Jurnal Natur Indonesia
24(1), April 2025: 8-14

p-ISSN 1410-9379
e-ISSN 2503-0345

Genotype Identification of *Carcharhinus sorrah* and *Carcharhinus leucas* in Riau Islands Province

Identifikasi Genotipe *Carcharhinus sorrah* dan *Carcharhinus leucas* di Provinsi Kepulauan Riau

Petra Sagita[1*], Sania Effendi[2], Efriyeldi[3]
[1]Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Kota Kinabalu, 88450 Malaysia
[2]Electrical Engineering, University of Gajah Mada, Yogyakarta, 55281 Indonesia
[3]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
*Correspondent Author: sagitapetra1@gmail.com

ABSTRACT

Sharks are predatory animals that live around coral reefs. This fish has slow growth and breeding limitations. Currently, its existence is increasingly threatened by the large number of captures, both as catch targets and bycatch, resulting in a decrease in the shark population in the waters. This study was conducted from November 2024 to January 2025 in Tanjung Pinang, Riau Islands Province. The purpose of this study was to genotype-identify *Carcharhinus sorrah* and *Carcharhinus leucas*, as well as to assess their conservation status. This study used a survey method. The analysis begins with several stages, namely extraction, amplification, electrophoresis, and sequencing. After identifying the species and its name, the next step is to determine its conservation status and international trade status. To find out the conservation status through the IUCN Red List and the international trade status through CITES Appendices. On the IUCN Red List, *Carcharhinus sorrah* is categorized as near threatened (NT), and *Carcharhinus leucas* is categorized as vulnerable (VU). Both species are listed in Appendix II of CITES.

Keywords: *Carcharhinus sorrah, Carcharhinus leucas*, Genotype, Phenotype, Conservation Status

ABSTRAK

Hiu adalah hewan predator yang hidup di sekitar terumbu karang. Ikan ini memiliki keterbatasan pertumbuhan dan berkembang biak yang lambat. Saat ini, keberadaannya semakin terancam oleh banyaknya penangkapan, baik sebagai target tangkapan maupun tangkapan sampingan, yang mengakibatkan penurunan populasi hiu di perairan. Penelitian ini dilakukan pada November 2024 hingga Januari 2025 di Tanjung Pinang, Provinsi Kepulauan Riau. Tujuan dari penelitian ini adalah untuk mengidentifikasi genotipe Carcharhinus sorrah dan Carcharhinus leucas, serta untuk menilai status konservasinya. Penelitian ini menggunakan metode survei. Analisis dimulai dengan beberapa tahap, yaitu ekstraksi, amplifikasi, elektroforesis, dan pengurutan. Setelah mengidentifikasi spesies dan namanya, langkah selanjutnya adalah menentukan status konservasi dan status perdagangan internasionalnya. Untuk mengetahui status konservasi melalui Daftar Merah IUCN dan status perdagangan internasional melalui Lampiran CITES. Dalam Daftar Merah IUCN, *C. sorrah* dikategorikan sebagai hampir terancam (NT) dan *C. leucas* dikategorikan sebagai rentan (VU). Kedua spesies tersebut terdaftar dalam Lampiran II CITES.

Kata Kunci: *Carcharhinus sorrah, Carcharhinus leucas*, Genotipe, Fenotipe, Status Konservasi

INTRODUCTION

Sharks are one of the cartilaginous fish or elasmobranchii, characterized by having fins and gills on the left and right sides of the head. Fish have slow growth rates, long productive periods, and breeding limitations. The genus *Carcharhinus* belongs to the family Carcharhinidae, a group of sharks often found in shallow to medium waters. In the marine ecosystem, sharks are the top predators in the food chain that play a role in controlling various marine animal populations in the food chain. According to Sadili et al. (2015), in Indonesia, there are 221 species of sharks and rays, comprising 117 species of sharks, 101 species of rays, and 3 species of ghost sharks (Chimera), across 44 families.

The Riau Islands are one of the provinces with a large water area in Indonesia. This water area has potential for marine biodiversity, including sharks. However, sharks are increasingly threatened due to numerous fishing

Received: 7 February 2026
Accepted: 29 March 2026

and trade activities. Shark fishing in the Riau Islands is driven by increasing market demand for shark fins and processed shark products. Excessive fishing has an impact on shark populations in these waters, decreasing their numbers. If the shark population decreases or even disappears, the ecological balance in the waters will be disrupted. According to Amani et al. (2022), the current shark population is estimated at only about 31% of the 1,250 species of vertebrate fish in Indonesia.

Regulations regarding the conservation of natural resources and their ecosystems in Indonesia are written in Law No. 5 of 1990. The utilization of various types of sharks has been regulated internationally through agreements in international forums such as the International Union for Conservation of Nature and the Convention on International Trade in Endangered Species. In addition, the government has also established regulations related to the utilization of shark species through the Decree of the Minister of Marine Affairs and Fisheries No. 18 of 2013 concerning the status of the fully protected Whale Shark and the Regulation of the Minister of Marine Affairs and Fisheries No. 5 of 2018 concerning the prohibition of the export of whitetip sharks *(Carcharinus longimanus)* and hammerhead sharks *(Sphyrna lewini, Sphyrna mokarran, Sphyrna zygaena)* (Mopay et al., 2017).

Research on sharks' genotype identification (DNA analysis) using DNA Barcoding has been conducted previously in Indonesia. Sembiring et al. (2015) conducted shark catch target identification using DNA Barcoding in all shark fin traders found in Indonesia. Hidawati et al. (2020) conducted DNA Barcoding and conservation status research in Bangka. Bramasta et al. (2021) conducted DNA Barcoding and phylogenetic analysis research in Bali. In addition, Sahaba et al. (2021) conducted DNA barcoding to authenticate fresh shark products from West Nusa Tenggara waters. Research on shark species identification should be conducted at multiple levels among shark traders and distributors in the Riau Islands, given that in the Riau Islands, shark fishing and trading activities are still widely carried out. That information on shark species in the Riau Islands remains limited. Therefore, this study was conducted to determine which shark species are caught and have the potential to be traded in the Riau Islands, along with their conservation status, by identifying the body parts of the sharks obtained, using the DNA Barcoding method, and observing the morphology of the sharks found.

MATERIALS AND METHODS

Time and place

This research was conducted from November 2024 to January 2025 in Tanjung Pinang, Riau Islands Province (Figure 1). Sampling was conducted at the research site, and genotype identification was performed in the biodiversity laboratory in Denpasar, Bali.

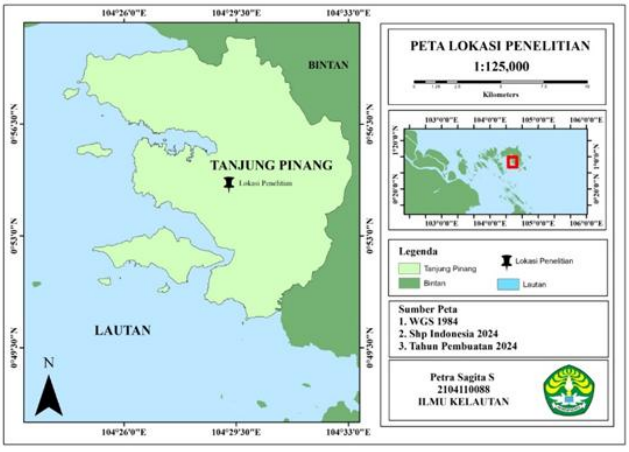

Figure 1. Research location

Methods

The method used in this study is the survey method, namely, direct data collection in the research location. Data collection is in the form of primary data obtained from survey activities in traditional markets and distributors in Tanjung Pinang, Riau Islands, and the data obtained is then analyzed in the laboratory.

Sampling

Fish samples were obtained from fishermen's catches in the Riau Islands waters, which were landed at

traditional markets and distributed to distributors in Tanjung Pinang. Shark's meat samples were taken approximately 3 cm long or 5 g per individual, then placed into a labeled sample bottle and added to 10 ml of 96% alcohol. The sample was then placed in a cool box and stored in a freezer, where it would be identified by genotype in the laboratory.

Genotypic Identification

In identify sharks by genotype, shark meat samples collected at the sampling location were analyzed using molecular techniques. The analysis will be conducted at the Denpasar Biodiversity Laboratory in Bali. The analysis begins with several stages, namely extraction, amplification, electrophoresis, and sequencing. DNA amplification uses the PCR (Polymerase Chain Reaction) method (Bramasta et al., 2021). Genetic data obtained from the sequence results were analyzed to determine species identification using the BLAST (Basic Local Alignment Search Tool) technique, namely matching sample data obtained in the research location with the DNA sequence database on the GenBank website https://www.ncbi.nih.nlm.gov/.

Phenotypic Identification

Phenotypic identification of sharks is based on their observable characteristics. Observations are made by examining the physical appearance or morphology of sharks, including body color, fin color, head shape, mouth shape, and fin shape. Then, the shark samples are photographed as documentation. Furthermore, the results obtained are adjusted to the identification guideline book Economically Important Sharks and Rays of Indonesia" (White et al., 2006).

Data Analysis

The division of groups and types of individuals based on genetic analysis (a phylogenetic tree) can be performed in MEGA X using the Neighbor-Joining statistical method.

RESULT AND DISCUSSION

Genotype Characteristics (DNA Analysis)

DNA analysis is used to identify an organism's genetic composition, thereby determining its genotype. The body part used for DNA analysis in sharks is the meat.

Electrophoresis Analysis

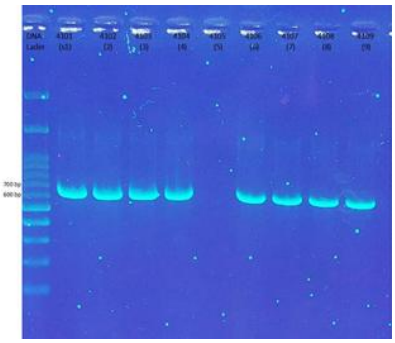

Figure 2. DNA Electrophoresis results

The results of DNA extraction of the shark meat genome have been used as a DNA template in the COI gene amplification process. Electrophoresis of PCR products (Figure 2) shows DNA bands in each DNA sample track at approximately 500-700 bp, corresponding to the amplicon length. DNA bands that appear thick and amplify well indicate optimal PCR conditions and can proceed in the next stage, namely, sequencing (Syam et al., 2019).

BLAST Analysis

The BLAST (Basic Local Alignment Search Tool) analysis system at https://blast.ncbi.nlm.nih.gov/ was used to identify species names and calculate DNA homology percentages. The BLAST analysis results are shown in Table 2.

Table 2. Results of the identification of the type of shark genus *Carcharhinus* using BLAST

No	Sample Code	Species Name	Query Cover	Per. Ident	Accession Number
1.	DBP014106 (6)	*Carcharhinus sorrah*	100%	98,84%	OR392560.1
2.	DBP014103 (3)	*Carcharhinus leucas*	100%	100%	OP007121.1

The results of the identification of shark species landed and stored in the Riau Islands using BLAST are shown in Table 3. All samples have been well amplified, and the BLAST results show a 100% match to the estimated shark species for the pieces obtained. Based on DNA-based species identification using genetic sequencing and data registered in GenBank, two specimens were determined as sharks of the genus Carcharhinus, namely in sample DBP014106 (6). According to the identification results, it is *Carcharhinus sorrah*, also known as the spot-tailed shark or lanyam shark (Figure 3). Meanwhile, in sample code DBP014103 (3), after identification, the results are Carcharhinus leucas, with the local names bull shark, savage shark, and bekeman shark (Figure 4). The BLAST analysis produced a phylogenetic tree (Phylogenetic trees) with branching connections. Creating a phylogenetic tree helps visualize taxonomic units, such as species or genes. The root of the tree is a point that acts as the parent of all organisms being analyzed. Alignment of sample sequences with sequences from the GenBank database was performed using MEGA 6 and Clustal W. Phylogenetic trees were constructed to assess the relationships among the samples analyzed in this study and other sequences in GenBank. Phylogenetic analysis shows the level of kinship for each sample.

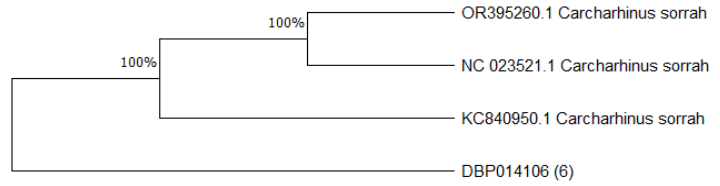

Figure 3. Phylogenetic tree of sample DBP014106

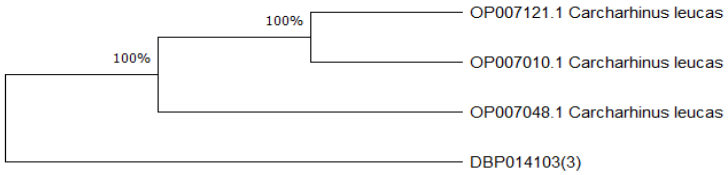

Figure 4. Phylogenetic tree of sample DBP014103 (3)

In this study, the phylogenetic tree was constructed using the neighbor-joining tree method. According to Dharmayanti (2011), the neighbor-joining tree method selects sequences that, when combined, provide the best estimate of the closest branch length, reflecting the true distance between the sequences. Based on field collections, two species of Carcharhinus were found: *Carcharhinus sorrah* and *Carcharhinus leucas*. Both species are included in the same genus group due to their nucleotide base similarities, so in the phylogenetic reconstruction, they are considered to have similar nucleotide characteristics.

Phenotype Characteristics

Phenotype identification makes it easier to recognize shark species by observing their morphology, including body shape, body color, mouth shape, tooth shape, fin shape, and fin color. The morphology of all identified sharks varies. The phenotype characteristics of the identified sharks are as follows:

Figure 5. *Carcharhinus sorrah* (Spot-tail shark)

Based on the results of the observations, *Carcharhinus sorrah* (Figure 5) has general characteristics, namely

black pectoral fins and the lower part of the tail fin. There are two dorsal fins on this type of shark, and the second dorsal fin is very short. Effendi et al. (2024) stated that the second dorsal fin is short and low, while the first dorsal fin is big and curved. Between the dorsal fins, there is a line. When viewed from below, this shark has a long, slightly pointed snout with sharp teeth and a sloping top; it has protrusions on the sides. The lower teeth are small and slender, with no protrusions between the sides. This species is widely caught because the shark's tail spots have meat, fins, liver oil, and skin that can be utilized and have economic value. According to Fields et al. (2018), the spot-tailed shark accounted for 1.04% of the fin cuts sold in Hong Kong, making it one of the most frequently encountered shark species in markets.

Figure 6. *Carcharhinus* leucas (Bull Shark)

Based on the observations, *Carcharhinus leucas* (Figure 3) has a wide, short head, a cylindrical body, and a large, slightly curved dorsal fin. There are no lines between the dorsal fins. The caudal fin of *C. leucas* has a very distinctive shape with a longer upper lobe than the lower lobe. The snout is very short and rounded when viewed from below; the distance from the snout tip to the mouth is shorter. This shark has triangular teeth with wide, sharp, strong, and serrated edges.

Bull sharks are often seen in tropical coastal waters around the world, including shallow coastal waters. Weigmann (2016) stated that bull sharks are demersal and pelagic fish that live in tropical, subtropical, and temperate waters both near the coast and offshore, usually living near the seabed from the wave line to a depth of 164 m; however, most live in shallow waters up to a depth of 30 m. In Indonesia, this species can be found in the waters of Kalimantan, Sumatra, and Papua (Nurastri & Marasabessy, 2021).

Conservation Status

Conservation status is an indicator of the level of threat a living species faces from extinction. Conservation status aims to protect and preserve living species. The International Union for Conservation of Nature and Natural Resources (IUCN) Red List and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) trade status list are used as references for global conservation status. The conservation and trade status of sharks obtained at the research location are shown in Table 3.

Table 3. Conservation Status (IUCN) and trade status (CITES) of sharks

No	Species	IUCN	CITES
1.	*Carcharhinus sorrah*	Almost Endangered (*Near Threatened*, NT)	Appendix II
2.	*Carcharhinus leucas*	Vulnerable (*Vulnerable*, VU)	An appendix II

According to the IUCN, the conservation status of sharks of the genus Carcharhinus in the Riau Islands falls in two categories. The Near Threatened (NT) category is given to shark species that may be threatened or close to extinction, although not included in the threatened status. The species included in this category is *Carcharhinus sorrah* (IUCN, 2020). This type of shark is commercially caught in many areas for its body parts, including meat, fins, and liver oil. If fishing practices are not controlled, it will significantly reduce the population of this species. Meanwhile, *Carcharhinus leucas* is listed in Vulnerable (VU) by the IUCN (2020). The vulnerable category is given to species that are at high risk of extinction in the wild.

According to CITES, the trade status of sharks of the genus Carcharhinus landed in the Riau Islands indicates that the two identified species are listed in Appendix II, which lists species that are not endangered but may become endangered if traded without regulation (CITES, 2022). Wijayanti et al. (2018) stated that if shark and ray fishing activities are not accompanied by supervision and control, overfishing will occur, resulting in a long-term decrease in the numbers of these fish in nature in the wild and eventually their extinction.

CONCLUSION

Sharks that have been identified by genotype in the Riau Islands are *Carcharhinus* sorrah and *Carcharhinus* leucas. Both species are included in the IUCN Red List; Carcharhinus sorrah is classified as Near Threatened (NT), and *Carcharhinus* leucas is classified as Vulnerable (VU). For these two species, there are no national regulations governing their distribution and trade. In the international trade regulations at CITES, all species found are included in Appendix II.

REFERENCES

[CITES] Convention on International Trade in Endangered Species of Wild Fauna and Flora., 2022. Checklist of CITES Species.

[IUCN] International Union for Conservation of Nature., 2020. The IUCN Red List of Threatened Species.

[KKP] Keputusan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 18/KEPMENKP/2013 Tentang Penetapan Status Perlindungan Penuh Ikan Hiu Paus *(Rhincodon Typus).*

[PP] Peraturan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 5/PERMEN-KP/2018 tentang Larangan pengeluaran ikan hiu koboi *(Carcharhinus longimanus)* dan hiu martil *(Sphyrna spp.)* dari Wilayah Negara Republik Indonesia ke luar wilayah Negara Republik Indonesia.

Amani, M.D., Sari, R.P., Effendi, I., 2022. Endangered shark species identified in Bintan Island Waters, Riau Island Province, Indonesia. *Tropical Marine Environmental Sciences*, 1(1): 8-17.

Ansyah, H., Gusti, H., Yeni, M., 2023. Jenis biaya dan pendapatan peternak kelulut di Dusun Kayu Ara Desa Kayu Ara Kecamatan Mandor Kabupaten landak. *Jurnal Hutan Lestari*, 11(1): 195 – 205

Bramasta, R.C., Faiqoh, E., Hendrawan, I.G., Sembiring, A., Yusmalinda, N.L.A., 2021. Identifikasi hiu yang diperdagangkan di Bali menggunakan metode DNA Barcoding dan analisis filogenetik. *Journal of Marine and Aquatic Sciences*, *7*(1): 84-93.

Dharyamanti, I.N.L.P., 2011. Filogenetika molekuler: Metode taksonomi organisme berdasarkan sejarah evolusi. *Wartazoa, 1*(21): 1-10.

Effendi, I., Sari, R.P., Amani, M.D., 2024. Identification, conservation status, trade, and legal protection basis of Carcharhinus shark caught in the waters of Riau Islands Province, Indonesia. *International Journal of Conservation Science*, 15(4): 1871-1884.

Fields, A.T., Fischer, G.A., Shea, S.K., Zhang, H., Abercrombie, D.L., Feldheim, K.A., Chapman, D.D., 2018. Species composition of the international shark fin trade assessed through a retail market survey in Hong Kong. *Conservation Biology*, 32(2): 376 - 389.

Hidawati, R., Supratman, O., Syarif, A.H., Aisyah, S., 2020. DNA barcoding dan status konservasi ikan hiu (Hemiscyl-liidae dan Charcharhinidae) yang didaratkan di PPN Sungailiat Bangka. *Journal of Fisheries and Marine Research*, *4*(3): 316-323.

Mopay, M., Wullur, S., Kaligis, E., 2017. Identifikasi molekuler sirip ikan hiu yang didapat dari pengumpul sirip di Minahasa. *Jurnal Pesisir dan Laut Tropis*, *5*(2): 1-7.

Nurastri, V.D., Marasabessy, I., 2021. Status konservasi ikan terancam punah yang diperdagangkan keluar Kota Sorong (Studi kasus: Ikan hiu berdasarkan identifikasi di Loka Pengelolaan Sumberdaya Pesisir dan Laut Sorong). *Jurnal Riset Perikanan dan Kelautan*, 3(1): 303 - 318.

Sadili, D., Dharmadi, D., Fahmi, F., Sarmintohadi, S., Ramli, I., Sudarsono, S., 2016. Rencana Aksi Nasional (RAN) konservasi dan pengelolaan hiu dan pari periode 2016-2020. Jakarta (ID): Direktorat Konservasi dan Keanekaragaman Hayati Laut, Ditjen Pengelolaan Ruang Laut, Kementerian Kelautan dan Perikanan Indonesia.

Sahaba, M.A.B., Abdullah, A., Nugraha, R., 2021. DNA barcoding untuk autentikasi produk hiu segar dari Perairan Nusa Tenggara Barat. *Jurnal Pengolahan Hasil Perikanan Indonesia*, *24*(3): 425-432.

Sembiring, A., Pertiwi, N.P.D., Mahardini, A., Wulandari, R., Kurniasih, E.M., Kuncoro, A.W., Cahyani, N.K.D., Anggoro, A.W., Ulfa, M., Madduppa, M., Carpenter, K.E., Barber, P.H., Mahardika, G.N., 2015. DNA Barcoding reveals targeted fisheries for endangered sharks in Indonesia. *Fisheries Research*, 164: 130-134.

Syam, Z.Z., Budiarsa, I.M., Astija, A., 2019. The characterization of beta chain fibrinogen (FGB) gene from maleo (*Macrocephalon maleo* S. Muller 1846), Tuva Village, Gumbasa Sub-District, Sigi Regency, Central Sulawesi. *Jurnal Riset Pendidikan MIPA*, *3*(2): 94-100.

Undang-Undang Nomor 5 Tahun 1990 tentang Konservasi sumber daya alam hayati dan ekosistemnya.

Weigmann, S., 2016. Annotated checklist of the living sharks, batoids and chimaeras (Chondrichthyes) of the world, with a focus on biogeographical diversity. *Journal of Fish Biology*, 88(3): 837-1037.

White, W.T., Last, P.R., Stevens, J.D., Yearsley, G.K., Fahmi, F., Dharmadi, D., 2006. *Economically important sharks and rays of Indonesia*. Australian Center for International Agricultural Research (ACIAR).

Wijayanti, F., Abrari, M.P., Fitriana, N., 2018. Keanekaragaman spesies dan status konservasi ikan pari di tempat pelelangan ikan Muara Angke Jakarta Utara. *Jurnal Biodjati*, *3*(1): 23 - 35.