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Zoology

Revision of the Status of Invasive and Non-Native Animal Species in Georgia (Sakartvelo)

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Abstract. This study presents a revised checklist of invasive and alien (non-native) animal species recorded in Georgia (Sakartvelo), based on a critical evaluation of published records, faunistic data, and evidence of establishment and spread. The analysis demonstrates that 88 species currently qualify as invasive or alien within the country, of which 51 are confirmed as invasive due to their established populations and documented ecological, economic, or genetic impacts. The remaining species are regarded as introduced or non-native taxa whose invasive status remains uncertain or context-dependent. The study also reassesses several previously reported taxa and excludes numerous species that represent native Caucasian fauna, natural range expansions, doubtful records, or taxa lacking reliable documentation. Particular emphasis is placed on the necessity of distinguishing true invasive species from merely introduced or newly recorded organisms in order to avoid conceptual inaccuracies in biodiversity assessments. Two insect species are reported from Georgia for the first time: *Hermetia illucens* (Linnaeus) (Diptera: Stratiomyidae) and *Haritalodes derogata* Fabricius (Lepidoptera: Crambidae). The revised checklist provides an updated framework for future monitoring, conservation planning, and management of invasive fauna in Georgia. © *2026 Bull. Natl. Acad. Sci. Georg.*

Keywords: invasive, alien, Sakartvelo, Georgia, biodiversity

Introduction

In many cases, the term *invasive species* has been applied, particularly in taxonomic groups that have not been comprehensively documented in a given geographical region. In such situations, species may represent previously overlooked components of the native or long-established fauna rather than recent introductions, with their apparent novelty reflecting historical gaps in sampling and collecting effort. Consequently, the status of each species should be evaluated individually, on the basis of historical distribution data, possible pathways of introduction, and evidence of establishment, spread, and impact,

in order to determine whether it should be regarded as an *invasive or non-native (alien) species* or merely a newly documented regional record.

The designation of a species as invasive requires more than evidence of historical introduction. Although several taxa were reportedly introduced to Georgia during the mid-20th century or later, introduction alone is insufficient to justify invasive status in the absence of documented establishment, population persistence, spread, and ecological, genetic, or economic impacts. In many cases, historical records are not supported by recent field data or population studies, and such species may represent transient introductions, failed establishments, locally extinct populations, or misidentified records. Species for which no contemporary evidence exists demonstrating self-sustaining populations or measurable impacts should therefore not be classified as invasive but rather regarded as introduced or alien species of uncertain invasion status.

The invasive status of a species must be evaluated on a regional and temporal basis using up-to-date distributional and ecological data, thereby avoiding conceptual inflation of the term *invasive* and ensuring a scientifically defensible assessment of non-native fauna. While all invasive species are non-native, the majority of non-native species do not become invasive, as invasiveness requires evidence of establishment, spread, and negative impact. Species intentionally introduced for biological control are likewise non-native by origin but should not be considered invasive unless there is clear evidence of uncontrolled expansion and significant non-target effects. Finally, it should be noted that natural range expansion through dispersal does not render a species non-native.

The paper presents a list of "invasive/non-native" species (Japaridze and Seropian, 2025), however, the use of combined terminology creates conceptual ambiguity unless the status of each taxon is clearly defined, also they don't consider publication by Aleksidze et al. (2021) "Invasive Alien Species of Georgia" and some other original publications. The list includes a number of Caucasus endemic species and naturally expanding Mediterranean taxa that are incorrectly classified as invasive or non-native, indicating a lack of distinction between natural dispersal, internal translocation, and true biological invasion. For this reason, we revise the applied approach to improve scientific rigor and avoid potential confusion. It should also be noted that the taxonomic list is arranged in reverse evolutionary order, from mammals to ctenophores, whereas the conventional and biologically appropriate sequence is the opposite.

Materials and Methods

We surveyed all original and recent references dealing with this subject of invasive or non-native/alien species. Present survey was compiled from data mined from the original literature. Bibliographical errors have been corrected, and species missing from the list of invasive or non-native species have been added.

We made three categories to group and consider species scientifically correctly. These groups are: 1. Invasive species – Species that are non-native (alien) and for which there is clear evidence of establishment, spread, and ecological, economic, or genetic impact in Georgia; 2. Non-native (alien)/introduced species – Species that have been introduced outside their natural range by human activities, but for which invasiveness has not been demonstrated, or remains context-dependent or uncertain; 3. Species that should not be considered invasive or non-native (alien) – Species that: are native to Georgia, or represent natural range expansions, or are cryptogenic/taxonomically uncertain, or were historically misclassified due to lack of data, misidentification, or conceptual errors.

Results

1. Invasive species

Invertebrata

Ctenophora: 1. *Mnemiopsis leidyi* Agassiz, 1865 (Mamish et al., 2020).

Mollusca: 2. *Corbicula fluminalis* (Müller, 1774); 3. *Mytilopsis leucophaeata* (Conrad, 1831), 4. *Physella acuta* (Draparnaud, 1805); 5. *Ferrissia californica* (Rowell, 1863); 6. *Eobania vermiculata* (Müller, 1774) (Mumladze et al., 2019); 7. *Anadara kagoshimensis* (Tokunaga,1906) (Gogmachadze and Mikashavidze, 2005; Vadachkoria et al. 2020); 8. *Rapana venosa* (Valenciennes, 1846) (Bondarev, 2014).

Malacostraca: 9. *Melita nitida* Smith, 1873 (Copilaș-Ciocianu et al., 2020); 10. *Penaeus semisulcatus* De Haan, 1844 is reported from Georgian Black Sea waters based on a single specimen collected near Batumi in 2014, although the species is alien to the Black Sea basin, there is currently no evidence of establishment or invasive behavior in Georgia; 11. *Rhithropanopeus harrisii* (Gould, 1841) (Japoshvili and Aslan, 2020).

Arachnida: 12. *Tropilaelaps mercedesae* Anderson & Morgan, 2007; 13. *Varroa destructor* Anderson & Trueman, 2000 (Janashia et al., 2024); 14. *Panonychus citri* (McGregor, 1916) (Reck, 1941).

Insecta: Coleoptera: 15. *Xylosandrus germanus* (Blandford, 1894) has been recorded in Georgia with limited occurrences (Japoshvili et al. 2022). It is an ambrosia beetle native to East Asia that has been widely introduced to Europe and other regions through the transport of infested wood and timber; 16. *Epuraea ocularis* Fairmaire, 1849 (Tsinkevich and Solodnikov, 2014); 17. *Leptinotarsa decemlineata* (Say, 1824) (Japoshvili and Aslan, 2020; Seperteladze et al., 1985); 18. *Stelidota geminata* (Say, 1825) (Tsinkevich and Solodnikov, 2014).

Diptera: 19. *Drosophila suzukii* (Matsumura, 1931) (Japoshvili et al. 2018).

Hemiptera: 20. *Daktulosphaira vitifoliae* (Fitch, 1855) (Aleksidze et al., 2021; Jibladze, 1975); 21. *Eriosoma lanigerum* (Hausmann, 1802) (Aleksidze et al., 2021; Batiashvili and Dekanoidze, 1974); 22. *Aphis forbesi* Weed, 1889(Aleksidze et al., 2021; Jibladze, 1975); 23. *Dialeurodes citri* (Ashmead, 1885); 24. *Lopholeucaspis japonica* (Cockerell, 1897) (Aleksidze et al., 2021; Batiashvili and Dekanoidze, 1974); 25. *Ceroplastes japonicus* Green, 1921(Aleksidze et al., 2021; Borchsenius, 1949; Yasnosh and Japoshvili, 1998); 26. *Icerya purchasi* (Maskell, 1879); 27. Pseudococcus calceolariae (Maskell, 1879) (Aleksidze et al., 2021; Kobakhidze, 1965); 28. *Halyomorpha halys* (Stål, 1855) (Aleksidze et al., 2021; Gapon, 2016); 29. *Corythucha arcuata* (Say, 1832) (Shchurov, 2019); 30. *Corythucha ciliata* (Say, 1832) (Supatashvili et al., 2016); 31. *Orosanga japonica* (Melichar, 1898) (Akiner et al., 2022); 32. *Metcalfa pruinosa* (Say, 1830) (Tavartkiladze et al., 2022); 33. *Stictocephala bisonia* kopp & Yonke, 1977 (Ruchin, 2023).

Lepidoptera: 34. *Tuta absoluta* (Meyrick, 1917) (Aleksidze et al., 2021; Lobjanidze and Beruashvili, 2019); 35. *Hyphantria cunea* (Drury, 1773) (Japoshvili et al. 2006); 36. *Cydalima perspectalis* (Walker, 1859) (Aleksidze et al., 2021; Matsiakh, 2015); 37. *Cameraria ohridella* Deschka, Dimic, 1986 (Didmanidze et al., 2010); 38. *Glyphodes pyloalis* Walker, 1859 (Kanchaveli et al., 2009); 39. *Micromelalopha sieversi* Marumo, 1920 (Japaridze and Seropian, 2025); 40. *Paysandisia archon* (Burmeister, 1880) (Mori et al. 2022); 41. *Phthorimaea operculella* (Zeller, 1873) (Aleksidze, 2014); 42. *Samia cynthia* Drury, 1773 (Stolyarov and Goderdzishvili, 1991; Zolotuhin et al., 2011); 43. *Haritalodes derogata* Fabricius, 1777, 1 female, collected on *Hibiscus* sp. 26.07.2021, Javakhishvili 78-80 square, Leg. N. Dzneladze. COI was sequenced BOLD ID: 24090065506Y. **New record from Georgia.** Voucher is placed in the collection of Institute of Entomology, Georgian Academy of Sciences.

Vertebrata

Pisces: 44. *Carassius gibelio* (Bloch, 1782); 45. *Pseudorasbora parva* (Temminck & Schlegel, 1846); 46. *Gambusia holbrooki* Girard, 1859; 47. *Hypophthalmichthys molitrix* (Valenciennes, 1844); 48. *H. nobilis* (Richardson, 1845) (Epitashvili et al., 2025); 49. *Hemiculter leucisculus* (Basilewsky, 1855)[38]; 50. *Planiliza haematocheilus* (Temminck & Schlegel, 1845) (Varshanidze et al., 2022).

Mammalia: 51. *Procyon lotor* (Linnaeus, 1758) (Janashvili, 1979; Kalandarishvili and Heltai, 2019).

2. Non-native (alien) / introduced species

Invertebrata

Ctenophora: 1. *Beroe ovata* Bruguiere, 1789 (Mamish et al., 2020).

Annelida: 2. *Ficopomatus enigmaticus* (Fauvel, 1923).

Mollusca: 3. *Mya arenaria* Linnaeus, 1758.

Copepoda: 4. *Acartia tonsa* Dana, 1849, 5. *Oithona davisae* Ferrari & Orsi, 1984.

Maxillopoda: 6. *Amphibalanus improvisus* (Darwin, 1854), 7. *Amphibalanus eburneus* (Gould, 1841) (Varshanidze et al., 2022).

Malacostraca: 8. *Oxidus gracilis* (Koch, 1847) (Kokhia and Golovatch, 2020). 9. *Penaeus semisulcatus* De Haan, 1844 is reported from Georgian Black Sea waters based on a single specimen collected near Batumi in 2014, although the species is alien to the Black Sea basin, there is currently no evidence of establishment or invasive behavior in Georgia (Guchmanidze et al., 2017);

Arachnida: 10. *Theridula gonygaster* (Simon, 1873) (Marusik, 1989; Mcheidze, 1992; Otto, 2022).

Insecta: Coleoptera: 11. *Epitrix hirtipennis* (Melsheimer, 1847) (Gul-Aslan et al., 2012); Following species 12. *Cryptolaemus montrouzieri* Mulsant, 1850, 13. *Harmonia axyridis* (Pallas, 1773), 14. *Rhyzobius lophanthae* (Blaistdell, 1892), 15. *Rodolia cardinalis* (Mulsant, 1850) were introduced for biocontrol [Gapon, 2016; Migeon and Arabuli, 2022; Ghazaryan et al., 2024).); 16. *Maladera castanea* (Arrow, 1913) (Japoshvili et al., 2020).

Diptera: 17. *Hermetia illucens* (Linnaeus, 1758) is a Neotropical dipteran species native to Central and South America that has been widely introduced outside its native range through human activities. One male of this species was recorded from Tbilisi, Isani, lat. 41678129, lon. 44.851960, 15.09.2025, collected by hand, G. Japoshvili. **New record for Georgia.** Voucher is placed in the collection of Institute of Entomology, Georgian Academy of Sciences. 18. *Obolodiplosis robiniae* (Haldeman, 1847) (Skuhrava et al., 2013).

Hemiptera: 19. *Leptoglossus occidentalis* Heidemann 1910 (van der Heyden, 2018).

Hymenoptera: 20. *Aphelinus mali* Haldeman, 1851 (Kobakhidze, 1965); 21. *Microterys clauseni* Compere, 1926 (Aleksidze et al., 2021; Yasnosh and Japoshvili, 1998); 22. *Scutellista caerulea* (Fonscolombe, 1832) (Aleksidze et al., 2021).

Lepidoptera: 23. *Antheraea pernyi* Guerin, Meneville, 1855 (Japaridze and Seropian, 2025); 24. *Phyllonorycter platani* (Staudinger, 1870) (Martynov and Nikulina, 2018).

Orthoptera: 25. *Velarifictorus micado* (Saussure, 1877) (Mulder and Gorochov, 2019).

Psocoptera: 26. *Dorypteryx domestica* (Smithers, 1958) (Seropian et al. 2023).

Vertebrata

Pisces: 27. *Oreochromis niloticus* (Linnaeus, 1758) (Kuljanishvili et al., 2021a); 28. *Ctenopharyngodon Idella* (Valenciennes, 1844), 29. *Morone saxatilis* (Walbaum, 1792), *Coregonus Albula* (Linnaeus, 1758), 30. *Oncorhynchus mykiss* (Walbaum, 1792), 31. *Salmo gegarkuni* Kessler, 1877 (Kuljanishvili et al., 2021b); 32. *Cyprinus carpio* Linnaeus, 1758 (Epitashvili et al., 2025).

Reptilia: 33. *Phoenicolacerta laevis* (Gray, 1838) (Tarkhnishvili et al., 2017).

Mammalia: 34. *Nyctereutes procyonoides* (Gray, 1834), 35. *Myocastor coypus* (Molina, 1782), 36. *Ondatra zibethicus* (Linnaeus, 1766)

(Bukhnikashvili and Kandaurov, 2002); 37. *Hystrix indica* Kerr, 1792 (Amori et al., 2016).

3. Species that should not be considered invasive or non-native (alien)

Invertebrata

Cnidaria: 1. *Craspedacusta sowerbii* Lankester, 1880

A brief note in Seropian & Japaridze (2025) mentions *C. sowerbii* in a list of alien species, but they do not provide primary occurrence data (e.g., exact site, date, collector, or reference) supporting it for Georgia, therefore it can't be considered as a invasive or non-native species.

Annelida: 2. *Sigambra tentaculata* (Treadwell, 1941) (Varshanidze et al., 2022). The paper does not provide: original record source, date of first detection in Georgia, evidence of human-mediated introduction, evidence of impact. Therefore, until confirmation above mentioned information we must place this species in this group. 3. *Dipolydora quadrilobata* (Jacobi, 1883) (Varshanidze et al., 2022). There is no evidence of introduction pathway, invasive behavior, date of arrival in Georgia or any reference support. 4. *Polydora ciliata* (Johnston, 1838) has long been recorded as a natural component of the Black Sea polychaete fauna and is treated as a native species in comprehensive regional inventories (Surugiu, 2005).

Malacostraca: 5. *Callinectes sapidus* has been reported from the Black Sea coast of Georgia since at least the 1970s (Shaverdashvili and Ninua, 1975), but in the absence of published evidence for established, self-sustaining populations and documented impacts in Georgian waters, it should be treated as a non-native species of uncertain invasion status rather than unequivocally invasive;

6. *Macrobrachium nipponense* (De Haan, 1849) in Georgia available in the Iliauni biodiversity database lacks a published primary source (Tarkhnishvili et al., 2025), in the absence of verifiable documentation (e.g., museum vouchers or a peer-reviewed report), we do not consider it confirmed for the Georgian fauna; 7. *Pontastacus leptodactylus* (Eschscholtz, 1823) is a native narrow-clawed crayfish of the Ponto-Caspian region, including the Black Sea basin, and genetic analyses confirm its deep evolutionary origins within this area; there is no evidence from Blaha et al. (2021) to treat it as non-native or invasive in Georgia.

Insecta: Coleoptera: 8. *Dendroctonus micans* (Kugelann, 1794) (Kobakhidze, 1965) is native to palaearctic region therefore it can't be considered as a non-native. 9. *Xanthogaleruca luteola* (Müller, 1766) is a Palearctic species native to Europe and western Asia, therefore, its occurrence in Georgia (Japoshvili and Aslan, 2020) represents part of its natural range rather than a non-native or invasive introduction.

Lepidoptera: 10. *Cameraria ohridella* Deschka & Dimic, 1986 (Didmanidze et al., 2010); 11. *Plodia interpunctella* (Hübner, 1813) is a cosmopolitan synanthropic species long associated with human dwellings and stored products and is treated by Zaguliaev (1981) as a widespread, established element of anthropogenic habitats rather than as an invasive or non-native species.

Vertebrata

Pisces: Native species 12. *Gobius xanthocephalus* Heymer & Zander, 1992; 13. *Pomatoschistus bathi* Miller, 1982 (Janashvili, 1979); 14. *Esox lucius* Linnaeus, 1758 (Kuljanishvili et al., 2020); 15. *Gobio caucasicus* Kamensky, 1901, 16. *Neogobius fluviatilis* (Pallas, 1814), 17. *Sander lucioperca* (Linnaeus, 1758), 18. *Silurus glanis* Linnaeus, 1758 (Epitashvili et al., 2025); 19. *Gobio artvinicus* Turan, Japoshvili, Aksu & Bektaş, 2016; 20. *Gymnocephalus cernua* (Linnaeus, 1758), 21. *Perca fluviatilis* Linnaeus, 1758, 22. *Rhinogobius lindbergi* Berg, 1933, 23. *Syngnathus abaster* Risso, 1827 (Kuljanishvili et al., 2021b).

Mammalia: In addition, 24. *Sciurus vulgaris* Linnaeus, 1758 should not be regarded as non-native species, nor is it appropriate to classify it as "invasive" in Georgia. It is native or historically natural components of the regional fauna, with distributions extending naturally into the Caucasus (Enuki-

dze, 1969). Not alien species 25. *Sarpa salpa* (Linnaeus, 1758), 26. *Sparus aurata* Linnaeus, 1758, 27. *Sardinella aurita* Valenciennes, 1847, 28. *Lithognathus mormyrus* (Linnaeus, 1758), 29. *Parablennius incognitus* (Bath, 1968) (Varshanidze et al., 2022).

Discussion

A critical re-evaluation of species listed as invasive or non-native in previous publications shows that a substantial proportion of taxa cannot be assigned to these categories based on currently available evidence. In many cases, records were transferred uncritically from broader regional sources (e.g. Europe or Eurasia) without verification of occurrence, establishment, or impact in Georgia, resulting in inflated national counts and reduced reliability of faunal inventories.

Notably, several taxa included in the "invasive/non-native" list of Japaridze and Seropian (2025) represent endemic elements of the Caucasus fauna, such as *Gobio caucasicus*, *Gobio artvinicus*, and *Salmo gegarkuni*. The inclusion of such regionally restricted species highlights the need for greater caution in applying the combined "invasive/non-native" designation and for clearer distinction between alien introductions and native biogeographic elements.

A number of coleopteran species cited as alien or invasive lack any published evidence confirming their occurrence in Georgia and appear to have been included solely on the basis of secondary compilations, particularly Orlova-Bienkovskaja (2019), which concerns alien beetles of European Russia. These taxa, including *Acanthoscelides obtectus* (Say, 1831), *Bruchidius siliquastri* Delobel, 2007, *Bruchidius terrenus* (Sharp, 1886), *Callidiellum rufipenne* N. Ohbayashi, Kimura & Satô, 1994, *Cercyon laminatus* Sharp, 1873, *Cryptopleurum subtile* Sharp, 1884, *Litargus balteatus* LeConte, 1856, *Lyctus brunneus* (Stephens, 1830), *Megabruchidius dorsalis* (Fåhraeus, 1839), *Naupactus cervinus* Boheman, 1840, *Rhynchophorus ferrugineus* (Olivier, 1791), *Serangium montazerii* Fürsch, 1995, and *Zygogramma suturalis* (Fabricius, 1775), should not be treated as components of the Georgian fauna until supported by voucher-based published records. Similar exclusions apply to taxa such as *Lamprodila festiva* (Linnaeus, 1767) and *Trichopoda pictipennis* Bigot, 1876, for which reliable faunistic documentation from Georgia is lacking.

Uncertainty also applies to several vertebrates (e.g. *Trachemys scripta* (Thunberg, 1792), *Cervus nippon* Temminck, 1838, *Neogale vison* (Schreber, 1777)), which have been mentioned in connection with Georgia but for which no evidence of self-sustaining natural populations has been published. In such cases, available information is limited to isolated observations, historical introductions, or secondary reports, and their establishment within Georgian ecosystems remains unconfirmed.

Other taxa, including *Haplochrois theae* (Kuznetzov, 1916) and *Svistella bifasciata* (Shiraki, 1911), have been reported only indirectly or through citizen-science observations, underscoring the importance of primary documentation and examined material in national assessments of invasion status.

Overall, the compilation of 134 "invasive/non-native" species by Japaridze and Seropian (2025) substantially overestimates the confirmed invasive and alien fauna of Georgia. Applying evidence-based criteria and separating invasive species from non-native introductions, native taxa, natural range expansions, and undocumented records results in a revised total of 88 species, of which 51 are classified as invasive and 37 as non-native. Two taxa, *Hermetia illucens* and *Haritalodes derogata*, are newly documented for Georgia, and a COI barcode sequence is provided for the latter.

Accurate classification of invasion status is essential for biodiversity research, conservation planning, and management decisions, and future inventories should rely on voucher-based records, primary sources, and explicit terminology to ensure comparability with international standards.

ზოოლოგია

ინვაზიური და არაადგილობრივ ცხოველთა სახეობების სტატუსის რევიზია საქართველოში

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კვლევაში წარმოდგენილია საქართველოში დაფიქსირებული ინვაზიური და უცხო (არაადგილობრივი) ცხოველთა სახეობების განახლებული ჩამონათვალი, რომელიც ეფუძნება ლიტერატურული მონაცემების, ფაუნისტური ჩანაწერებისა და სახეობათა გავრცელებისა და დამკვიდრების კრიტიკულ ანალიზს. დადგინდა, რომ ამჟამად საქართველოში 88 სახეობა შეიძლება ჩაითვალოს ინვაზიურად ან უცხო სახეობად, მათგან 51 სახეობა კი დადასტურებულად ინვაზიურია, რადგან ხასიათდება სტაბილური პოპულაციებითა და ეკოლოგიური, ეკონომიკური ან გენეტიკური მახასიათებლებით. დანარჩენი სახეობები განხილულია როგორც უცხო ან ინტროდუცირებული ტაქსონები, რომელთა ინვაზიური სტატუსი ჯერ კიდევ დაუზუსტებელია. კვლევაში ასევე გადახედილია წინა პუბლიკაციებში მოხსენიებული რიგი ტაქსონებისა და სიიდან ამოღებულია ბუნებრივად გავრცელებული, კავკასიის ენდემური, არასაკმარისად დოკუმენტირებული ან მცდარად იდენტიფიცირებული სახეობები. პირველად საქართველოს ფაუნისთვის დაფიქსირდა ორი მწერის სახეობა: Hermetia illucens (Linnaeus) (Diptera: Stratiomyidae) და Haritalodes derogata Fabricius (Lepidoptera: Crambidae). განახლებული ჩამონათვალი წარმოადგენს მნიშვნელოვან საფუძველს საქართველოში ინვაზიური ფაუნის მომავალი მონიტორინგის, ბიომრავალფეროვნების დაცვისა და მართვის ღონისძიებების დაგეგმვისათვის.

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