

# Inventory of introduced fish species traded in Medan Regency, North Sumatra, Indonesia

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**Abstract.** Reports regarding introduced fish species traded in Medan have never been reported, even though the invasive impact of several species has occurred, especially in Lake Toba, North Sumatra. This research aims to collect data on the introduced fish species traded in Medan, North Sumatra, Indonesia. This research used a survey method by collecting data on introduced fish in 30 aquarium shops. The research was conducted from March to May 2024. The identified fish were then assessed for their frequency to determine their distribution percentage in aquarium shops in Medan. The results of the analysis showed that there were 55 species of introduced fish traded in Medan City which were classified into 46 genera, 29 families, 14 orders. The order Cichliformes dominates the number of species reaching 20%, followed by Cypriniformes 18%, Characiformes 13%, Siluriformes 13%, Osteoglossiformes 9%, Anabantiformes 6%, Cyprinodontiformes 5% and others 16% (species < 3%).

## 1 Introduction

The spread of introduced fish species in European countries began in the mid-19<sup>th</sup> century and continued to increase until the 1960s and 1970s [1]. It is recorded that in several rivers in England, the introduction of fish has been carried out since the 15th century [2,3]. The introduction of fish in the Czech Republic began in the 18th century, with 41 introduced fish species currently inhabiting its waters, and some of them have been successfully cultivated [4]. Nico and Pam [5] informed that in the United States in 1920 there were only 6 species of introduced fish, an increase of 3 species in 1945, and an increase to 50 species in 1980.

Indonesia has been introducing fish since before the 18th century, with a total of 16 species initially. To date, 24 species of introduced fish have been officially recorded [6]. However, it is estimated that more fish will be introduced along with the development of fish keeping as a hobby, which can then be released or released into nature for various reasons. The reasons for fish introduction in several countries are often similar, such as for cultivating superior fish, improving fish communities in public waters, and for game fishing activities

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[1,4]. As in other countries, introduced fish species are also imported into Indonesia as ornamental fish trade commodities, for consumption, or for other purposes such as controlling mosquitoes or increasing the quality and production of farmed fish. Currently, many groups of these types of fish have adapted well to Indonesia, and sometimes it is even difficult for the general public to distinguish whether a type of fish is native to Indonesia or an introduction, such as common carp (*Cyprinus carpio*). In England, carp was once considered the "queen of the rivers" because this species was commonly found in rivers [7]. In fact, several introduced fish varieties are also found in ponds and lakes that are accessible to the general public [3].

Data regarding introduced fish species traded in Medan is still minimal, so an inventory is needed. This concerns the invasive potential of this introduced fish if it is released into the waters, so management of this fish is needed to control its trade. This research aims to collect data on the introduced fish species traded in Medan, North Sumatra, Indonesia.

## 2 Method

Data collection was carried out in 30 aquarium shops spread across Medan in 2024. Fish that were possible to purchase were collected and further identified in the Lab. Biology, Universitas Negeri Medan, Indonesia. Fish that command high prices should only be photographed clearly to avoid misidentification. Introduced fish are identified based on several fish species determination books. The identified fish were then assessed for their frequency to determine their distribution percentage in aquarium shops in Medan.

## 3 Results and discussion

The identification results showed that there were 55 introduced fish species from 30 ornamental fish shops in Medan. These 55 introduced fish species show the significant diversity of the introduced fish trade in Medan. Based on the Fi value, it shows that *Betta splendens* had the highest reaching 93.33%, while the lowest included *Acipenser ruthenus*, *Channa aurantimaculata*, *Gyrinocheilus aymonieri*, and *Scleropages jardinii* reach of 3.33%, respectively.

The family with the highest number of species is Cichlidae with 11 species including *Amphilophus citrinellus*, *A. labiatus*, *Astronotus ocellatus*, *Cichla ocellaris*, *C. piquiti*, *Cynotilapia afra*, *Haplochromis compressiceps*, *Melanochromis auratus*, *Oreochromis mossambicus*, *O. niloticus*, and *Symphysodon aequifasciata*. The Cichlidae has more than 2000 species and some of them are important ornamental and cultivated fish throughout the world [8]. The unique characteristics of each species in the Cichlidae are the main attraction for ornamental fish lovers. The variety of fish species, as well as varying body shapes in terms of size, and color combination patterns, make this family unique and different from other ornamental fish families. This makes the Cichlidae very sought after because new varieties are often discovered with very unique patterns and colors.

The second family with high number of species is the Cyprinidae. The Cyprinidae is a very diverse group of fish and are freshwater fish that live in waters with moderate currents and mostly live in the pelagic layer. This family has characteristics that can be seen from the teeth located at the top of the throat, known as pharynx teeth, which function as chewing teeth because they do not have molars. The Cyprinidae is also characterized by the ability of a mouth that can be pulled forward (protactile), the mouth is slightly facing downwards, eye sockets with edges that are open or covered by skin, the number of barbels never exceeds 4, and they do not have additional fins [9]. The introduced fish species from the Cyprinidae

obtained during the research were *Balantiocheilos melanopterus*, *Carassius auratus*, *Cyprinus carpio*, *Epalzeorhynchus frenatum*, and *Puntigrus tetrazona*.

Sturgeons (*A. ruthenus*) are protected fish with an IUCN conservation status of endangered and are included in CITES Appendix II, meaning that their commerce is strictly regulated. This species originates from Eurasia including the Black, Azov, and Caspian Seas. During the research, this species was only found in one shop (Shop of Ikan Hias dan Aquarium), this was because the price was high so it was relatively difficult to sell.

Introduced fish species have the potential to become invasive fish that are able to adapt easily and thus dominate a body of water. The presence of these introduced fish has the potential to cause environmental imbalance. According to Leunda [10], there are three impacts of the presence of introduced fish, namely its effect on the environment, the health of wildlife and society, as well as its economic impact. The impacts of introduced fish on the environment and animal health can include their role as predators, parasites or competitors, as well as being agents that cause the pathogens into the environment. Apart from that, the possibility of cross-breeding with native fish can also threaten the survival of native fish [11].

## Conclusion

There are 55 introduced fish species traded in Medan which are classified into 46 genera, 29 families, 14 orders. The order Cichliformes dominates the number of species reaching 20%, followed by Cypriniformes 18%, Characiformes 13%, Siluriformes 13%, Osteoglossiformes 9%, Anabantiformes 6%, Cyprinodontiformes 5% and others 16% (species < 3%).

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**Tabel 1.** Introduced fish species in Medan, North Sumatra, Indonesia

TABLE 2. INTRODUCED FISH SPECIES IN CANADA, NORTH ATLANTIC, AND THE GULF OF ST. LAWRENCE																										
N o	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ft
1	<i>Acipenser ruthenus</i> Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	3.33
2	<i>Anphilophus citrinellus</i> Günther, 1864	-	-	-	-	-	+	+	+	+	-	+	-	-	-	-	+	+	+	-	-	-	-	-	+	40.0 0
3	<i>Anphilophus labiatus</i> Günther, 1864	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-	16.6 7
4	<i>Apteronotus albifrons</i> Linnaeus, 1766	-	-	+	-	+	-	+	+	+	-	+	-	-	-	-	+	-	-	+	-	-	-	+	-	33.3 3
5	<i>Astronotus ocellatus</i> Agassiz, 1831	-	-	-	-	+	+	+	+	+	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-	36.6 7
6	<i>Balanitochelios melanopterus</i> Bleeker, 1850	-	-	-	-	+	+	+	+	-	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-	16.6 7
7	<i>Betta splendens</i> Regan, 1910	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	93.3 3
8	<i>Carassius auratus</i> Linnaeus, 1758	-	-	-	-	+	+	+	+	+	-	-	+	-	+	+	+	+	-	-	-	-	-	-	+	40.0 0
9	<i>Channa auranimaculata</i> Musikasinthorn, 2000	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.33
10	<i>Channa micropeltes</i> Cuvier, 1831	-	+	-	+	-	-	+	-	+	-	+	-	-	-	-	+	-	-	+	-	-	-	-	+	33.3 3
11	<i>Chitala borneensis</i> Bleeker, 1851	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	6.67
12	<i>Chitala chitala</i> Hamilton, 1822	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	6.67
13	<i>Chromobotia macracanthus</i> Bleeker, 1852	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	13.3 3
14	<i>Cichla ocellaris</i> Bloch & Schneider, 1801	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.67
15	<i>Cichla piquiti</i> Kullander & Ferreira, 2006	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	6.67
16	<i>Clarias gariepinus</i> Burchell, 1822	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	6.67
17	<i>Colossoma macropomum</i> Cuvier, 1816	-	+	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	23.3 3
18	<i>Cynotilapia afra</i> Günther, 1894	+	+	+	+	-	-	-	-	-	-	+	-	-	-	-	+	+	+	-	-	-	-	+	-	40.0 0
19	<i>Cyprinus carpio</i> Linnaeus, 1758	+	-	-	+	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-	-	-	+	-	20.0 0
20	<i>Danio rerio</i> Hamilton, 1822	-	+	+	+	+	+	-	+	+	-	+	+	-	-	-	+	+	+	+	+	+	+	+	-	63.3 3
21	<i>Danioides microlepis</i> Bleeker, 1854	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-	-	-	+	-	16.6 7
22	<i>Danioides polota</i> Hamilton, 1822	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	6.67

N o	Species	1	2	3	4	5	6	7	8	9	1	11	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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50	<i>Scleropages jardini</i> Saville-Kent, 1892	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.33
51	<i>Semaprochilodus insignis</i> Jardine, 1841	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.67
52	<i>Symphysodon aequifasciata</i> Pellegrin, 1904	-	-	+	+	+	+	-	-	-	-	-	+	+	-	-	-	-	-	+	+	-	-	-	+	-	-	-	-	40.00
53	<i>Synodontis decorus</i> Boulenger, 1899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	6.67
54	<i>Tetraodon duboisi</i> Poll, 1959	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.67
55	<i>Xiphophorus hellerii</i> Heckel, 1848	-	+	+	+	+	+	-	-	-	-	-	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	60.00

Where: Aquarium shop of (1) Amnai Polem, (2) Taufiq Aquarium, (3) Best Friend, (4) Lia Aquarium, (5) Istaba Aquascape Pray, (6) Ichha Aquarium, (7) Aquarium Belawan, (8) Satria Aquarium, (9) Alif Aquatic, (10) Arowana Aquarium, (11) Ikan Hias dan Aquarium, (12) Rahmad Aquarium, (13) Berlin Pancing 2, (14) Irel Aquarium, (15) Berlin Pancing 3, (16) King Arwana, (17) Dinda Aquatic, (18) Alif Aquarium, (19) Nabila Aquarium, (20) Handoko Aquarium, (21) JG Aquarium, (22) Sinar Aquarium, (23) Sinar Mas Aquarium, (24) Toko Ikan Wanda, (25) Toko Ikan Hias Akbar, (26) Taufik Aquarium, (27) Rumah Ikan, (28) Dako Aquarium, (29) Aquarium Sarah, and (30) Rumah Ikan 2. (-) Absent and (+) Present.

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