



The Import Status of Ornamental Mollusca in the Republic of Korea

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ABSTRACT

This study investigates the importation of ornamental and pet aquatic mollusks into South Korea from 2009 to 2024, updating the national list of alien mollusks and providing baseline data for ecological risk assessments and biosecurity strategies. A total of 240,898 individuals from 67 species, 26 families, 12 orders, and 3 classes were recorded. Gastropods were the most frequently imported, with 53 species, and major exporting countries included Indonesia, the Philippines, and the United States, with the highest number of imports from the Philippines. Frequently imported species such as *Vittina waigiensis*, *Tectus fenestratus*, and *Turbo fluctuosus* were mainly marine. Some species were listed in CITES Appendix II. Alien species like *Pomacea canaliculata*, *Perna viridis*, and *Nassarius* spp. pose ecological threats by competing with native species, disrupting food webs, and transmitting diseases. These findings provide essential data for managing invasive mollusks.

Keywords: Biosecurity, Convention on International Trade in Endangered Species of Wild Fauna and Flora, Ecological risk, Import status, Ornamental Mollusca

Introduction

The phylum Mollusca constitutes the second-largest animal group, after arthropods, with approximately 100,000 recognized species worldwide (MolluscaBase, 2024). Most species are marine, but some have evolved to thrive on land, with more than 6,000 species living in freshwater habitats (Lydeard & Cummings, 2019). Mollusca consists primarily of the classes Gastropoda and Bivalvia, which are groups of organisms that perform diverse ecological functions ranging from the maintenance of aquatic eco-

system stability, productivity, and biodiversity to ensuring environmental health and human well-being (Atkinson *et al.*, 2023; Sousa *et al.*, 2024).

In recent years, these mollusks have become popular with novice and experienced pet owners alike owing to their relatively simple rearing environment, their ability to serve as scavengers, and the wide variety of species available as pets and ornamental animals (Ng *et al.*, 2016). In the Republic of Korea, invasive mollusks such as *Pomacea* spp., *Neritina* spp., and *Melanoides tuberculata* are sold through online pet stores and aquariums. In particular, in addition to intentional introductions with clear importation procedures, unintentional introductions, while attached to aquatic plants and aquarium ornaments, are common, and it has been reported that a significant proportion of invasive mollusks are introduced unintentionally (Lee *et al.*, 2010).

The introduction of invasive mollusks into domestic

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aquatic ecosystems can have detrimental ecological consequences, including competition with native species, the disruption of food webs, habitat destruction, and disease transmission (Geist *et al.*, 2025; Zannella *et al.*, 2017). In particular, the indiscriminate release of such organisms during rearing or after death increases the likelihood of invasion into natural ecosystems, which can pose a potential biosecurity threat. Furthermore, some gastropods, such as *Schistosoma* spp. or *Angiostrongylus* spp. can infect humans when they ingest the next stage of the parasite or infected secondary hosts (Lu *et al.*, 2018). The potential for the anthropogenic spread of these parasites has been emphasized in previous studies (Madsen & Frandsen, 1989) and has continued to be a subject of concern in recent years (Lu *et al.*, 2018; Mastitsky *et al.*, 2014).

There is a paucity of official statistics or systematic research on the importation of mollusks for pet and ornamental purposes in the Republic of Korea. Instead, reliance is placed on fragmented information obtained through informal channels, such as online stores and pet communities. Therefore, the aim of this study was to investigate the current status of aquatic mollusks imported into the Republic of Korea for pet and ornamental purposes, update the list of invasive mollusks introduced into the Republic of Korea, and provide a basis for future ecosystem risk assessment and biosecurity management strategies.

Case Report

The import (export) quarantine statistics of the National Fisheries Quality Management Service were used to determine the status of ornamental aquatic mollusks imported into the Republic of Korea from 2009 to 2024 (NFQS, 2025). The species taxonomy and international endangered species status for aquatic mollusks identified as imported were sourced from the Global Biodiversity Information Facility and the Convention on International Trade in Endangered Species of Wild Fauna and Flora

(CITES) (CITES, 2025; GBIF, 2025).

Discussion

Status of Mollusca imports into the Republic of Korea

An analysis of aquatic mollusks imported into the Republic of Korea for ornamental purposes from 2009 to 2024 showed that 240,898 individuals, of three classes, 12 orders, 26 families, and 67 species, were imported. Of the aquatic mollusks imported, Gastropoda accounted for the largest share with 53 species (79.1%), followed by Bivalvia with 12 species and Cephalopoda with one species (Appendix 1). Of these, six Gastropoda and two Bivalvia species have been recorded on the National Species List (NIBR, 2025).

The annual fluctuations in imports have ranged from a low of seven to a high of 26, with augmentation since 2009, a modest decrease from 2016, and a resurgence after 2022 (Fig. 1A). Prior to 2016, the average number of individuals imported annually was less than 10,000. However, since 2017, it has exceeded 20,000 annually (Fig. 1B). These findings may be attributed to the fact that, in the context of pet imports, initial interest is spread across a broad spectrum of species. However, as the importation process progresses, interest gravitates toward a select few species that are more amenable to captivity and less demanding in terms of maintenance (Hausmann *et al.*, 2023; Valdez, 2021).

Ornamental mollusks are imported into the Republic of Korea from 15 countries, including Indonesia, the Philippines, the United States, Singapore, Palau, Vietnam, Sri Lanka, Japan, the Marshall Islands, Taiwan, the Federated States of Micronesia, Brazil, Egypt, Kenya, and Tonga. Of these, Indonesia exported the most species (40), followed by the Philippines (32), the United States (15), and Singapore (7), with species imported from the four countries accounting for approximately 92.5% of the total. In terms of the number of individuals, the Philippines exported the largest number of individuals (126,419), followed by

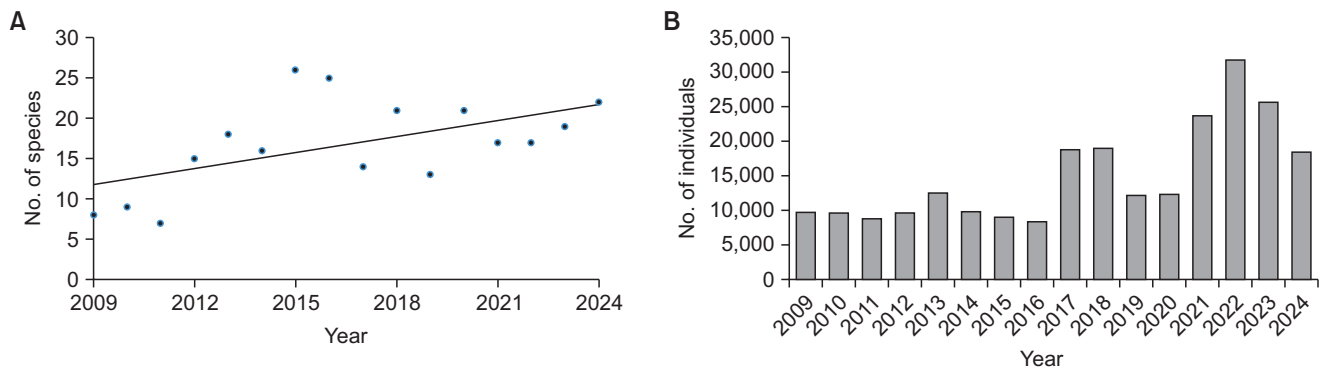


Fig. 1. Annual import status of ornamental Mollusca. (A) Number of species. (B) Number of individuals.

Indonesia (62,771), Singapore (26,678), and the United States (9,435), with individuals imported from these four countries accounting for approximately 93.5% of the total (Fig. 2).

Major species

Among the imported mollusks, *Vittina waigiensis* accounted for the largest number of imports at 53,783, followed by *Tectus fenestratus* at 45,990, *Rochia niloticus* at 42,334, *Trochus histrio* at 16,880, and *Turbo fluctuosus* at 12,751, with Gastropoda accounting for the majority of imports (Fig. 3, Appendix 1) (GBIF, 2025b; 2025c; 2025d; 2025e). In addition, most mollusks imported were marine with 61 species, followed by estuarine with four species, and freshwater with two species (Appendix 1).

A combination of ecological, aesthetic, and management factors contributes to the preference for saltwater species over freshwater species in the ornamental mollusk

market. Firstly, saltwater environments exhibit a higher level of biodiversity than freshwater environments, with more diverse ornamental mollusk species available (Gadhavi *et al.*, 2023). In fact, saltwater snails such as *Tectus*, *Trochus*, *Rochia*, and *Turbo* have high aesthetic value as aquarium ornamental genera due to their colorful forms and unique shell patterns (Babu *et al.*, 2011). These morphological traits are important factors in the selection of ornamental species and are thought to be major contributors to the preference for saltwater mollusks.

Seven species listed by the CITES were identified, representing 10.4% of all imports, with six Bivalvia and one Cephalopoda species. All of the species were placed in Appendix II of the CITES (CITES, 2025), a list of species that are not currently endangered but may become endangered without strict regulations on international trade (CITES, 2025). In particular, *Tridacna*, a genus of Bivalvia that has traditionally been overfished over the

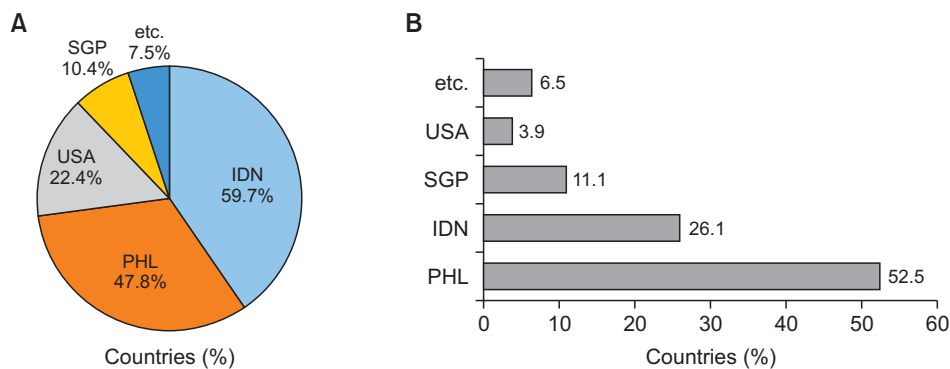


Fig. 2. Import status of ornamental Mollusca by major countries. (A) Percentage of species. (B) Percentage of individuals. SGP, Singapore; IDN, Indonesia; USA, the United States; PHL, Philippines.



Fig. 3. Major imported species of ornamental Mollusca. (A) *Vittina waigiensis*. (B) *Tectus fenestratus*. (C) *Rochia niloticus*. (D) *Turbo fluctuosus*. Source: GBIF, 2025b; 2025c; 2025d; 2025e.

past few decades due to increased demand for their meat and shells, accounted for the most, with five species (Van Wynsberge *et al.*, 2016).

Ecological risk

Aquatic mollusks are likely to be introduced into domestic aquatic ecosystems, both intentionally and unintentionally (Banha *et al.*, 2019), and upon introduction, they have the potential to cause ecological harm in different ways, including competition with native species, the disruption of food webs, habitat destruction, and disease transmission (Gallardo *et al.*, 2016). Among the aquatic mollusks imported into the Republic of Korea, freshwater species include *Pomacea canaliculata*, which is included in the List of 100 of the World's Worst Invasive Alien Species of the International Union for Conservation of Nature. In some regions, this species is used for eco-friendly agricultural practice (Jeong *et al.*, 1999; Moon *et al.*, 1998). Regarding saltwater species, five *Nassarius* species and *Perna viridis* were identified. *P. viridis* is widely distributed in the Asia-Pacific region and has undergone global spread via ship ballasts, hull attachment, and aquaculture. This species is recognized as an invasive species that causes significant damage to the aquaculture industry owing to competition with numerous attached species (Gracia & Rangel-Buitrago, 2020). It is currently designated as an invasive species in the Republic of Korea, where imports are strictly controlled (Ministry of Environment, 2020). Furthermore, many popular ornamental pets are native to tropical countries. Given the prevalence of trematodiasis in these regions, which is of medical and veterinary significance, there is a pressing need to direct special attention towards species from these areas as potential vectors of zoonotic diseases (Nguyen *et al.*, 2021; Pratumchart *et al.*, 2019). Five *Nassarius* species are also known to be primary or secondary intermediate hosts for trophozoites and hookworms (Barnett & Miller, 2018; Cheng *et al.*, 1973).

Recently, *Melanoides tuberculata* and *Mieniplotia scabra*, gastropods that are popular in the ornamental market for their scavenging and parthenogenetic abilities to control algae and organic matter, have been identified in Jukdangcheon stream (Park *et al.*, 2024; 2025). Since they are not found on official import lists, they appear to have “hitchhiked” during the distribution of ornamental aquatic plants in aquariums (Duggan, 2010; Kwong *et al.*, 2010). As such, it is necessary to establish a continuous online and offline surveillance system for invasive mollusks entering the Republic of Korea through various routes, in addition to the systematic management of freshwater and saltwater species by identifying their integrated status beyond the scope of management by relevant government agencies (Lee *et al.*, 2010).

Author Contributions

Conceptualization: YP, YC. Data curation: YP, DC, MJ. Formal analysis: YP. Funding acquisition: YC. Writing – review & editing: YP, SJK.

Conflict of Interest

The authors declare that they have no competing interests.

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Appendix 1. Import status of ornamental Mollusca list in the Republic of Korea (2009–2024)

Class	Scientific name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Habitat	Country	CITES
Bivalvia	<i>Ctenoides ales</i>							45										MAR	PHL	
Bivalvia	<i>Ctenoides scabra</i>	5		25	9	3	10	38	4	17	89	74	104		108	88	110	MAR	PHL, IDN	
Bivalvia	<i>Hippopus hippopus</i>		5															MAR	PLW	II
Bivalvia	<i>Limaria hians</i>	50	75	386	386	117	15	68	20	285	88			49	51			MAR	PHL, IDN	
Bivalvia	<i>Limaria orientalis</i>					8												MAR	IDN	
Bivalvia	<i>Perna viridis</i>			1														MAR	PHL	
Bivalvia	<i>Spondylus foliaceus</i>							2										MAR	USA	
Bivalvia	<i>Tridacna crocea</i>	200	794	400	246	650	352	300	500		25			450	216			MAR	VNM, PLW, IDN	II
Bivalvia	<i>Tridacna derasa</i>		5	7	460	72		98										MAR	PLW, MHL	II
Bivalvia	<i>Tridacna gigas</i>	20			4													MAR	IDN, PHL	II
Bivalvia	<i>Tridacna maxima</i>		20	457	120	442	13	100	280	40				150		500		MAR	VNM, MHL, FSM, TON, TWN, EGY	II
Bivalvia	<i>Tridacna squamosa</i>		20		40	100		50	100		89				10		100	MAR	VNM, PLW, IDN	II
Cephalopoda	<i>Nautilus pompilius</i>	23					25	67	67									MAR	PHL, JPN	II
Gastropoda	<i>Agathistoma fasciatum</i>							50	50									MAR	USA	
Gastropoda	<i>Anentome helena</i>	600																FW	SGP	
Gastropoda	<i>Astrarium calcar</i>															10		MAR	PHL	
Gastropoda	<i>Astrarium rhodostomum</i>				1											100	80	MAR	IDN, PHL	
Gastropoda	<i>Babylonia formosae</i>															150	30	MAR	IDN	
Gastropoda	<i>Babylonia spirata</i>							10	5			5	125			50		MAR	IDN	
Gastropoda	<i>Canarium urceus</i>				44													MAR	IDN	
Gastropoda	<i>Cerithium muscarum</i>							100	50							420	50	MAR	USA, IDN	
Gastropoda	<i>Chromodoris willani</i>			15														MAR	PHL	
Gastropoda	<i>Clypeomorus irrorata</i>						1,000											MAR	USA	
Gastropoda	<i>Conomurex luhuanus</i>												20				185	MAR	PHL, IDN	
Gastropoda	<i>Cypraea tigris</i>	24	2	31	50	21	58	59	26		86	2		7	1			MAR	PHL, IDN, SGP	
Gastropoda	<i>Engina mendicaria</i>			21		81	40	140	95	200	94		200	944	1,030	1,380	1,274	MAR	PHL, USA, IDN, SGP	
Gastropoda	<i>Euthria cornea</i>										1							MAR	SGP	

Appendix 1. Continued

Class	Scientific name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Habitat	Country	CITES
Gastropoda	<i>Haliotis cracherodii</i>							5										MAR	PHL	
Gastropoda	<i>Lithopoma tectum</i>				3,356	55	240	90			130	100	300	365	180	655		MAR	IDN, PHL, USA	
Gastropoda	<i>Margarites costalis</i>												529	440				MAR	IDN	
Gastropoda	<i>Margarites pupillus</i>					500	100											MAR	USA	
Gastropoda	<i>Megastrea undosa</i>				500													MAR	USA	
Gastropoda	<i>Mitra mitra</i>							1										MAR	IDN	
Gastropoda	<i>Monetaria annulus</i>				10						4							MAR	IDN	
Gastropoda	<i>Nassarius coronatus</i>										15	200	410	5				MAR	PHL, IDN	
Gastropoda	<i>Nassarius distortus</i>							20	30		325	193	920	1,115	860	505	1,565	MAR	USA, IDN, PHL	
Gastropoda	<i>Nassarius graphiterus</i>												365	282	790	420	1,315	MAR	PHL, IDN	
Gastropoda	<i>Nassarius margarifer</i>												10					MAR	PHL	
Gastropoda	<i>Nassarius pullus</i>								50					19				MAR	PHL	
Gastropoda	<i>Nerita atramentosa</i>																	MAR	USA	
Gastropoda	<i>Nerita undata</i>																	MAR	USA	
Gastropoda	<i>Neritina natalensis</i>									8,006							10	MAR	IDN	
Gastropoda	<i>Norrisia norrisii</i>					100												EZ	IDN, LKA	
Gastropoda	<i>Olivia miniacea</i>							13	5									MAR	USA	
Gastropoda	<i>Ovula ovum</i>				2													MAR	PHL	
Gastropoda	<i>Phrontis vibex</i>							140	55		18		265			10	130	EZ	PHL, USA, IDN	
Gastropoda	<i>Pictocolumbella ocellata</i>													370	3,230	1,145	1,269	MAR	PHL, IDN	
Gastropoda	<i>Polinices lacteus</i>								2									MAR	PHL	
Gastropoda	<i>Polinices mammilla</i>							40										MAR	PHL	
Gastropoda	<i>Pomacea canaliculata</i>									600								FW	IDN	
Gastropoda	<i>Rochia niloticus</i>	8,904	8,854	7,840	7,903	1,598	98	1,828	1,450	1,229	960	600	70				1,000	MAR	PHL, IDN, SGP, USA	
Gastropoda	<i>Siratus pliciferoides</i>		3															MAR	IPN	
Gastropoda	<i>Strombus alatus</i>				18			5										MAR	USA	
Gastropoda	<i>Strombus labiatus</i>										3		15					MAR	IDN	
Gastropoda	<i>Tectus fenestratus</i>			300	1,440	5,007	3,876	4,240	3,625	3,224	4,790	3,745	5,207	5,119	2,885	2,532		MAR	PHL, IDN, VNM	
Gastropoda	<i>Tectus pyramis</i>								50	230			85	1,129	3,100	2,130	2,560	MAR	IDN, PHL	

Appendix 1. Continued

Class	Scientific name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Habitat	Country	CITES
Gastropoda	<i>Tengella granulata</i>								2									MAR	LKA	
Gastropoda	<i>Tritia reticulatus</i>															150		MAR	IDN	
Gastropoda	<i>Trochus chloromphalus</i>									100								MAR	IDN	
Gastropoda	<i>Trochus histrio</i>									100	30	585	570			13,917	1,678	MAR	IDN, LKA	
Gastropoda	<i>Trochus maculatus</i>				170	860	1,834	1,239	607	160	135	185	445	70	40	500	731	MAR	IDN, LKA, PHL, KEN	
Gastropoda	<i>Trochus radiatus</i>														163	460	120	MAR	PHL, IDN	
Gastropoda	<i>Turbo argyrostomus</i>												151					MAR	PHL, IDN	
Gastropoda	<i>Turbo bruneus</i>					20	40	217	55		50	50	10					MAR	IDN, JPN	
Gastropoda	<i>Turbo fluctuosus</i>					3,377	800	290	630	2,286	521	1,454	1,300	840	595	508	150	MAR	PHL, IDN, USA, SGP	
Gastropoda	<i>Vitta virginea</i>															300		EZ	BRA	
Gastropoda	<i>Vittina waigtensis</i>									2,200	12,948	4,020	2,750	12,330	16,400	3,135	EZ	PHL, SGP, IDN		

MAR, marine; FW, freshwater; EZ, estuarine zone; PHL, Philippines; IDN, Indonesia; PIW, Palau; USA, the United States; VNM, Vietnam; MHL, Marshall Islands; FSM, Micronesia; TON, Tonga; TWN, Taiwan; EGY, Egypt; JPN, Japan; SGP, Singapore; LKA, Sri Lanka; KEN, Kenya; BRA, Brazil; CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora.