Genomic Monitoring of Retriever Breeds in Germany: A Baseline Analysis of DRC Data (2024–2026)

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Introduction

Genetic diversity and the distribution of disease-associated variants are key components of population health in purebred dogs.

The German Retriever Club (DRC), established in 1963, represents six retriever breeds (Chesapeake Bay, Curly Coated, Flat Coated, Golden, Labrador, and Nova Scotia Duck Tolling) with distinct demographic and breeding histories.

This study establishes a genomic baseline across these breeds, including allele frequencies of disease-associated variants, coefficients of inbreeding (COI), and genetic diversity (heterozygosity).

These data provide a foundation for ongoing monitoring of breed health within the DRC population.

Methodology

Genotype data from dogs tested by the DRC between September 2024 and May 2026 were analyzed.

The analysis included two parts:

- Allele frequencies for disease-associated variants in DRC mandatory and recommended testing panels (with sample sizes varying by breed and test uptake), and
- Measures of genetic diversity, including COI and heterozygosity. Genotypes and runs of homozygosity (ROH) were calculated from ~35k SNP data generated from CombiBreed's proprietary Illumina array, using PLINK, following Meyermans et al.(2020).

All analyzes were conducted separately for each retriever breed. Allele frequency data from MyBreedData (May 2026) were used for comparison.

Discussion

This study establishes a genomic baseline for retriever breeds registered with the DRC.

Allele frequencies were largely consistent with MyBreedData, with two notable differences:

Curly Coated Retriever: lower EIC frequency (limited sample size)

NSDTR: lower CDDY/IVDD frequency

Highest allele frequencies were observed for risk-associated or complex traits (e.g. DM, ichthyosis, copper toxicosis-associated variants, POMC, CDDY/IVDD), reflecting reduced selection pressure compared to monogenic disorders.

COI and heterozygosity patterns differed among breeds:

Chesapeake Bay Retriever: lower COI, higher heterozygosity; limited popular sire effects

Curly Coated Retriever: bimodal COI; separation of working and show lines

Flat Coated & Golden Retrievers: higher COI; historical popular sires

Labrador Retriever: lower COI, higher heterozygosity; larger population and imported sires

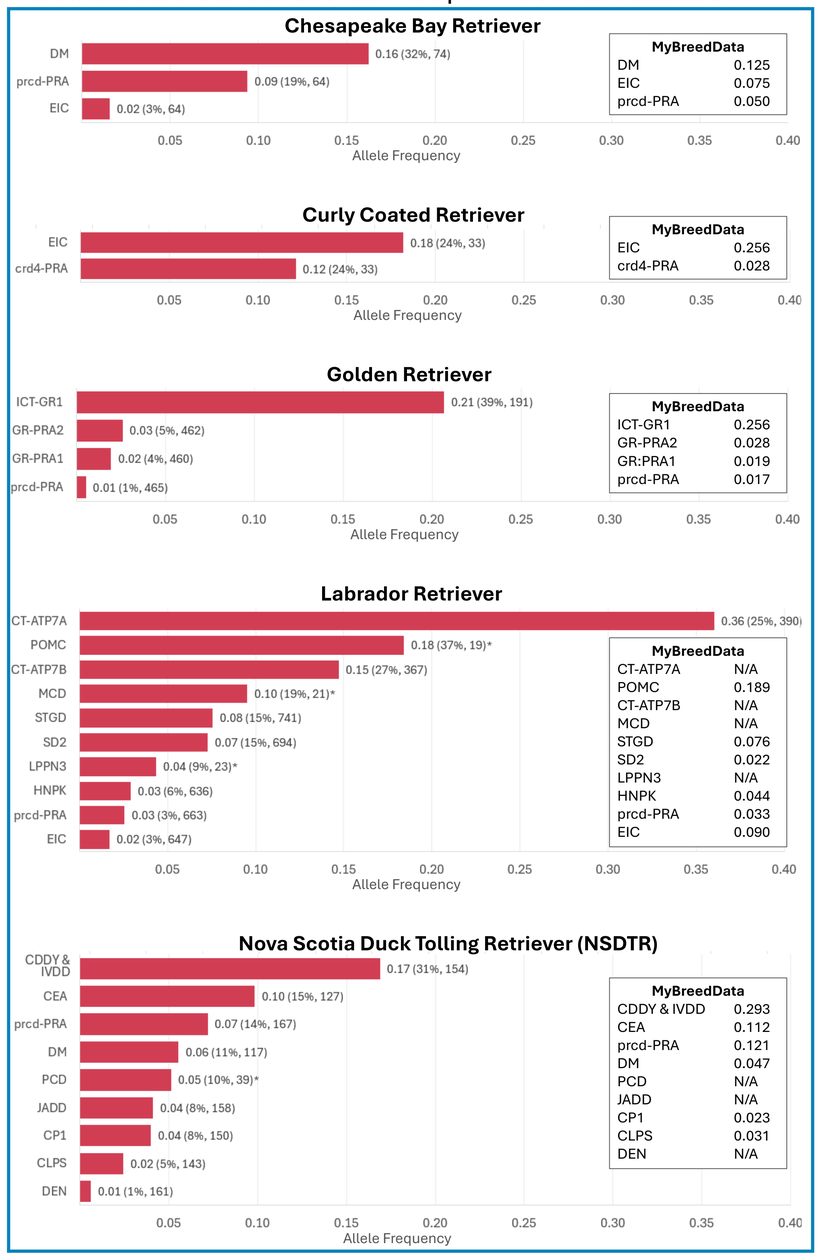
NSDTR: lower COI, higher heterozygosity; later studbook closure and structured breeding

These data reflect current DRC population structure during the study period.

Results

Allele Frequencies varied across breeds and were broadly consistent with MyBreedData, with some notable differences for specific variants. The highest frequencies were observed for variants associated with complex or risk-modifying traits (e.g. DM, ichthyosis, copper toxicosis-associated variants, POMC, and CDDY/IVDD).

Figure 1: Allele Frequencies of tests of DRC interest. Charts include all variants with non-zero allele frequencies; * indicates n <30. Values are shown as: allele frequency (carrier frequency; n tested). The Flat Coated Retriever is not shown, as no relevant tests are defined. MyBreedData allele frequencies are shown for comparison (accessed May 2026); N/A indicates the variant was not present in the database.



Disease abbreviations: **CDDY & IVDD**: Chondrodystrophy and Intervertebral Disc Disease risk; **CEA**: Collie Eye Anomaly; **CLPS**: Cleft Lip/Palate and Syndactyly; **CP1**: Cleft Palate 1; **crd4-PRA**: crd4-Progressive Retinal Atrophy; **CT-ATP7A**: Copper Toxicosis modifier ATP7A-related; **CT-ATP7B**: Copper Toxicosis risk ATP7B-related; **DEN**: Degenerative Encephalopathy; **DM**: Degenerative Myelopathy; **EIC**: Exercise-Induced Collapse; **GR-PRA1**: Golden Retriever Progressive Retinal Atrophy 1; **GR-PRA2**: Golden Retriever Progressive Retinal Atrophy 2; **HNPK**: Hereditary Nasal Parakeratosis; **ICT-GR1**: Ichthyosis Golden Retriever type 1; **JADD**: Juvenile Addison's Disease; **LPPN3**: Laryngeal Paralysis and Polyneuropathy Type 3; **MCD**: Macular Corneal Dystrophy; **POMC**: Obesity risk; **PCD**: Primary Ciliary Dyskinesia; **prcd-PRA**: prcd-Progressive Retinal Atrophy; **SD2**: Skeletal Dysplasia 2; **STGD**: Stargardt Disease 1.

Variants tested in ≥30 individuals but not detected: **Chesapeake Bay Retriever**: Ectodermal Dysplasia (49); **Curly Coated Retriever**: Glycogen Storage Disease IIIa (33); **Golden Retriever**: Congenital Eye Malformation-Golden Retriever (54); Congenital Hypomyelinating Polyneuropathy MPZ-related (35), MTMR2-related (35), SH3TC2-related (35); Degenerative Myelopathy (54); Ichthyosis-Golden Retriever Type 2 (191); Muscular Dystrophy (66); Neuronal Ceroid Lipofuscinosis 5 (517); Osteogenesis Imperfecta-Golden Retriever (54); **Labrador Retriever**: Centronuclear Myopathy (661); **Nova Scotia Duck Tolling Retriever**: Cardiac Laminopathy (103); Cerebellar Degeneration-Myositis Complex (34).

Conclusion

The DRC population aligns closely with the wider population, with breed-specific patterns reflecting population structure and breed history. These results provide a foundation for continued genomic monitoring and support informed breeding strategies within the DRC.

COI and heterozygosity profiles differed among breeds, with variations in distribution and range.

Figure 2: Calculations of Coefficient of Inbreeding and Heterozygosity for each DRC breed.

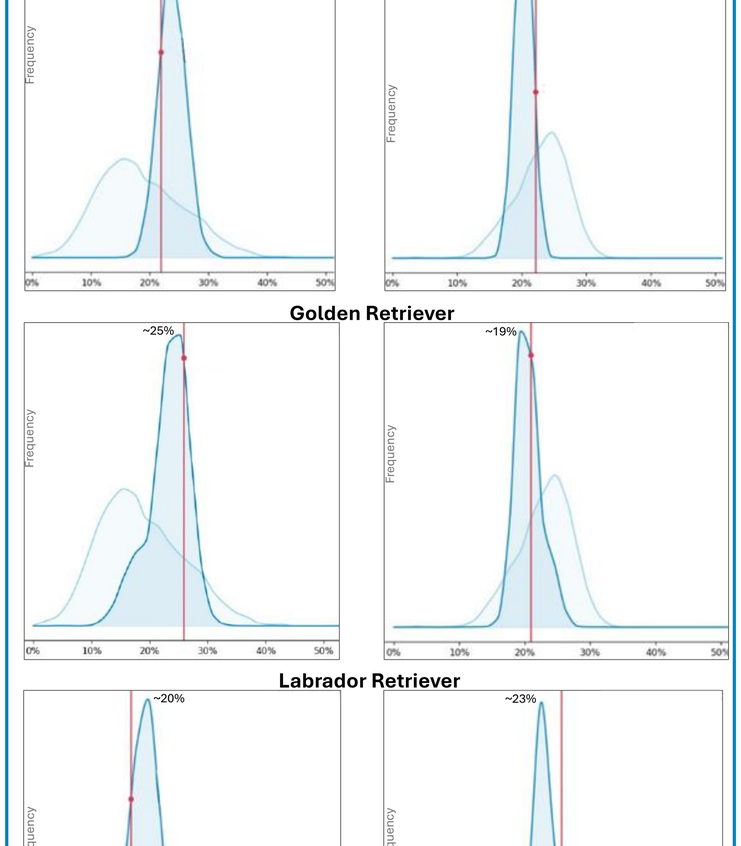


Figure Legend:

- **All breeds**: top/bottom samples and up to 100 evenly distributed individuals per breed, plus all other breeds with >25 samples; scaled for magnitude.
- **Breed of Interest**: all individuals per breed (n >25); scaled for magnitude.
- **Individual dog**: original reference sample used to generate plot; not required for interpretation

References:

Meyermans, R., Gorssen, W., Buys, N. *et al.* How to study runs of homozygosity using PLINK? A guide for analyzing medium density SNP data in livestock and pet species. *BMC Genomics* **21**, 94 (2020). https://doi.org/10.1186/s12864-020-6463-x

MyBreedData [Database]. (2026). Breed-specific genetic diversity and genetic disorder data. Retrieved May 25, 2026, from https://www.mybreeddata.com.

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