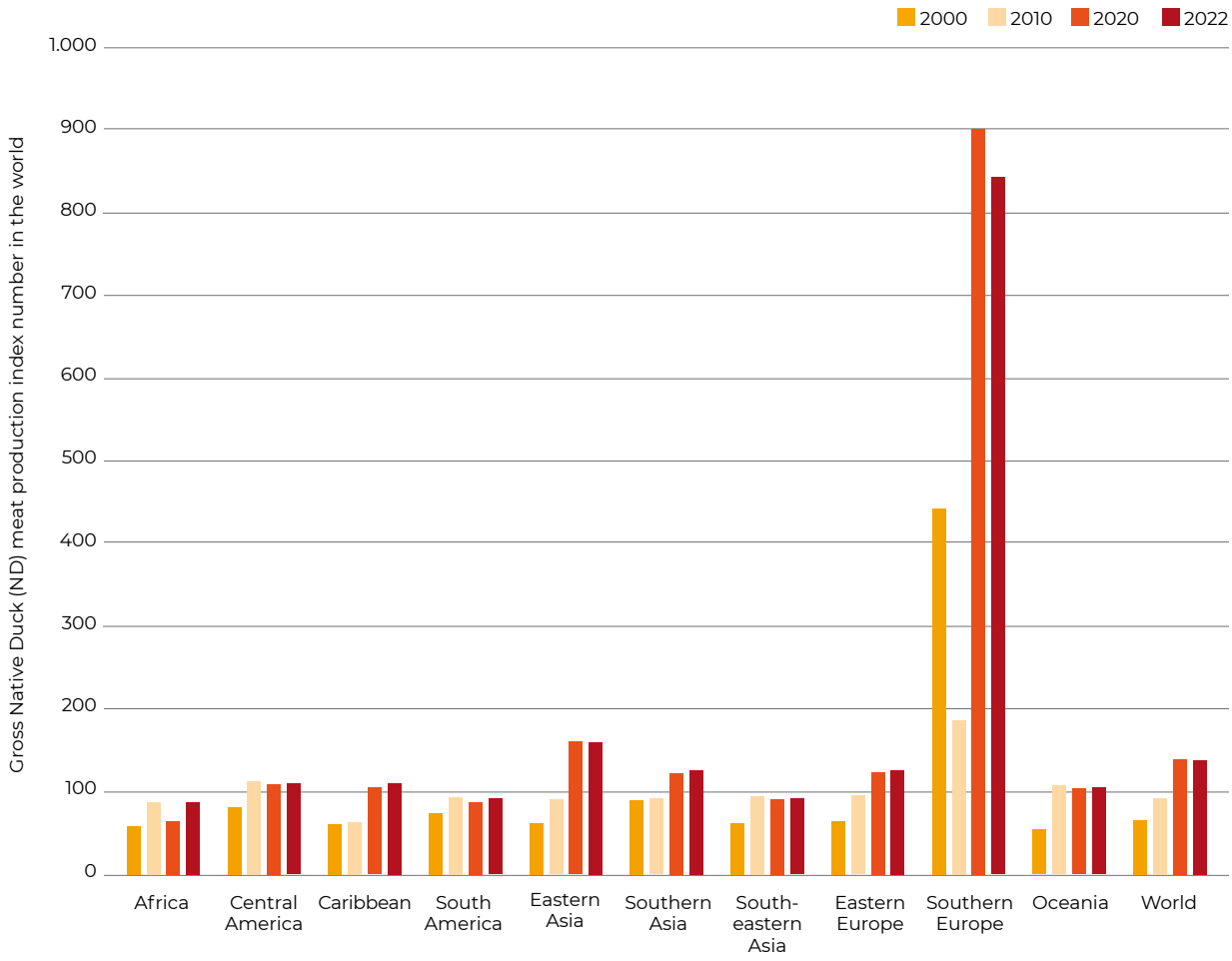

Figure 8. *Gross Native Duck (ND) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

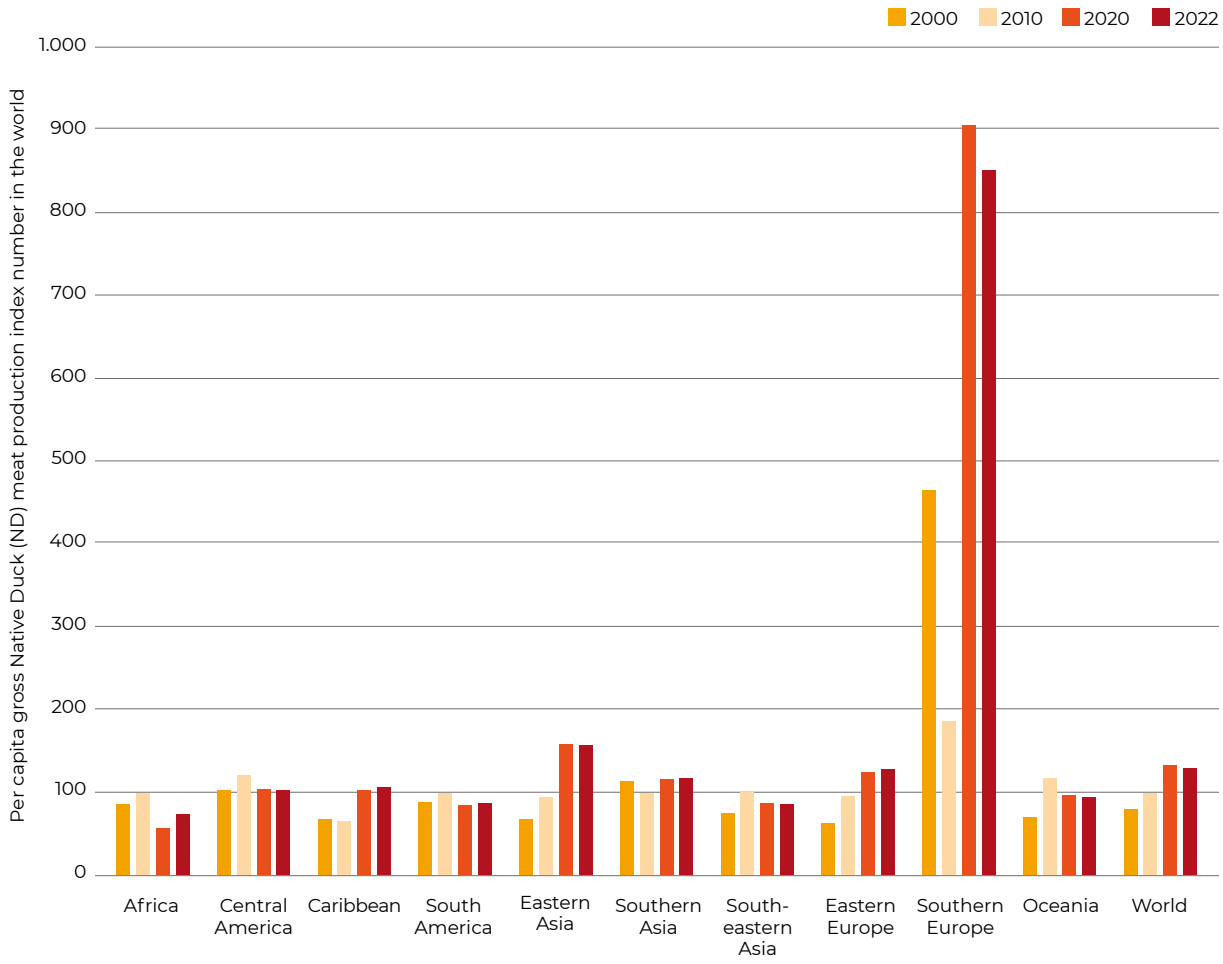

Figure 9. *Per capita gross Native Duck (ND) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

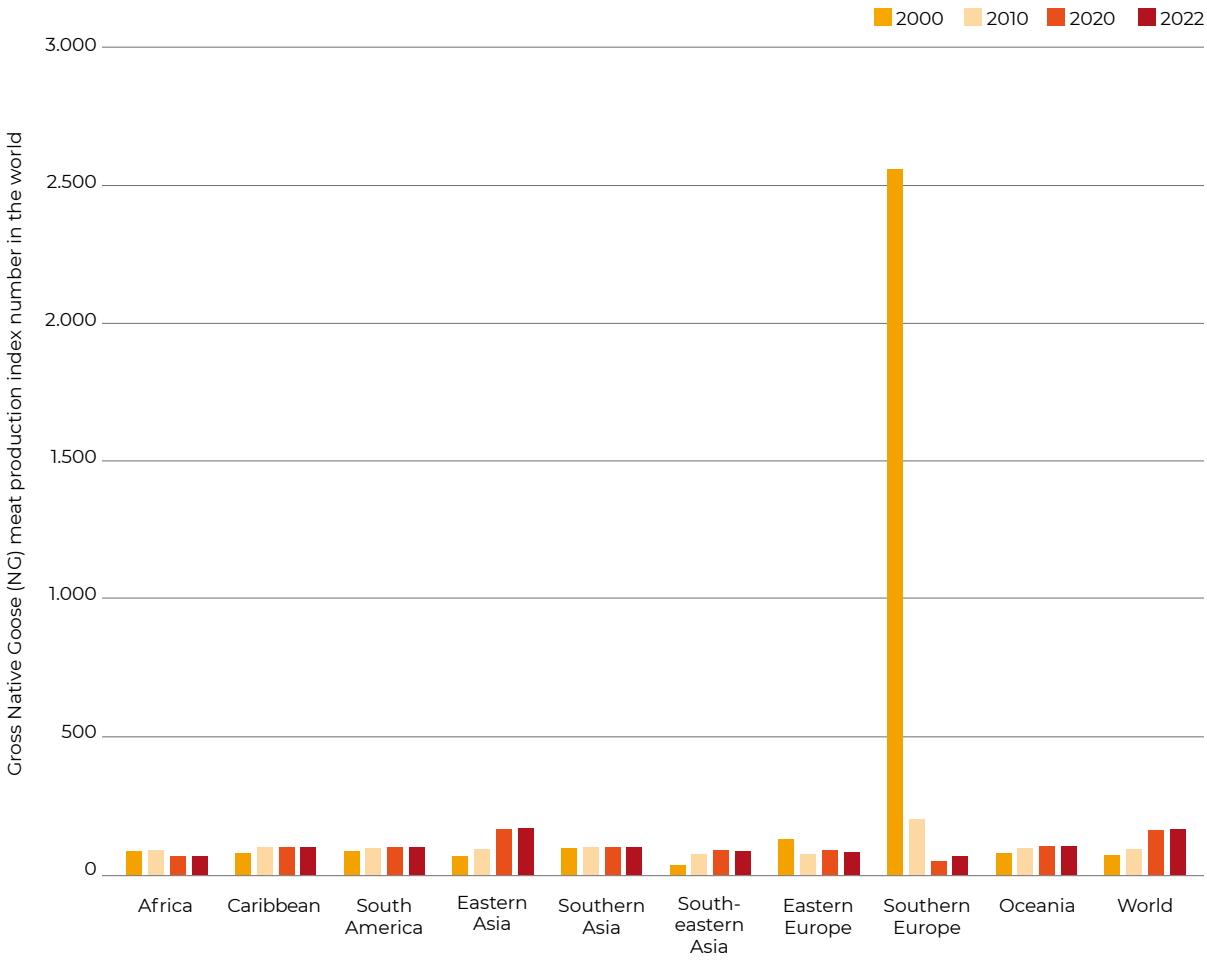

Figure 10. *Gross Native Goose (NG) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

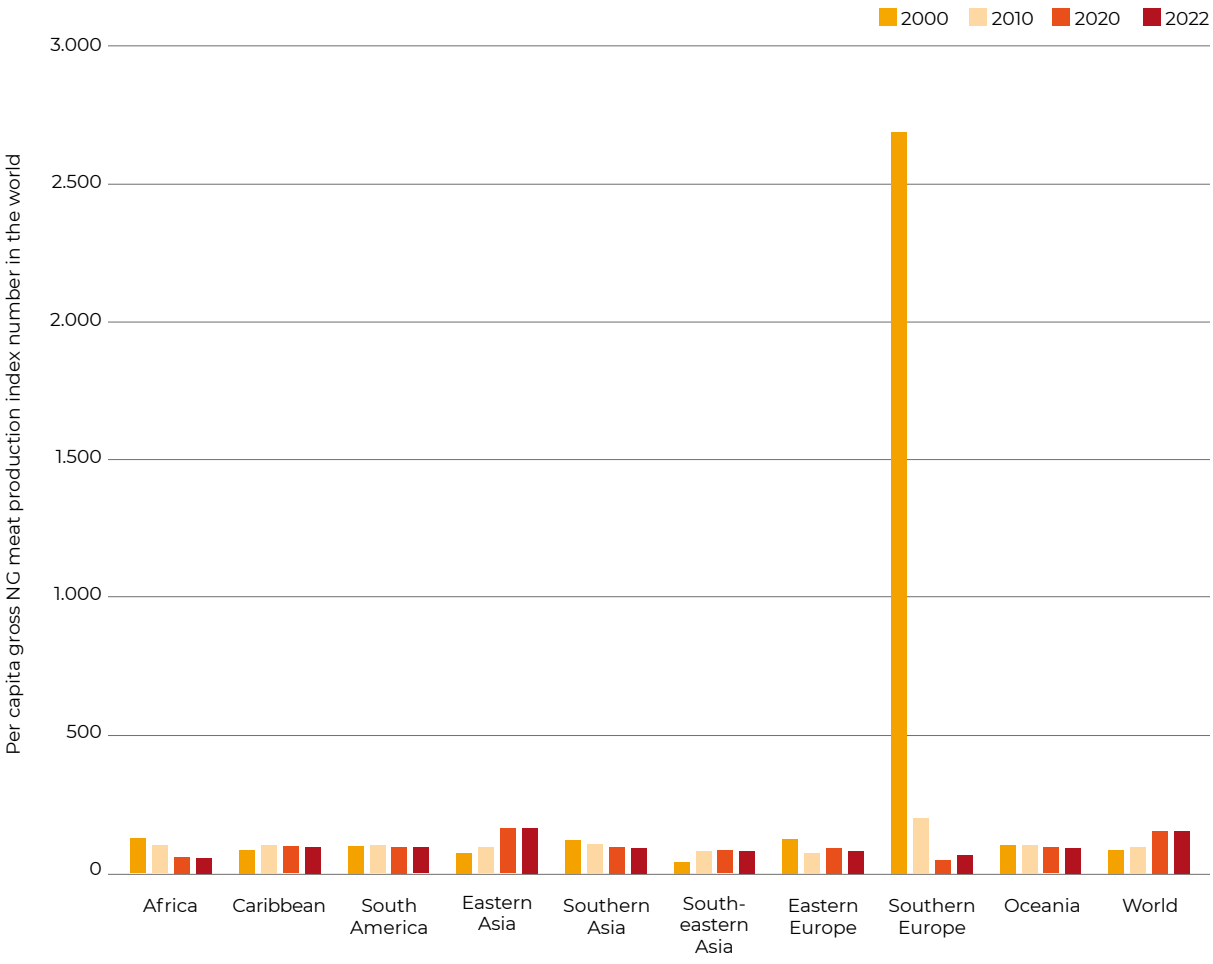

Figure 11. *Per capita gross NG meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

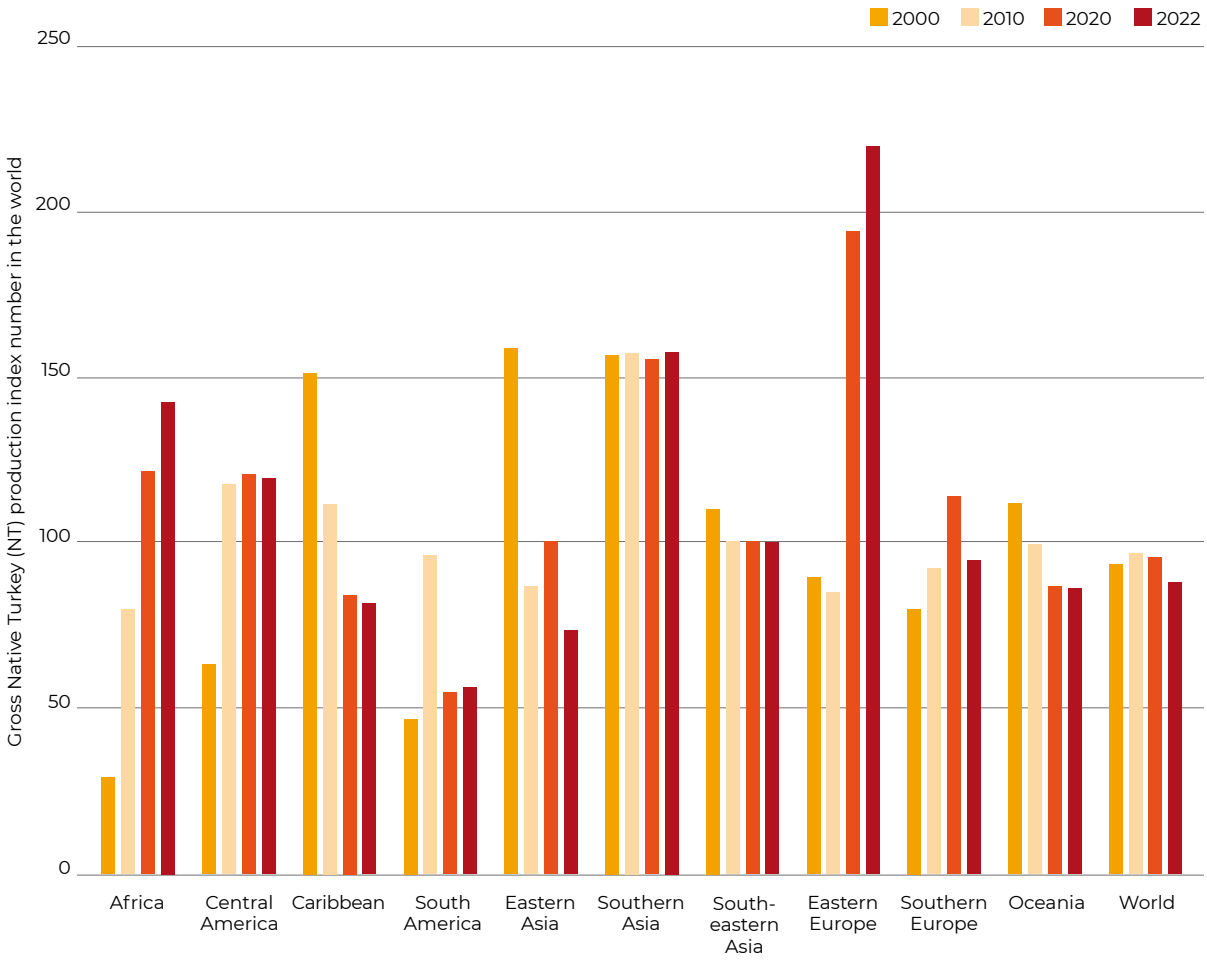

Figure 12. *Gross Native Turkey (NT) production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

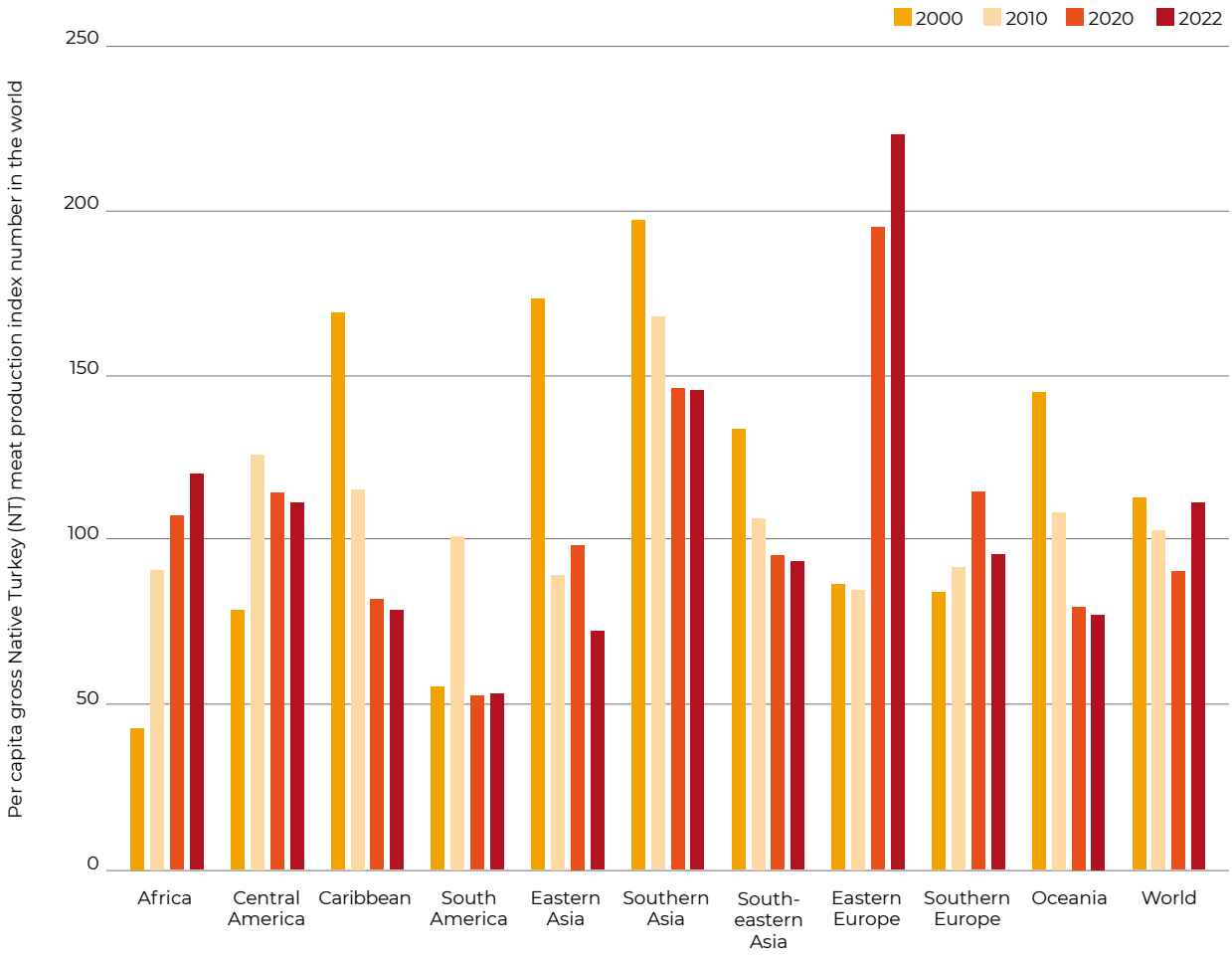

Figure 13. *Per capita gross Native Turkey (NT) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

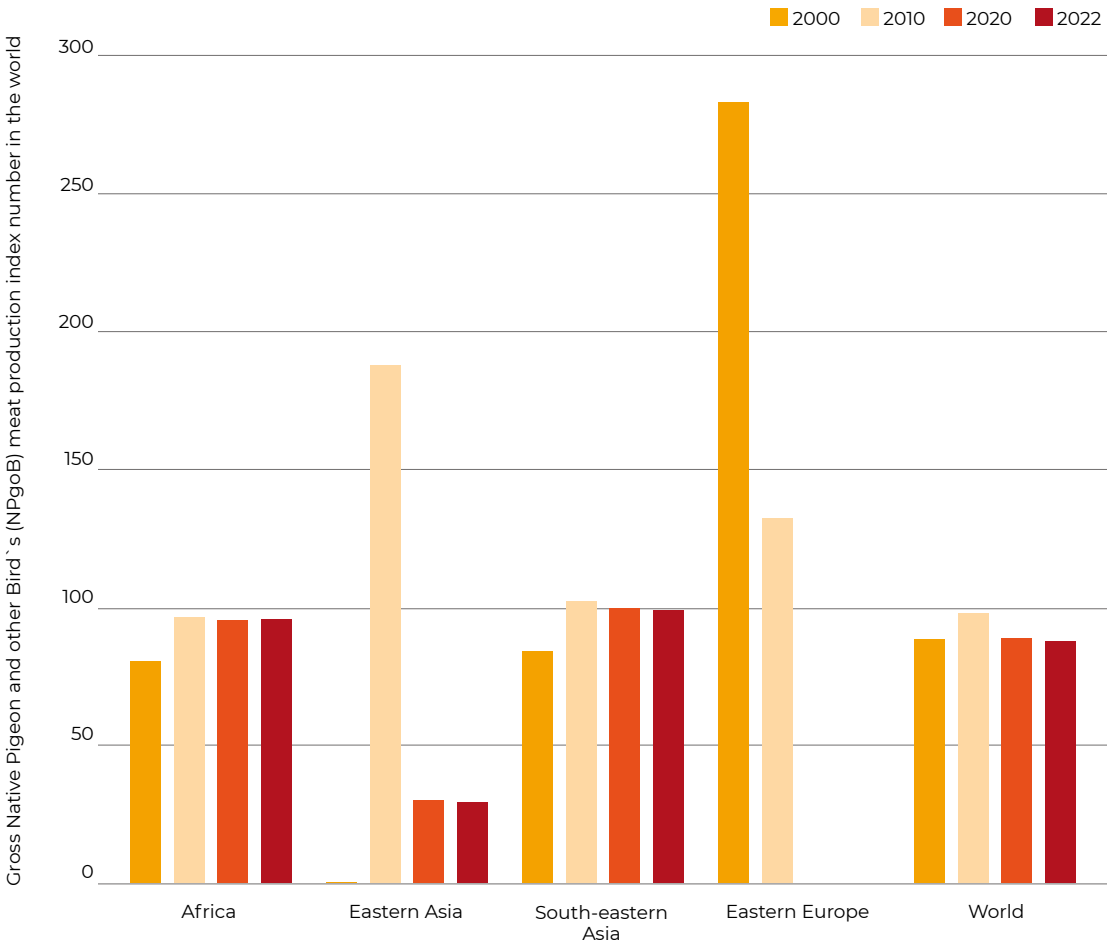

Figure 14. *Gross Native Pigeon and other Bird`s (NPgoB) meat production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

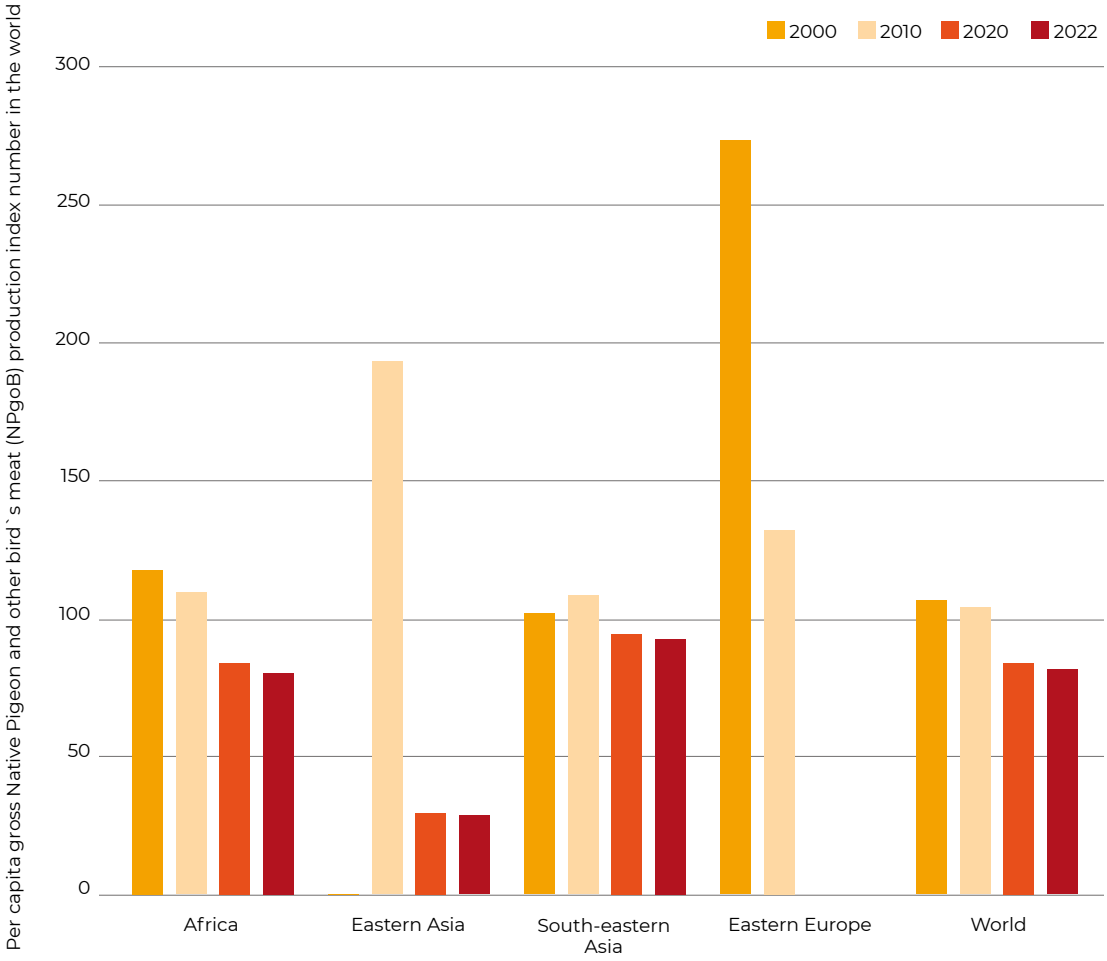

Figure 15. *Per capita gross Native Pigeon and other bird`s meat (NPgoB) production index number in the world and by regions and sub-regions as listed in the Appendix. The columns represent the production index during the years 2000-2022, the indices refer to 100 being the average of the years 2014-2016 as referenced by the FAO (data from FAOSTAT, 2025)*

PROSPECTS FOR GENETIC IMPROVEMENT

NP birds are characterized by their great phenotypic and genetic diversity in LLMICs (Guèye, 2002; Mwacharo *et al.,* 2006; Spalona *et al.,* 2007; Hoffmann, 2009; Mtileni *et al.,* 2011, 2012; Shapiro *et al.,* 2013; Lan Phuong, *et al.,* 2014; Bigi *et al.,* 2016; Dahloum *et al.,* 2016; Dorji *et al.,* 2017; Okumu *et al.,* 2017; Bibi *et al.,* 2021; Balog *et al.,* 2024; Tixier-Boichard, 2025). The great variation in egg weight, growth rate, adult weight as well as the variability observed in the existence of different ecotypes demonstrates the great NP genetic diversity. This heterogeneity and the excellent adaptation to various harsh and resource-limited agro-ecological conditions and environments, including disease resistance indicates that NP form a rich gene pool and a vital reservoir of gene resources that is ideal for selective breeding and multiplication of the best genotype for a particular production environment. Therefore, NP birds should survive and need to be studied, preserved and conserved (Spalona et al., 2007; Hoffmann, 2009; Mtileni et al., 2011, 2012; Al-Qamashoui *et al.,* 2014; Manyelo *et al.,* 2020), each bird being a 'running gene bank' (Guèye, 2002). Therefore, NP are valuable genetic resources which ought to be preserved and conserved for future breeding improvement, especially as it is believed that, for example, 33% of NC breeds are facing extinction (FAO, 2007; Hoffmann, 2009). In 2025, 23.3% of the 2,348 NP breeds surveyed worldwide present a risk status ranking from vulnerable to critically endangered, and 5.6% are already extinct (***Table 2***). In Italy, 53 NC breeds have been described to date, the majority of which are reported to be endangered or extinct (Franzoni *et al.,* 2021).

Development programs aimed at improving husbandry, feeding and health care (Padhi, 2016) and productivity of NP birds ought to be sustainable in order to have lasting impacts on food and nutrition security, income generation and health of human populations in LLMICs. Padhi (2016) reported that genetic improvement of NP through selection may be time consuming but the improvement will be permanent. Through crossbreeding improvement may be faster (Mwacharo *et al.,* 2006; Khan, 2008), but research of NP aims at the production of birds with higher production potential.

Table 2. *Risk status of NP breeds (chickens, domestic ducks, Muscovy ducks, emus, geese, Guinea fowl, nandus, ostriches, partridges, peacocks, pheasants, pigeons, quails and turkeys) by region (FAO, 2025b)*

Status*	Region							
	Africa	Asia	Europe and the Caucasus	Latin America and the Caribbean	Near and Middle East	North America	Southwest Pacific	Grand Tota
Unknown	222	498	525	110	50	19	23	1,447
Not at risk	24	60	123	7	3	1	3	221
Vulnerable	1	1	50	0	1	0	1	54
Endangered maintained	0	7	36	0	0	1	0	44
Endangered	2	9	263	0	0	1	16	291
Critical maintained	0	2	4	0	0	0	0	6
Critical	0	17	105	0	0	0	29	151
Cryo conserved only	0	0	2	0	0	0	0	2
Extinct	2	7	115	0	1	2	5	132
Grand Total	251	601	1,223	117	55	24	77	2,348

OPPORTUNITIES FOR FUTURE RESEARCH AND DEVELOPMENT

Despite all the published studies (Spalona *et al.,* 2007; Mtileni *et al.,* 2011, 2012; Shapiro *et al.,* 2013; Lan Phuong, *et al.,* 2014; Bigi *et al.,* 2016; Dahloum, *et al.* 2016; Dorji *et al.,* 2017; Okumu *et al.,* 2017; Bibi *et al.,* 2021; Balog *et al.,* 2024), the genetic diversity inherent in LLMICs' NP has yet to be fully further studied and described in detail and in a consistent and harmonized manner, after identifying the offered opportunities. Enough knowledge of the inter- and intra-specific genetic variation among different phenotypic lines should be gained, although such an information is a prerequisite for making informed decisions on sustainable conservation and genetic improvement. Therefore, it is necessary to assess and ascertain the diversity levels in NP birds in order to determine improvement and conservation priorities. Owing to the husbandry systems practiced by NP-keeping farmers and the resulting high risk of inbreeding, which may negatively affect diversity levels, improvements in knowledge and technical skills need to be considered for both NP-keeping farmers and extension workers.

Further studies should focus on detailed assessment and ascertainment of morphometric variations and production characteristics of NP birds in different agro-eco-climatic zones using standardized protocols to ensure consistency and harmonization of results. Considering the wide variation in reproduction and production performances observed under both controlled semi-intensified and free range small extensive scavenging system, NP constitute a vast gene pool that could be exploited by breeders through selection. Moreover, numerous studies on the productivity, adaptability and resistance to various diseases and environmental factors such as heat stress of NP birds in various LLMICs' regions are required. The basis and mechanisms behind the resistance of NP to fowl typhoid; Marek's Disease and Newcastle diseases should be further assessed and ascertained, and the possibilities of transferring these traits to other poultry deeply explored. Furthermore, the presence of unique alleles or allelic combinations coding for specific production traits and characteristics related to more adaptability and disease resistance is of interest for genetic linkage studies associated with the identification of quantitative trait loci (QTLs).

The demand for food products from NP is increasing because of their image of "natural" products being more nutritious and healthier especially when raised extensive or organically and without industrial residues. The higher organoleptic properties of NP birds' meat and eggs, compared with those of commercial poultry breeds which are considered as lacking in flavour and taste, are frequently mentioned. However, the organoleptic properties of NP birds' meat and eggs should be quantified and, if confirmed, then NP birds could be used to further develop specific poultry breeds for niche markets.

Conclusions

Despite efforts to develop the intensive poultry sub-sector, NP farming is still very important in LLMICs of Africa, Central Asia, Eastern Asia, Southern Asia, South-eastern Asia, Central America, South America, Caribbean, Eastern Europe, Southern Europe, and Oceania. The paper shows the contributions of NP to food security, wealth creation and sustainable livelihoods under resource-limited conditions. Moreover, it calls for policies and strategies for the sustainable preservation and conservation of NP breeds in order to avoid extinction.

Disclosure statement

No potential conflict of interest was reported by the author.

APPENDIX

Countries of world's regions and sub-regions *(FAOSTAT, 2025)*.	
World's geographic areas	***Countries***
Africa (Af)	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe
Central America (CAm)	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama
Caribbean (Ca)	Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago
South America (SAm)	Argentina, Plurinational State of Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, and Bolivarian Republic of Venezuela
Central Asia (CAs)	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan
Eastern Asia (EA)	Hong Kong SAR of China, Mainland China, Taiwan Province of China, Democratic People's Republic of Korea, Japan, Mongolia, and Republic of Korea
Southern Asia (SAs)	Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Nepal, Pakistan, and Sri Lanka
South-eastern Asia (SeA)	Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam
Eastern Europe (EE)	Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, and Ukraine
Southern Europe (SE)	Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, Serbia, Slovenia, and Spain
Oceania (Oc)	Australia, Cook Islands, Fiji, French Polynesia, Federated States of Micronesia, New Caledonia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, and Vanuatu
World	195 countries

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