The GENDIVERSITY Table

The Genetic Diversity Table compiles published estimates of genetic diversity in fish species based on COI-π (Cytochrome C Oxidase subunit I nucleotide diversity). It includes data from both fished and unfished populations and serves as a foundational resource for examining patterns of genetic variation and connectivity across different marine environments.

By enabling comparisons across species and regions, the table helps identify potential impacts of fishing pressure, historical bottlenecks, or habitat fragmentation. These insights are essential for assessing population health, adaptability, and resilience, and provide a scientific basis for conservation and fisheries management strategies.

The concept and methodology behind this table are based on the work of Petit-Marty et al. (2021), who demonstrated that COI-π can serve as a simple and effective early diagnostic of declining population sizes and genetic erosion in commercial fish species.

Source and coverage

As of October 2025, the table contains over 2,200 records representing 953 fish species, compiled from more than 220 peer-reviewed studies. COI-π values were calculated using standardized methods across studies, employing molecular genetics tools such as DNAsp (Rozas et al. 2017), or Arlequin (Schneider et al. 2000). This consistency ensures that estimates can be compared between populations and geographic regions, and their variation over time.

What is COI-π?

COI-π is a measure of genetic diversity that represents the average number of nucleotide differences per site in the COI sequence between pairs of individuals in a population. It is estimated from the sequence alignment of Cytochrome C Oxidase subunit I (COI) gene, a mitochondrial marker widely used in molecular ecology due to its high resolution in detecting population structure.

Compared to other genetic diversity estimates such as heterozygosity or the average number of mutations (θW, Watterson 1975), COI-π is based on observed allele frequencies and is more sensitive to recent demographic changes (θπ; Nei, 1987). This makes it especially useful for identifying contemporary declines in genetic diversity that may not be detected by other genetic diversity estimates.

Factors That Influence Genetic Diversity

Several biological and ecological variables can influence COI-π values. These include long-term effective population size, demographic changes, generation time, variability in reproductive success, skewed sex ratios, and the degree of population connectivity or isolation. Habitat type also plays a role: for example, species restricted to narrow geographic ranges or specialized environments may naturally exhibit lower genetic diversity.

Low COI-π values may signal population declines or bottlenecks, reduced gene flow, or recent directional selection, while higher values generally suggest stable and well-connected populations with greater adaptive potential.

Data Structure

Each entry in the Genetic Diversity Table includes key information in Table 1 to contextualize the COI-π value.

Table 1. Definitions of information provided in the Genetic Diversity table.

Field	Definition
COI-π	Refers to genetic diversity estimate in COI mitochondrial gene.
SD	Refers to standard deviation of COI-π.
SampleSize	Refers to the number of individuals sequenced for calculation of COI-π.
SamplingPeriod	Refers to the year or period of sampling.
SamplingArea	Specifies the sampling station or area.
Territory	Specifies the country of the sampling station or area.
Ecosystem	Specifies the sampling area under the classification of marine ecoregions; names are based on FishBase conventions.
Region	Specifies the geographical region of the species' population. Analysed datasets allow searches and assessments for East Asia (FAO Area 61: Northwest Pacific), Mediterranean (FAO Area 37: Mediterranean and Black Sea), and Worldwide (global dataset encompassing all regions).
Comments	Provides supplementary information for each record, e.g. life stage of samples, season of sampling, and number of samples per country.
Main Ref.	Refers to the published source of genetic diversity data. Clicking on this field opens the Reference Summary page, which gives the bibliographic details, i.e., author, year, title and source.

Threshold Values for Genetic Diversity Risk

To help interpret COI-π values, threshold ranges have been established based on a global synthesis of empirical data (Petit-Marty et al., 2022). These thresholds vary by region and taxonomic class (i.e. Actinopterygii and Elasmobranchii), reflecting differences in ecological conditions and evolutionary histories. For Actinopterygii, the underlying datasets encompass 1,426 species globally, including specific subsets for East Asia (118 species) and the Mediterranean (47 species), The corresponding risk thresholds, based on 95% confidence interval, are presented separately for each region in Table 2.

For Elasmobranchii, threshold values are determined exclusively for the worldwide dataset, which comprises 473 samples representing 256 species, as detailed in Table 3. COI-π of fish populations are assigned a risk category depending on whether the value falls below, within, or above the confidence interval obtained for the fish class and geographic location.

These ranges provide a reference for evaluating whether genetic diversity of a species is unusually low or high relative to other species in the same region. They are not strict conservation thresholds but rather a first diagnostic tool for identifying populations that may warrant closer investigation.

Table 2. Actinopterygii COI-π Risk Thresholds by Region (95% CI).

Genetic Diversity Level	Worldwide COI-π	East Asia COI-π	Mediterranean COI-π
Low genetic diversity	0 - 0.0035	0 - 0.0035	0 - 0.0028
Medium genetic diversity	0.0036 - 0.0040	0.0036 - 0.0049	0.0029 - 0.0041
High genetic diversity	> 0.0040	> 0.0049	> 0.0041

Table 3. Elasmobranchii COI-π Risk Thresholds (Worldwide, 95% CI).

Genetic Diversity Level	Worldwide COI-π
Low genetic diversity	0 - 0.0021
Medium genetic diversity	0.0021 - 0.0025
High genetic diversity	> 0.0025

Web site

The Genetic Diversity Table can be accessed by navigating to:

- Species Summary page → More Information section → Genetics → Genetics Diversity, and selecting the "**Genetic Diversity**" link.
- Information by Territory → Miscellaneous → Genetic Diversity, and selecting the "**Genetic Diversity**" radio button.
- Information by Ecosystem → Miscellaneous → Genetic Diversity, and selecting the "**Genetic Diversity**" radio button.
- Information by Topic → Genetics → Genetic Diversity, and selecting the "**Genetic Diversity**" radio button.

A tool for genetic diversity assessment can be found under the 'Tools' section on the Search page. For guidance, refer to the manual.

References

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