STATUS REPORT
DUTCH BIODIVERSITY
2026

Naturalis
Biodiversity
Center

The cover features two common cuttlefish (*Sepia officinalis*). This ten-armed mollusc is known for its ability to change colour and texture very quickly. Another characteristic is that cuttlefish have an internal skeleton: the back shell. This white, oval "sea foam" can often be found on the beach (and in many bird cages!).

Foto: Marion Haarsma

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Due to overfishing and climate change, cod are becoming increasingly rare in the Dutch North Sea. The southern North Sea has always been close to the southern limit of this cold-water fish's range, however global warming is making the water in this area too warm for cod larvae. Consequently, the number of fish that reach maturity remains low, even if we fish less.

Atlantic cod | Photo: Jelger Herder

FOREWORD

A family settles in an unspoiled area. They depend on the fish in the lake nearby their new home for their livelihood. Over time, more families move to the area. They too take up fishing. The community thrives. One day, however, one of the fishermen realizes he can catch more fish and sell them to a neighboring village. He becomes rich. The other fishermen see this and want to get rich too, and so they also cast out extra nets.

In the early stages of this story, it was possible for the fish population to recover after each catch. But with every additional fisherman this became more difficult, to the point where the fish population declined dramatically as a result of overfishing. In the end, everyone was worse off. This story is known as *The Tragedy of the Commons*. The American economist who wrote this theory, Garrett Hardin, was pessimistic. He argued that humans will always strive for individual profit maximization, meaning that any form of common property—the commons—is doomed to fail. According to him, short-term thinking always trumps what is needed for the collective in the long term.

Something similar to the lake above is happening in the North Sea. Fishing disrupts the balance in the sea, and that is not the only factor: the presence of data cables, wind farms, cargo transport and recreational activities also create a cumulative burden that puts pressure on the North Sea's native inhabitants.

In theory, it should be possible for us to turn the tide by restoring the balance, for example by limiting fishing or by installing habitat-friendly wind farms. But we now know, as described elsewhere in this report, that this is not enough for the cod. Climate change—the result of a global tragedy of the commons—has caused the cod's habitat to shift northward.

We know this because we are gaining a deeper understanding of nature through more intensive monitoring, a broadening of our knowledge, and collaboration between disciplines, organizations, and countries. This Biodiversity Status Report brings much of this knowledge together, organized according to the species found in our Kingdom. This year, for the first time, we are also including the Dutch Caribbean countries and municipalities.
The report is a snapshot from which we can draw many conclusions. The conservation status of species provides us with guidelines for policies and behaviors that can help us manage our common heritage in such a way that it can flourish in the long term.

Hardin, however, would say that this is a futile endeavor. After all, we are incapable of putting the common good before our own interests. Fortunately, the creation of this report proves the opposite. Many people have contributed to gathering the underlying data, in particular many citizen scientists.
This form of collaboration is a hopeful refutation of Hardin's pessimism. Together with many partners, Naturalis is working toward the protection, restoration, and sustainable use of our biodiversity. Expanding and sharing knowledge is our most important task in this endeavor.

Because what we have knowledge of,
we can better protect.

Marcel Beukeboom
Director - General,
Naturalis Biodiversity Center

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Managing editor:
Merel Bozua-Hope

Editorial team:
Marcel Beukeboom, Koos Biesmeijer, Maaike van de Kamp - Romijn, Vincent Merckx, Willem Renema

Final editing:
Anoushka Kloosterman, Sebastiaan van Loosbroek

Article authors:
Jordy van der Beek, Lisa Becking, Koos Biesmeijer, Rykel de Bruyne, Dolfi Debrot, Fleur van Duin, Pepijn Helleman, Bert Hoeksema, Erik Houtepen, Jessica Johnson, Vincent Kalkman, Bram Koese, Thomas Kuyper, Luís Lima Valente, Erik Meesters, Renate Olie, Willem Renema, Reina Sikkema, William Voorberg

Fact sheet contributors:
Kevin Beentjes, Jordy van der Beek, Floris Bennema, Hans de Blauwe, Rykel de Bruyne, Daan Drukker, Leni Duistermaat, Marco Faasse, Charles Fransen, Peter van Helsdingen, Vincent Kalkman, Harm Keidel, Roy Kleukers, Bram Koese, Martijn Kos, Luna van der Loos, Jan Macher, Jeremy Miller, Jorinde Nuytinck, Mick Otten, Willem Renema, Harry Smit, John Smit, Michael Stech, Mikkel Suijker, Oscar Vorst, Sytske de Waart, Jako van der Wal, Frank Wesselingh, Jan Wieringa, Theo Zeegers

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Martine Hermsen, Janneke Niezen, Henk Caspers

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Printer:
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Communication:
Bart Braun | communicatie@naturalis.nl

Postal Address:
Naturalis Biodiversity Center
P.O. Box 9517
2300 RA Leiden
contact@naturalis.nl | 071 - 7519 600

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SUMMARY

STATUS REPORT DUTCH BIODIVERSITY 2026

Our biodiversity remains under constant pressure, and nature conservation goals are slipping out of reach. Recovery is a collective effort. The key lies in a comprehensive approach: by reducing pressures and strengthening the natural system—both within and outside nature reserves—species and habitats can recover sustainably.

The recovery of internationally protected species and habitats is progressing too slowly; at this rate, agreed-upon targets will not be met. In the North Sea, recovery of biodiversity is lagging behind, and the Wadden Sea is at risk of losing its role as a nursery for fish.
In the Dutch Caribbean, nature conservation goals are also slipping out of reach. On Bonaire, St. Eustatius and Saba, 61% of habitats and 71% of species are in unfavorable condition. The health of the coral reefs—with their unique biodiversity and vital functions such as coastal protection—has declined sharply over the past 45 years. Precisely because healthy sections of coral reef still remain here, unlike in other parts of the Caribbean, the Netherlands bears a significant responsibility for their protection and restoration.

In addition to climate change, increasing human activities have a direct impact on (marine) ecosystems. In the European Netherlands, intensive agriculture, the intensive use of major waterways, and habitat loss are major stressors on nature. In the Dutch Caribbean, invasive alien species, feral goats, pollution, and increasing tourism pose the greatest threats. Without structural support, nature's resilience cannot withstand the accumulation of these pressures.

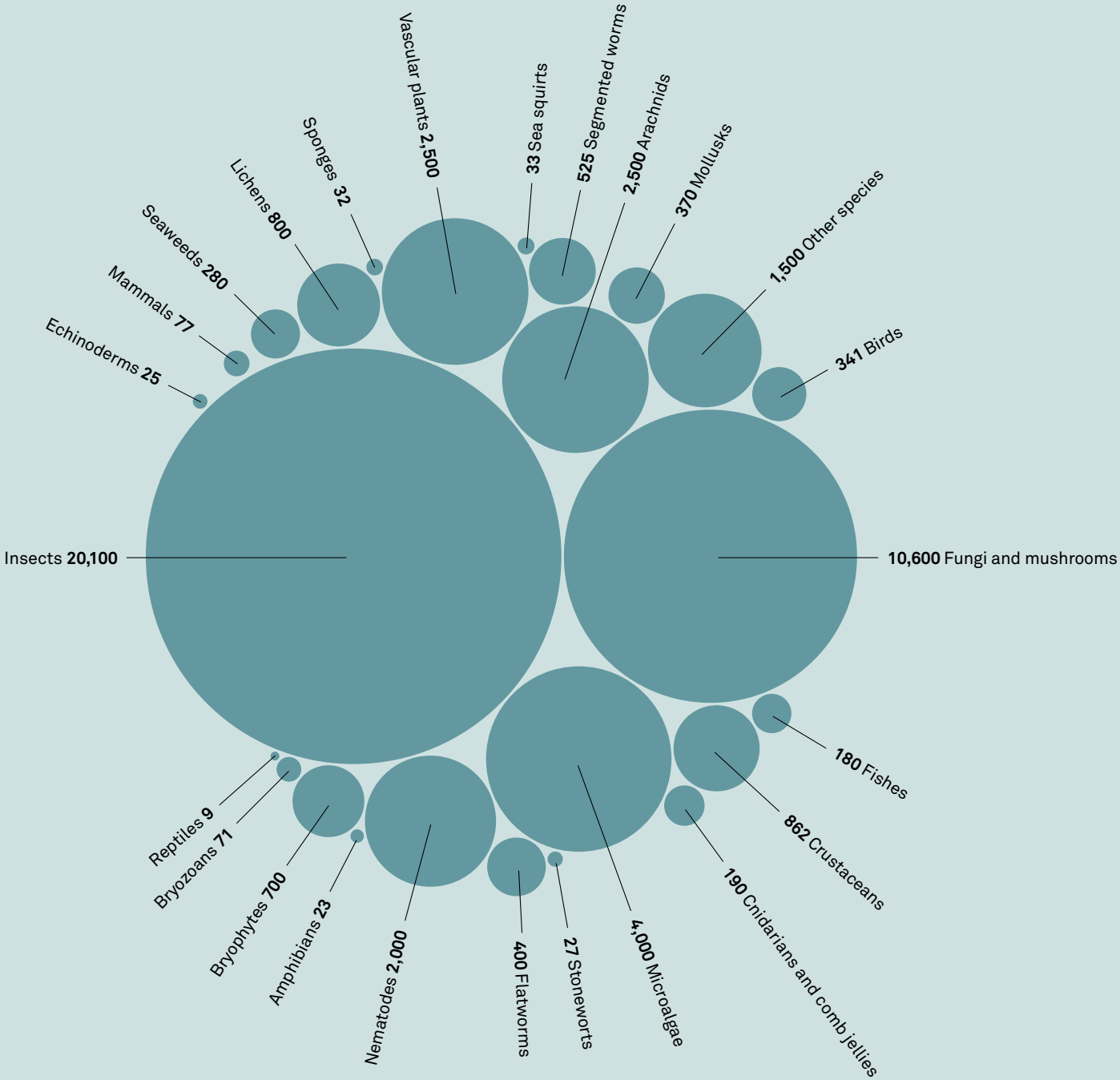
However, the social movement toward a nature-inclusive society is gaining momentum. The fact that 80% of Dutch people believe nature should be better protected (CLO/nl161903) shows that there is broad support for a healthy, biodiverse future. Numerous initiatives are dedicated to nature conservation, supported by citizen scientists who help monitor and protect the environment. This is driven not only by an appreciation for nature's beauty but by a growing realization that a healthy environment is indispensable to our future.

Economic interests and nature conservation often clash. For example, the growing tourism industry in the Dutch Caribbean is of great economic importance, but it increases pressure on the very ecosystems that form the basis of that appeal. The North Sea is also a vital economic zone for wind energy, recreation, transportation, defense and fisheries. The increasing activities have consequences for marine life. While significant efforts are underway to develop a future-proof spatial plan for the North Sea, the resulting impacts on biodiversity remain partially uncertain.

Our dependence on nature—for drinking water, food, building materials, recreation, and more—is indisputable. The human species cannot survive without biodiversity. A future-proof Netherlands demands systemic change. The ingredients are there. The choice to treat nature as a partner in everything we do and to prioritize biodiversity, is ultimately ours.

Short-snouted seahorse | Photo: Marion Haarsma

Over 48,000 species in the Netherlands



Species richness is more than just a number

In the Netherlands, the count stands at over 48,000 eukaryotic species (organisms with a cell nucleus). This is not a static number, but a constantly changing total. The figure is based on the Dutch Species Register (www.nederlandsesoorten.nl), supplemented with recent insights from experts.

When is a species included in the count?

We count all species that have reproduced independently in the Netherlands for at least ten consecutive years. We refer to these as established species. This includes the Dutch part of the North Sea. In addition, for migratory species groups such as birds, fish, and butterflies, we also include species that regularly stay here, for example to overwinter. For complex groups without a validated species list, such as microalgae, experts make accurate estimates to make the overall picture as complete as possible.

More species, more biodiversity?

Compared to last year, we have estimated the number of species to be a thousand higher. That does not mean that biodiversity has increased by a thousand species in a single year. The increase has several causes. First, we were able to include expert estimates of, for example, microalgae in the total. Additionally, science regularly makes new discoveries. Innovative techniques, such as DNA analysis, make it possible to better identify species that were previously hidden or very small. At the same time, global warming is causing southern species to migrate northward and settle here. Finally, new non-native species regularly enter our country through trade and transportation.

Is biodiversity improving?

More species does not necessarily mean that biodiversity is improving. While we welcome new species, others are disappearing from our landscape, such as the European sea sturgeon (efforts are underway to reintroduce it) and the marsh fritillary. However, these are still included in the statistics, as can also be seen under “disappeared species” on the Red Lists. The total figure primarily reflects our growing knowledge and shifts in nature. It says little about the vitality of the populations themselves.

European perch | Photo: Jelger Herder

ABOUT THIS REPORT
READING GUIDE

This is the second status report on Dutch Biodiversity, providing a current overview of species throughout the Kingdom of the Netherlands. Our goal is to provide you—policy professionals in government and private sectors, or other interested parties—with a clear picture of the state of biodiversity.

The world below sea level
This edition places a special emphasis on saltwater ecosystems. While many reports focus on land, this report literally dives below sea level. Marine ecosystems are often beyond our immediate field of view, yet the proper functioning of these ecosystems is inextricably linked to the climate and our well-being. With this focus, the status report fills a gap in existing overviews. Additionally, the upcoming WWF Living Planet Report will focus on the status of the Dutch freshwater ecosystems.

Geographical scope
Throughout this report, "Dutch Caribbean" refers to the six islands: the constituent countries of Aruba, Curaçao, and Sint Maarten, and the special municipalities of Bonaire, Sint Eustatius, and Saba. While the designation “Caribbean part of the Kingdom of the Netherlands” is the most precise, the terminology has been varied or abbreviated in some places to improve readability.

Structure of the report
The report is structured into an overarching section on the state of biodiversity, thirty factsheets featuring recent trend data per species group (covering the European Netherlands only), and several in-depth articles that explore specific aspects of biodiversity.

Acknowledgements and sources
For Naturalis, taxonomy and species identification are core activities. Our species counts are based on the Dutch Species Register (Nederlands Soortenregister), supplemented with information from published standard lists and experts..
This report highlights both policy-relevant and less-studied species and utilizes the most recent, publicly available information from Statistics Netherlands (CBS) and the Environmental Data Compendium (CLO). Publications up to April 20, 2026 have been included.

Statistics Netherlands (CBS)
Commissioned by the government, Statistics Netherlands (CBS) analyzes trends in nature for policy and scientific purposes. This data provides insight into biodiversity and the underlying pressures affecting it. We are very pleased that CBS has reviewed the data adapted by Naturalis from the CLO for factual accuracy, the correctness of its visual representation, and the validity of the accompanying source citations.

Ecological Monitoring Network (NEM)

The NEM serves as the source of nature data for the European Netherlands. This partnership between government authorities, provinces, and planning agencies provides the data with which CBS calculates trends and indicators. Its strength lies in broad participation: a network of professional species organizations and thousands of volunteers meet the government's information needs. Together with the CBS, they map the status of nature, resulting in publications such as the Butterfly Balance and Ravon Balance. The trends are published on the CLO. Thanks to this structural collaboration, the Netherlands possesses high-quality, internationally leading data.

The Dutch Caribbean

In the Dutch Caribbean nature conservation is organized differently, with six local organizations managing the nature parks on their respective islands. The organizations ACF (Aruba), Carmabi (Curaçao), Nature Foundation (St. Maarten), SCF (Saba), Stenapa (St. Eustatius), and Stinapa (Bonaire) are responsible for both the monitoring and day-to-day management of the nature parks on land and at sea. They collaborate within the Dutch Caribbean Nature Alliance (DCNA), a regional network that promotes cooperation and knowledge sharing to preserve the islands' unique biodiversity for the future.

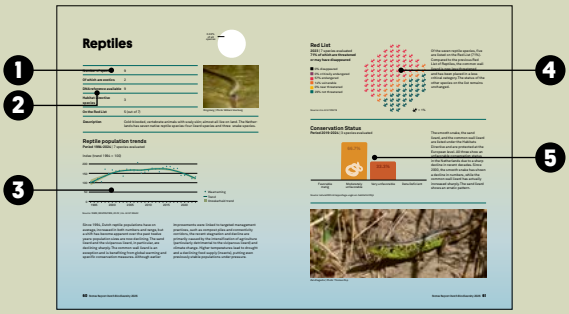
Status versus pathways for action

This report summarizes the state of biodiversity in our Kingdom. While we cite sources that provide insight into underlying pressures and pathways for action, this publication is intended to provide a factual foundation rather than policy advice. We hope it offers a valuable framework of reference for the many organizations and partnerships working hard to strengthen biodiversity. From nature-inclusive agriculture to green cities, these initiatives tackle complex challenges and help shape the future of our natural world in innovative ways.

Editorial team,
Marcel Beukeboom,
Koos Biesmeijer,
Maaike van de Kamp - Romijn,
Vincent Merckx,
Willem Renema

Leiden, May 2026

Guide to the fact sheets



1 Species counts

This section lists the total number of "established" species and how many of them are covered by the Birds and Habitats Directives. Under "Red List," we list the number of threatened species, with the total number of assessed species within that group in parentheses.

2 Availability of DNA references

This section shows the number of available records in the DNA reference library. As part of the ARISE program, we are building a database of all 48,000 Dutch multicellular species to map biodiversity through innovative monitoring. For each species group, we show the number of species with an available DNA barcode—a direct indication of our progress in making our natural world digitally identifiable.

3 Trend data

The graphs show the development of species groups over time. The source of these existing trends is listed below each graph.

4 Red List

This figure shows the number of assessed species and the percentage of threatened species. The five categories in the legend indicate the degree of threat, ranging from "vulnerable" to "disappeared."

5 Conservation Status (CS)

This figure is based on the EU's six-yearly report. The conservation status is considered favorable when:

- the species has a viable population in its natural habitat and is expected to remain so;
- the natural distribution range is not shrinking and is not expected to shrink;
- and there is sufficient habitat to sustain the species in the long term.

45%

of Dutch species are endangered or have disappeared

Squirrel | Photo: William Voorberg

GOALS FOR NATURE
A LONG WAY TO GO

Restoring biodiversity requires improvement and effort across many areas. Current steps toward nature restoration form a foundation, but a significant acceleration of efforts is needed to achieve the set goals for nature restoration in a timely manner.

Biodiversity is about life on Earth, from the smallest to the largest species. It encompasses genetic diversity, interaction networks, and entire ecosystems—on land, at sea, and in the air. Because it is not easy to assess the state of biodiversity as a whole, it helps to bring the most important indicators together in one place. For example, the Dutch Biodiversity Dashboard provides insight into progress toward nature restoration based on fourteen agreed-upon targets. The targets are divided into four themes: how is biodiversity faring—the flora, fauna, and their habitats? Is there enough space for nature? Are pressure factors decreasing? And is there a sustainable systemic change taking place among the government and consumers?

Everything is red or orange

Nearly all targets have a red or orange status (Fig. 1). Despite minor improvements, none have a green status. Within the biodiversity theme, 4 out of 5 indicators remain well below target. As a result, the recovery of species and habitats, the protection of pollinators, and the sustainability of ecosystem services are becoming increasingly out of reach.

Focus on threatened species

Much policy attention is focused on the European Birds and Habitats Directives, with the emphasis naturally placed on those species that are threatened with extinction and are therefore at risk of disappearing.
As for the species covered by the Birds Directive, nearly half are on track to meet the 2030 target, namely: by 2030, at least 30% of the species currently in a (very) unfavorable conservation status will have a favorable conservation status. The goal for 2050 is for all species to have a favorable conservation status, meaning a healthy population with sustainable future prospects. This goal is still far off.
Compared to six years ago, the status of half of the breeding birds have improved. More than a quarter are doing worse, and the rest have remained the same. Trends over several decades show improvement in 48% of cases and deterioration in 41%.

National Biodiversity Dashboard

Fig. 1: The National Biodiversity Dashboard provides a summary of the key data on biodiversity in the Netherlands and its relationship to existing policy. Of the fourteen targets, seven are marked red (out of reach) and five are marked orange (requiring additional effort).

See: Dashboardbiodiversiteit.nl

Groene kikker | Photo: William Voorberg

Living Planet Index Netherlands

1990 - 2024

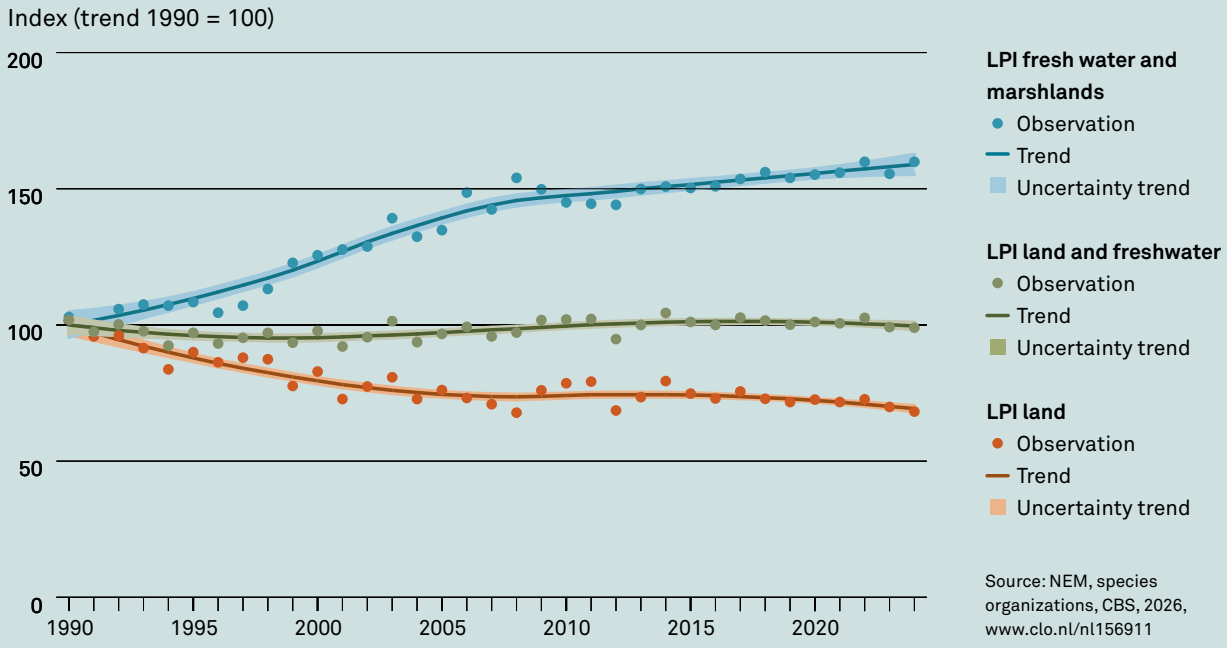


Fig. 2: The Living Planet Index for the Netherlands (LPI) in 2024 is at the same level as in 1990 (green line), with a slight decline followed by some recovery in the intervening years. The significant increase in freshwater and wetland species (blue line) offsets the decline in terrestrial fauna (orange line). The trend has been stable over the past twelve years. Marine habitat species are not included in this indicator.

For non-bird species covered by the Habitats Directive (including vascular plants, mosses, butterflies, dragonflies, fish, amphibians, and mammals), the outlook is bleaker. For these species, the 2030 target—a favorable conservation status for 30% of species—appears out of reach. Only 22% of the species listed in the Habitats Directive are doing well (have a favorable conservation status).

Fan clubs are needed

The Netherlands is home to many more species than those covered by the Birds and Habitats Directives (VHR). Of the more than 48,000 species of plants, animals, and fungi in our country, many are crucial to a resilient ecosystem. Yet they are not monitored nearly as intensively as the legally designated species. Monitoring requires people. Birds, mammals, butterflies, dragonflies, and vascular plants have large "fan clubs": volunteers who regularly count species in the field. That is why we know so much about these species groups. For the majority of insects and other invertebrates—both on land and in water—such fan clubs are lacking, meaning these groups are scarcely monitored. The hope is that the continued development of new technologies, such as eDNA and automatic image and sound recognition, will make it possible to better document some of these groups as well.

The Red Lists provide a broader perspective; in the Netherlands, they have been compiled for nineteen species groups. Only species that are threatened to some degree are included on a Red List.

Of the 7,954 species assessed, 462 have already disappeared (6%) and 3,100 are threatened (39%) (Fig. 3). While globally an average of 28% of species are threatened or extinct, this percentage is significantly higher in the Netherlands. Moreover, it is unlikely that the situation is any better for the many species that have not been studied.

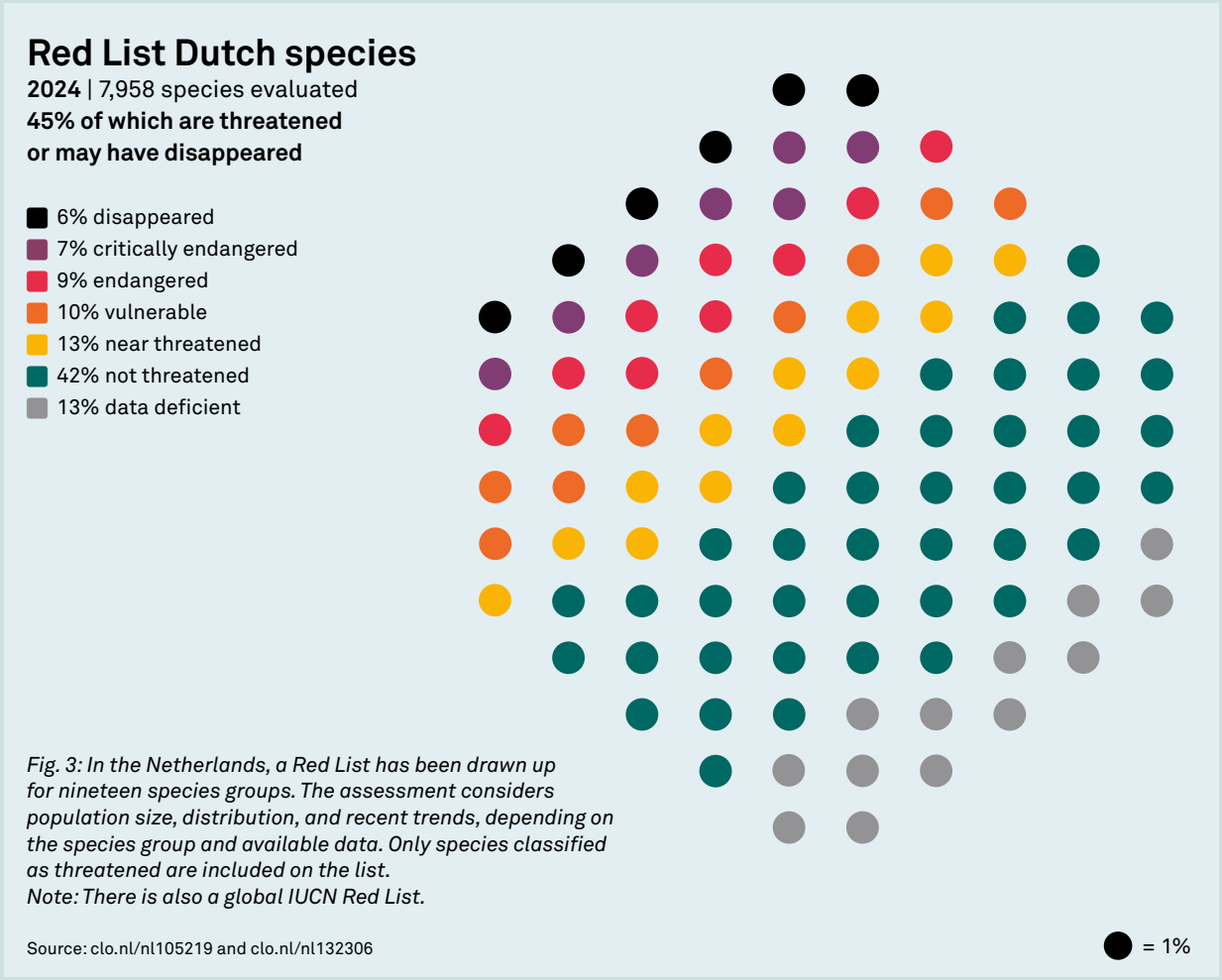


Fig. 3: In the Netherlands, a Red List has been drawn up for nineteen species groups. The assessment considers population size, distribution, and recent trends, depending on the species group and available data. Only species classified as threatened are included on the list.
Note: There is also a global IUCN Red List.

Source: clo.nl/nl105219 and clo.nl/nl132306

Slightly improved water quality

Freshwater quality has improved slightly: whereas in 2009 only 3% of the water was of good quality, the most recent measurements show that the biological quality of surface water is good in 15% of the 741 water bodies assessed (CLO/nl142006). This is a step in the right direction, but it is still far from the goal of the Water Framework Directive (KRW). This goal being that all surface water must be in good condition by 2027, meaning it is a healthy habitat for flora and fauna and that the quality meets the standards.
This modest shift is also reflected in the Living Planet Index (LPI), a biodiversity metric designed by the WWF. The LPI provides well-documented trends dating back to 1990 for specific species groups such as vertebrates, plants, butterflies, and dragonflies. LPI measurements began at a time when water quality was generally already poor, and thus reflect only the change since 1990. On average, the LPI shows a stable picture, but species in freshwater and wetlands show a slow increase (Fig. 2).

Pollinators in distress

Pollinators are a key indicator of the state of our biodiversity, as approximately 90% of wild plants and 75% of our food crops depend on pollination, primarily by bees and hoverflies (IPBES 2016). Protecting these insects is therefore one of the key objectives of the European Nature Restoration Law. Starting in 2027, all member states will be required to monitor pollinators and report on their status. A Dutch monitoring program has recently been launched.
Grassland butterflies are currently used as an indicator for all pollinators, and they show a dramatic decline: since 1992, their population has decreased by two-thirds. For this group as well, the nature conservation targets set for 2030 and 2050 remain out of reach.

Biodiversity restoration is not possible without government efforts to strengthen nature

Slowly but surely on the right track

Biodiversity restoration is not possible without government efforts to strengthen nature and ensure a hopeful future for all species in the Netherlands—including humans. Governments are working hard to fulfill their commitments. For example, the Nature Pact (2013) includes a commitment to create an additional 80,000 hectares of nature by 2027. Although 50,000 hectares have already been added over the past twelve years, progress is not fast enough to meet this goal.

The Dutch government is a signatory to the Kunming-Montreal Global Biodiversity Framework. The 23 targets of this agreement not only encompass the protection and restoration of biodiversity and nature, but also focus on effective government efforts and contributions from the business sector and civil society.

The NBSAP (National Biodiversity Strategy and Action Plan) outlines the Dutch approach for each goal. For example, for Goal 18—identifying and adjusting policy measures that are harmful to biodiversity—an inventory of detrimental measures has been compiled. A recent report shows that there are currently billions of euros worth of measures in place that cause full or partial harm to biodiversity (Alphen et al., 2026). Although the political will is there—for example, in the areas of agricultural nature management and the forest strategy—the path to implementation in practice often proves more difficult than anticipated.

The social movement that strives for a nature-inclusive—or even nature-positive—society is gaining momentum. Within the Nature-Inclusive Collective, businesses, governments, and civil society organizations are collaborating on tools such as "Net Nature Gain," which ensures that development projects ultimately result in improved biodiversity.

Growing interest

This aligns with the growing interest among municipalities, provinces, businesses, and conservation organizations in restoring nature, even outside strictly protected nature areas. The "Basic Quality of Nature" (BKN) approach has a role to play here, which is explored in greater detail later in this report. The BKN approach focuses less on specific species and more on creating the conditions for self-sustaining nature—a system that can function without human intervention, and in which at least the common species can live sustainably.

Stakeholders can directly influence these conditions: for example, the water system, the extent and distribution of natural areas in our landscapes, the nutrient balance, and the allowance of space for natural processes.

To achieve the goals of the Birds and Habitats Directives, it also makes sense to work on ecosystem restoration outside of protected nature areas, rather than focusing solely on specific species. After all, rare species in nature areas can only survive there in the long term if the surrounding ecosystem functions well for biodiversity. Moreover, the conditions for nature can be created. Whether species subsequently appear and remain in an area is largely unpredictable.

Koos Biesmeijer
Naturalis Biodiversity Center

Eurasian spoonbill | Photo: Marit Moerman

BIRDS AND HABITATS DIRECTIVES

WILL WE MAKE IT TO THE FINISH LINE?

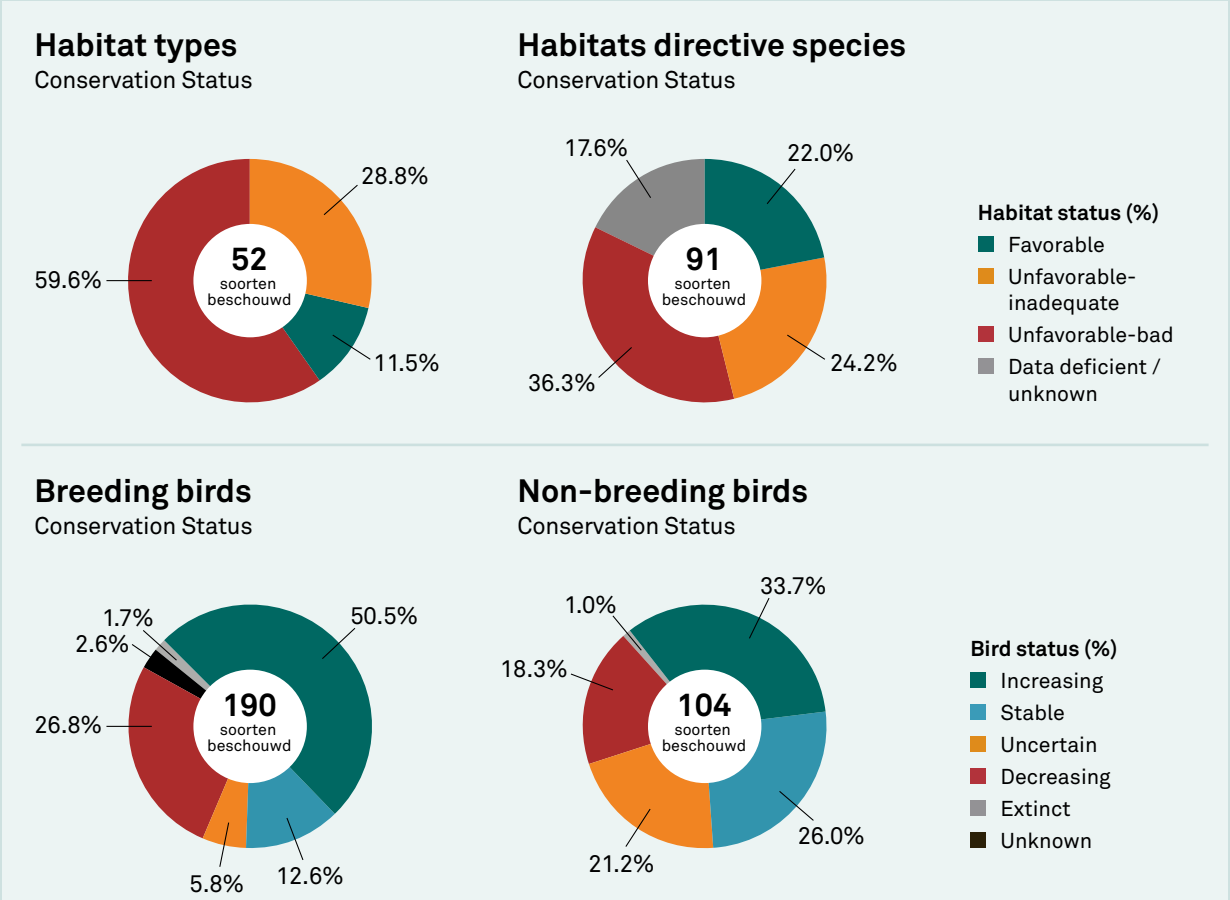
The Netherlands has a reporting obligation to the EU regarding a relatively small number of endangered species. The goal is to improve the conservation status of these Birds and Habitats Directive species, but the latest report shows that progress is insufficient to meet agreed-upon targets.

Every six years, the Netherlands submits a report to the European Commission on the implementation of the so-called Birds and Habitats Directives. The central objective of the European Birds and Habitats Directives is to protect biodiversity in Europe and ensure a favorable Conservation Status (CS). The Conservation Status is assessed based on distribution, population, habitat, and future prospects, with implementation and monitoring focused on the designated Natura 2000 sites. The most recent report was submitted at the end of 2025 and covers the period 2019–2024.

The status of species

The Birds and Habitats Directive reports show that the conservation status of species has generally remained inadequate over the past period (2019–2024). Despite protection within the Natura 2000 networks, a decline in numbers was observed between 1990 and 2023 for 14 of the 81 species listed under the Habitats Directive, 48 of the 190 breeding birds, and 21 of the 81 non-breeding birds listed under the Birds Directive. The Habitats Directive has included about ten species in the report for the first time, often because they are new to, or have returned to, the Netherlands. Examples include the wolf, the minke whale, and the European wildcat, as well as the allis shad (a migratory fish), the cinnabar-red flat bark beetle, the hermit beetle, and the lilypad whiteface dragonfly. Finally, the soprano pipistrelle bat and Bechstein's bat are now occurring frequently enough in the Netherlands to be included in the report for the first time.

The ultimate goal is for all species and habitats covered by the directives to have a favorable conservation status by 2050, with an interim target of restoring at least 30% of the species currently in a (very) unfavorable conservation status by 2030. In addition, the status of none of the species may deteriorate. We are not there yet. Currently, only 22% of the species listed in the Habitats Directive, 63% of breeding birds, and 60% of non-breeding birds are in good condition. It is highly questionable whether current and planned efforts are sufficient to achieve the goals within the set deadlines.



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

Looking beyond the familiar frameworks

The reports on the conservation status are an important policy tool, but they are not the only indicator of the status of species. The Red Lists offer an additional way of assessing species (Fig. 3, page 16). In addition to the legally mandated Birds and Habitats Directive reports and Red Lists, there is a large group of species that fall outside these frameworks (see figure). For the majority of Dutch species, the available data is insufficient to make conservation status assessments. The Nature Restoration Ordinance (NHV), which has been in effect since August 2024, requires reports on new species groups such as pollinators. For example, the EIS Kenniscentrum Insecten (commissioned by the Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN) recently launched a national monitoring program for butterflies, hoverflies, and bees that will run until 2030.

The various habitats are also part of European nature conservation policy. Of the 52 habitats listed as threatened under the Habitats Directive, only 6 are in good condition. Furthermore, the recent report shows that in recent years (2019–2024), only 3 of the 46 habitat types that were in poor condition have improved, while 28 have deteriorated. Also for habitats, we are still a long way from achieving the agreed-upon goals.

Known pressure factors

The poor results can be attributed to a series of well-known pressures that are compromising the quality of the habitats. For both the habitats and the species listed under the Birds and Habitats Directives, nitrogen deposition (primarily from agriculture), water pollution, the loss of landscape features (such as hedgerows), and climate change have the greatest impact. In addition, ineffective water management, such as land desiccation, hinders recovery. Finally, the emergence of invasive species plays a role, as they carry pathogens such as avian influenza. Addressing this combination of factors, both within and outside Natura 2000 sites, is extremely challenging. But it is also essential to shift the conservation status toward a favorable state by 2030 and 2050.

Koos Biesmeijer
Naturalis Biodiversity Center

Garden bumblebee | Photo: Claudia Schutte

Approximately

2000

documented species live in Dutch saltwater and brackish water areas

Northern Gannets | Photo: Getty Images

DUTCH SALTWATER AREAS
PRESSURE ON THE SEA

Due to factors such as climate change, human activity, and pollution, the natural environment in the North Sea and the Wadden Sea is under pressure. This is evident from two recent reports.

Nearly two-thirds of the Netherlands' surface area consists of saltwater (North Sea, Wadden Sea) or brackish water (Southern Delta, Eems-Dollard). Approximately 2,000 documented species live in these areas. Two reports published last year on the Wadden Sea and the North Sea reveal a worrying parallel: our saltwater environments are not faring well. Although the *State of the Wadden Sea* (by the Wadden Academy) and the third Marine Strategy report (on the North Sea) were prepared for different purposes, both reports indicate that environmental targets are not being met. The reason is a cumulative impact, primarily resulting from human activities (fishing, wind farms, recreation, resource extraction) combined with climate change.

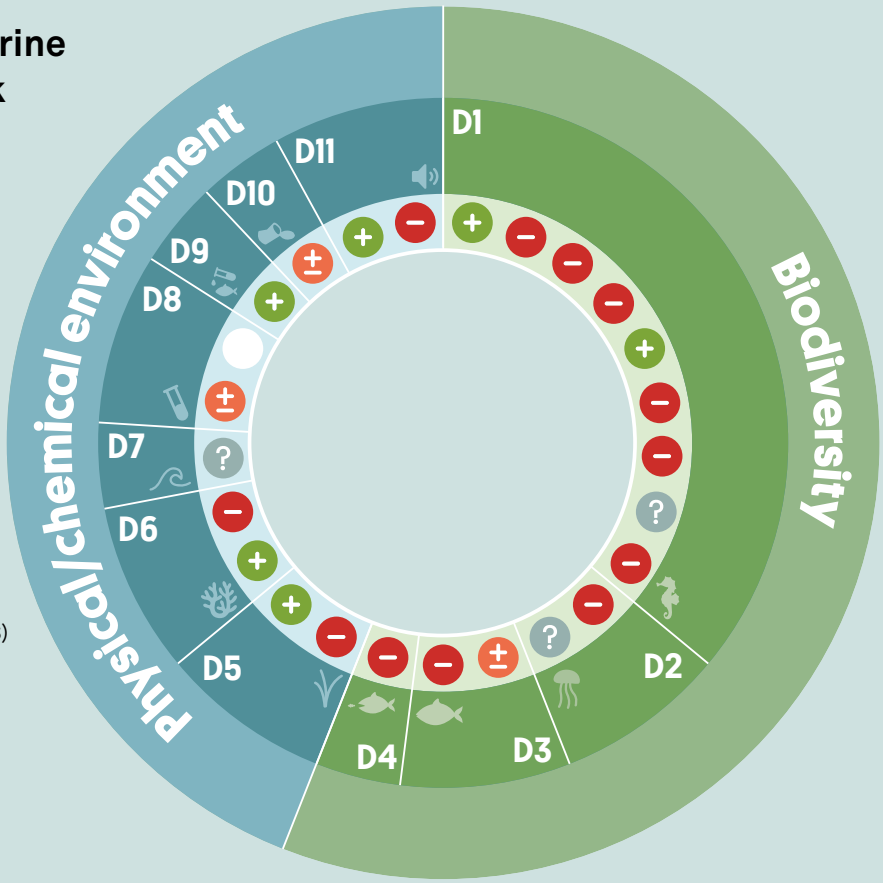
The Wadden Sea

The picture is not clear-cut. The State of the Wadden Sea report examined 238 indicators over a twelve-year period. Of these, 163 indicators have a legally mandated target value, such as those set by the Water Framework Directive or the Birds and Habitats Directives (for species and habitats). One-third of these legally mandated indicators outperform the target value and generally show a positive trend. On the other hand, one-third underperform the target value, and the vast majority of these are actually on a downward trend.

The situation varies among species groups. For phytoplankton (microscopic algae), the trend for 87% of the indicator species (15 in total) is unclear. Among benthic invertebrates (29 species), 38% score below the reference value, and 59% show an unclear trend.

The situation for fish is not good: 15 of the 16 species used as indicators are performing below the agreed standard. Only the rock gunnel scores well. The decline is evident among resident species, but also among those that use the Wadden Sea as a temporary, nutrient-rich nursery. This is a crucial ecological function of the area, and the report confirms earlier trend analyses by Statistics Netherlands (CLO/nl160202) that this nursery is functioning less and less effectively. For most habitats in the "sublittoral zone" of the Wadden Sea (the area that does not become exposed at

Indicators of the Marine Strategy Framework Directive (MSFD)



- Good environmental status (GES) achieved
- GES not yet achieved, but trend is positive toward the threshold value
- GES not achieved
- No incidents
- No indicator available yet.

D1 | Biodiversity
- Water column-feeding birds
- Benthic-feeding birds
- Surface-feeding birds
- Wading birds
- Seals
- Harbor porpoises
- Fishes
- Cephalopods (squids, octopuses)
- Pelagic habitats

D2 |Non-indigenous species
- Number of introductions of non-native species
- Established species, numbers

D3 | Commercially exploited species
fish, shellfish, and crustaceans
- Spawning stock biomass and fishing mortality
- Size distribution (fish size)

D4 | Food webs
- Food webs

D5 | Eutrophication
- Oxygen levels (concentrations)
- Chlorophyll a (concentrations)

D6 | Seafloor integrity and benthic habitats
- Physical loss of benthic habitats
- Benthic habitat quality

D7 | Permanent alteration of hydrographical conditions
- Hydrography (currents, turbulence)

D8 | Pollutants
- Contaminants in the marine environment
- Ernstige, acute (olie)verontreinigingen

D9 | Contaminants in fish/seafood
- Contaminants in fish and shellfish

D10 | Marine litter
- Marine litter

D11 | Energy supply including underwater sound
- Impulsive noise
- Continuous low-frequency noise

Fig. 1 These are the 25 indicators (divided into eleven main themes) for the Marine Strategy Framework Directive (MSFD). This figure shows that progress toward achieving Good Environmental Status (GES) for the biodiversity targets (roughly the right-hand side of the figure) lags behind that for the physical/chemical environment (left-hand side of the figure).

Source: Ministry of Infrastructure and Water Management (2020). Marine Strategy (Part 1): Update on the current environmental status. Noordzeeloket.nl. Edited by Willem Renema.

low tide), the conservation status is favorable. The area of the sublittoral zone (the area that never falls dry) has not decreased. This does not apply to the mudflats, sandbanks, and Spartina swards (areas that do become exposed at low tide). The area covered by cordgrass swards has shrunk and the quality has deteriorated, as the small cordgrass is being displaced by the non-native common cordgrass.

Changes in the exposed mudflats and sandbanks are the result of a complex interplay between natural processes and human activities. Due to the combination of sea-level rise and land subsidence, large parts of the Wadden Sea are becoming deeper. However, sand from the coast and silt from the North Sea are also entering the Wadden Sea, causing the area to become shallower. So far, more sand and silt have been deposited than is needed to compensate for rising sea levels and a subsiding seabed, so the mudflats continue to become exposed and do not shrink in size. The distribution of sand and silt determines where food, for example for waders, is found. This forces the birds to be flexible in their foraging behavior.

The North Sea

In recent years, the Netherlands has invested heavily in monitoring the North Sea, with the Marine Strategy (MSI 2025) serving as the legal framework. The way we view the North Sea has changed: whereas in 2012 the focus was still on physical and chemical stressors such as nutrient levels and pollution, we now take a broader view of the impact of human activities, such as fishing and the construction of wind farms.

The current report examines eleven species groups. Nine of these are vertebrates (such as fishes, birds, and marine mammals). Although these “iconic” species attract the most attention, it is precisely the lesser-known species that are crucial for a healthy ecosystem: microalgae and zooplankton form the basis of the food chain, and species such as the flat oyster, sand mason worms, and seagrasses serve as essential nurseries and shelters. The report shows a gradual improvement in environmental conditions. For indicators such as litter and impulse noise, "Good Environmental Status" (GES) has now been achieved. However, the recovery of biodiversity is lagging behind (see Fig. 1).
Current climate change and the intensified use of the North Sea are occurring at a pace that existing monitoring methods cannot fully keep up with. An appropriate approach to mapping the North Sea is necessary if we are to interpret the changes resulting from human activity. This could involve, for example, monitoring more species more frequently and linking biodiversity data to climate and environmental data.

The environmental targets for 2030 will not be met due to the cumulative effect of various factors.

Climate Change

Climate change is increasingly seen as a decisive factor in nature restoration. As seawater warms, natural reference values also change. Species such as cod, which live in colder waters and for whom the North Sea is their southernmost habitat, will decline. Species from warmer waters, for whom the North Sea is the northernmost part of their range, will conversely increase.
If this is the case, targets cannot be met—even if active policies are implemented to restore nature.

A changing climate also has a major impact on the food web. Different groups within the ecosystem may respond in different ways, which can lead to a mismatch in timing between the presence of fish larvae and the availability of food. This can trigger a chain reaction in the food chain.
In addition, climate change has indirect consequences. Changes in river discharge and other precipitation patterns can alter the stratification (the formation of distinct water layers that do not mix, or mix only minimally) of the North Sea. This affects the distribution of nutrients and oxygen in the water, which can lead to a decline in food production at the base of the food web. Many stress factors have multiple effects. Depending on their location, wind farms can, for example, disrupt summer stratification (the natural temperature variations in the water). At the same time, they also create habitats that were previously unavailable in the North Sea.

Hard substrates

According to the MSI-2025 report, natural hard substrate has largely disappeared. This includes both gravel and stones (geogenic) and hard substrates formed by animals (biogenic), such as oyster and (polychaete) worm reefs, which provide ample structure and thus protection for animals. However, more and more

Climate change and the expansion of activities in the North Sea are occurring at a pace that current monitoring cannot keep up with.

unnatural hard substrates are being added, such as shipwrecks, wind farms, and other infrastructure. The life forms inhabiting these habitats are not included in the report, nor are their effects on nature in the North Sea. Can these substrates contribute to the recovery of communities? Or do they facilitate the arrival of non-native and climate-shifting species?

Not separated

Of course, the Wadden Sea and the North Sea are only virtually separated: both areas influence each other. For example, both reports express concern about the Wadden Sea's role as a nursery. For many fish species, the shallow Wadden Sea (and the Delta) is an area where young fish find protection from larger predatory fish and can grow quickly due to the abundant food supply. Due to warming waters, young fish are now leaving earlier for deeper, cooler waters.

Bottom trawling is a major stressor for the North Sea and the Wadden Sea. Long-lived species (such as the Ocean quahog and the dead man's fingers) and habitat-forming species (such as the flat oyster and the honeycomb worm) are particularly hard hit. The seabed is becoming more homogeneous, with short-lived, rapidly reproducing species dominating.

The Marine Strategy states that efforts will be made to reduce this pressure by expanding protected areas closed to fishing and by developing fishing methods that cause less disturbance to the seabed.

There are success stories. A good example is the return of common eelgrass to the Wadden Sea. Around the Griend and south of Ameland, this seagrass has established itself and has expanded significantly in recent years. Efforts to bring it back have been underway since the 1990s, after it had largely disappeared in the 1930s. Crucial to this success were improvements in the restoration process, such as preventing seeds from being washed away prematurely.
This offers hope for the future. Perhaps it is possible to restore other (nearly) vanished habitats that have a positive effect on biodiversity by removing critical barriers to their development.

Willem Renema
Naturalis Biodiversity Center

Two reports, one international framework

- **Marine Strategy Framework Directive (MSFD):** This is the legal framework with eleven established key objectives (descriptors) for all European seas. It specifies what we must measure in order to speak of a "Good Environmental Status (GES)." The goal is for all seas to be healthy by 2030.
- **State of the Wadden Sea (MSI-2025):** This report provides an overview of the current state of the Wadden Sea. It supplements the broad MSFD descriptors with local, detailed data for the Wadden Sea (such as intertidal flats and specific bird populations).
- **Third Marine Strategy Report, Part 1 (2024–2030):** The policy document in which the Dutch government takes stock of the entire North Sea (including the Wadden Sea). Based on data from sources such as the MSI-2025, it reports to the European Union on the current state of the sea and progress toward environmental targets. In December 2025, this report, including the refined targets for the period up to 2030, was finalized..

Harbour seal | Photo: William Voorberg

DUTCH CARIBBEAN

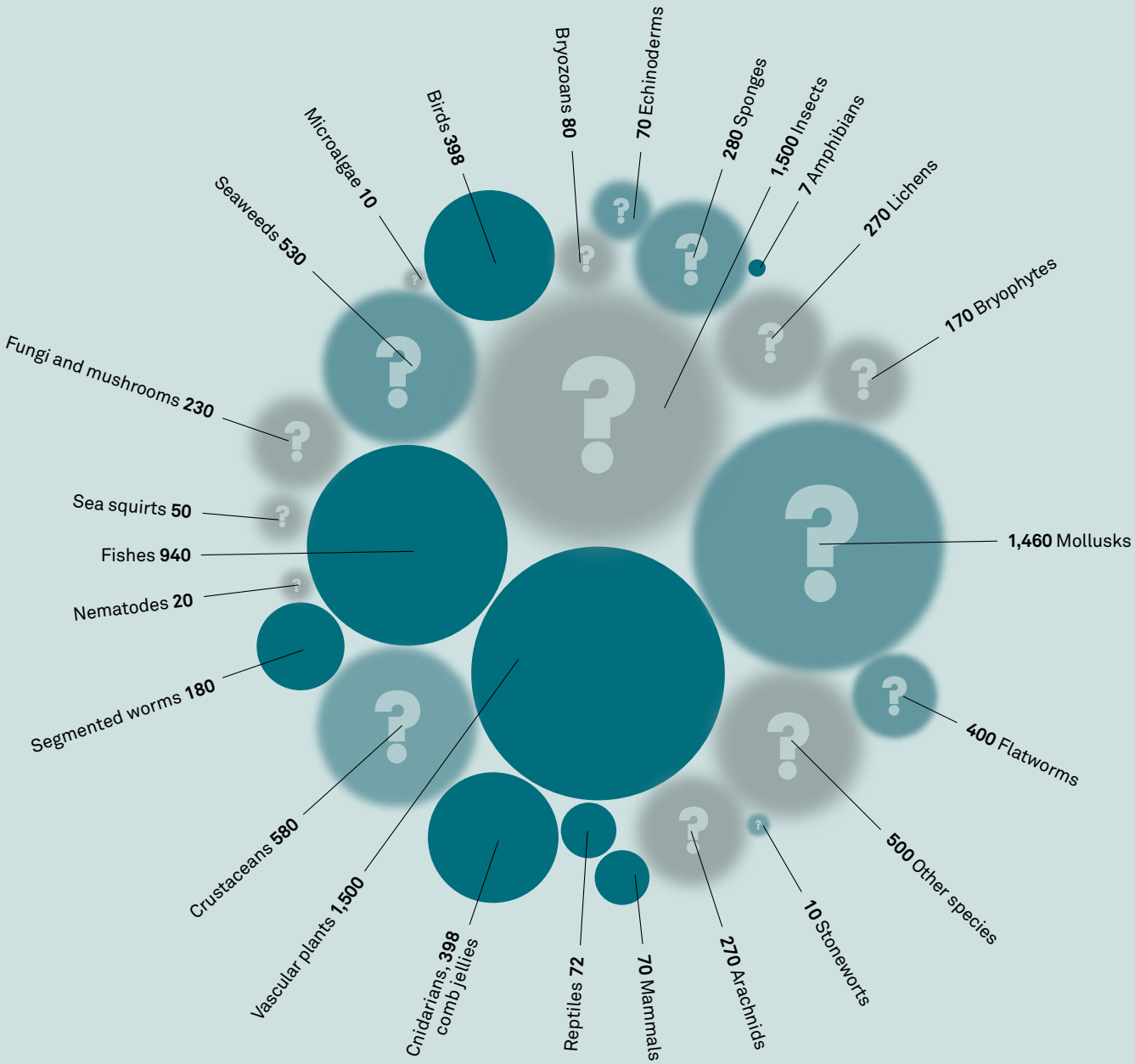
Although the Dutch Caribbean islands are often discussed together, there are clear differences in species composition between the ABC Islands, located off the coast of Venezuela, and the SSS Islands, situated 800 km to the northeast.

Saba, St. Eustatius, and St. Maarten (the SSS Islands) are part of the Lesser Antilles island arc. They are relatively green and home to many unique species typical of West Indian flora and fauna. Saba and the Saba Bank, in particular, are known for a very high concentration of unique (endemic) species.

Aruba, Bonaire, and Curaçao (the ABC Islands) are located off the coast of South America. They are drier (arid) and therefore have a very different natural environment, with many influences from the South American continent (such as cacti and specific reptiles).

Coral in Bonaire | Photo: Getty Images

Species in the Dutch Caribbean



Indicator number of recorded species in the Dutch Caribbean:

- Good: (Fairly) complete picture of the number of species
- Moderate: Limited knowledge of the number of species
- Poor: Insufficient knowledge of the number of species

No representative number of species

While we have a fairly complete picture for the European Netherlands, the situation for the Caribbean part of the Kingdom (the ABC and SSS islands) is much more complex. Currently there is not a complete species inventory. The Dutch Caribbean Species Register (www.dutchcaribbeanspecies.org) lists 9,755 established species (based on more than ten years of independent reproduction), but we know that the list is incomplete for many species groups.

Biodiversity Hotspots

The Dutch Caribbean are part of the *Caribbean Islands Biodiversity Hotspot*. This is a geographic area with an exceptionally high diversity of plant and animal species found nowhere else in the world, yet which are simultaneously severely threatened. One of the criteria for being designated a hotspot is that at least 70% of the original vegetation has been lost.

High biodiversity in the sea

Objectively speaking, biodiversity on the terrestrial part of the six islands (the landmass) is limited, especially on the drier islands. However, the species found there are remarkable and often unique to the area. See also the article “Islands: rich, unique, and vulnerable” on page 44 of this report. But by far the greatest diversity is found in the ocean. Currently, approximately 5,300 marine species have been recorded, and scientists agree that this is a significant underestimate. By comparison, at least 12,000 marine species are known to exist throughout the Caribbean region (Spalding et al., 2007, Miloslavich et al., 2010).

Gaps in knowledge

With further research, the total number of species is certain to increase by several thousand. The islands likely harbor hundreds of previously unrecorded insects, including dozens of species that are entirely new to science. Estimates suggest that one- to two-thirds of marine life remains undescribed (Appeltans et al., 2012). The knowledge gaps are particularly large for invertebrates, such as crustaceans, mollusks, echinoderms, sponges, cnidarians, and soft corals. For groups such as reef fish, sharks, marine mammals, seagrasses, and mangroves, the species are largely well-documented.

Gevlekte poetsgarnaal | Foto: Marion Haarsma

10%

of the yellow-shouldered amazons live on Bonaire

Yellow-shouldered amazon | PHoto:Getty Images

DUTCH CARIBBEAN RARE ISLAND INHABITANTS

The Caribbean part of the Kingdom is home to many unique species for which the Netherlands bears responsibility. Despite all policy intentions, the majority of these species are not faring well. The biggest problems are feral goats, invasive species, and climate change.

The tropical Dutch Caribbean region is not as green and wet as many people think. Some areas receive little rainfall. The ABC Islands (Aruba, Bonaire, and Curaçao) in particular experience a long dry season every year between January and September. This dry season and the relative scarcity of water can be challenging for the fauna. As a result, the islands are not particularly species-rich. By comparison, the Wadden Islands are more species-rich when it comes to vascular plants, birds, mammals, and bees, for example.

However, the plants and animals that live there—such as palm trees, iguanas, scorpions, and hummingbirds—give the landscape a tropical feel. In addition, there are many species found exclusively on these islands (endemic species). For example, the Bonaire palm is found only on Bonaire. The Aruba island rattlesnake is one of the rarest snakes in the world. The Bonaire island whiptail lizard and the striped anole (a lizard) are also found only on the Dutch Caribbean islands.

The islands are crucial for many species, as a large portion of the global population lives there. For example, Bonaire is home to 10% of all yellow-shouldered amazons, while the rest of the population is limited to the coasts of Colombia, Venezuela, Aruba, and Curaçao. The rare lesser Antillean iguana is now found on only about ten islands, including a small, critically endangered population on St. Eustatius.

Damaged vegetation

There is a strong focus on the restoration and conservation of the unique natural environment, including through the Nature and Environment Policy Plan for the Caribbean Netherlands 2020–2030 and the Biodiversity Plan for the Caribbean Netherlands. Nevertheless, the conservation status of 61% of the habitats and 71% of the species on Bonaire, St. Eustatius, and Saba is assessed as moderately unfavorable or very unfavorable. It is also notable that the quality of most vegetation, both in terms of structure and species composition, is considered substandard. The situation on the other islands (Aruba, Curaçao, and Sint Maarten) is partly comparable.

There is very little undisturbed vegetation left on the islands, so we don't really know what it originally looked like. Large-scale plantations, such as those for aloe vera, have had a major impact on nature, as have subsequent developments.
With the rise of industry and the service sector in the 1960s, crop cultivation largely ceased. The small gardens, which had been tended by many families on the islands, were abandoned.
Grazing pressure from feral goats increased sharply and remains a major problem on some islands. Tourism also grew, starting in the 1960s, with a massive increase in hotels and resorts along the coastlines beginning in the 1980s.

Free-roaming grazers

Today, free-roaming livestock, invasive species, and climate change are cited as the main causes of the poor state of nature on the islands. The vegetation on Bonaire, Aruba, and St. Eustatius, in particular, is heavily impacted by grazing goats, both inside and outside the national parks. This alters the vegetation structure (little undergrowth) and species composition: plants with tough leaves, large spines, or a bitter taste—such as cacti—thrive relatively well. In addition, the lack of ground cover leads to erosion, with soil runoff also damaging the coral reefs surrounding the islands.

Monitoring shows that vegetation is recovering well in areas where goats have been removed; plants are covering more ground in these places, and the number of species per unit area is increasing. This recovery is already visible across large areas of Curaçao and at the local level on the other islands as well. This trend is expected to continue in the coming years. In addition, local reforestation projects are proceeding successfully. Knowledge exchange between the islands, more intensive monitoring, and the allocation of funding play a key role in restoring vegetation across larger areas. Reducing grazing pressure is not easy, however. Measures such as fencing and population management are time-consuming and expensive. Moreover, removing goats is not a popular measure: the animals are viewed as communal property.

Invasive species in potting soil

Because the islands are heavily dependent on imports, the risk of introducing non-native species is high. The annual flow of containers from all corners of the globe brings along species that do not originally belong here. Potting soil from plant nurseries, in particular, has proven to be a source of non-native species. Dozens of these exotic species are now known, ranging from birds and reptiles to bugs, spiders, and ants.
Although many invasive species are, as far as we know, harmless, some pose a problem. For example, on St. Eustatius, the common green iguana poses a threat to the native Antillean iguana. The New Guinea flatworm, which has been found on Bonaire and St. Maarten since 2023, poses a threat to land snails. The IUCN even ranks this worm among the hundred most harmful invasive alien species in the world.
The giant African snail recently discovered on the ABC Islands also poses risks to humans. This snail serves as a host for various nematodes (roundworms) that can cause serious diseases. To control the further influx of such exotic species, stricter inspections of imported cargo and plant imports are advisable.

Climate change

The 340,000 residents of the islands are not responsible for climate change, but they are feeling its effects. Low-lying areas, such as the capital Kralendijk (Bonaire), may be threatened by rising sea levels in the future. In addition, the intensity of hurricanes on the SSS islands is increasing. For example, storms in 2017 damaged the remaining forests on Sint Eustatius so severely that the population of the internationally endangered bridled quail-dove declined by more than 70%.
The increasingly dry climate is detrimental to vegetation, especially when combined with overgrazing by free-roaming grazers. With the increasing intensity of rainstorms, this could lead to greater erosion. Improved water retention and vegetation restoration can counteract these negative effects.
Everything that happens on land—from the disappearance of mangroves and natural vegetation to the discharge of wastewater and overgrazing—has a major impact on marine life. Healthy and biodiverse vegetation on land is therefore a crucial step in protecting marine life and preserving the islands as a paradise for divers and snorkelers.

Vincent Kalkman
Naturalis Biodiversity Center

Dolfi Debrot
Wageningen Marine Research

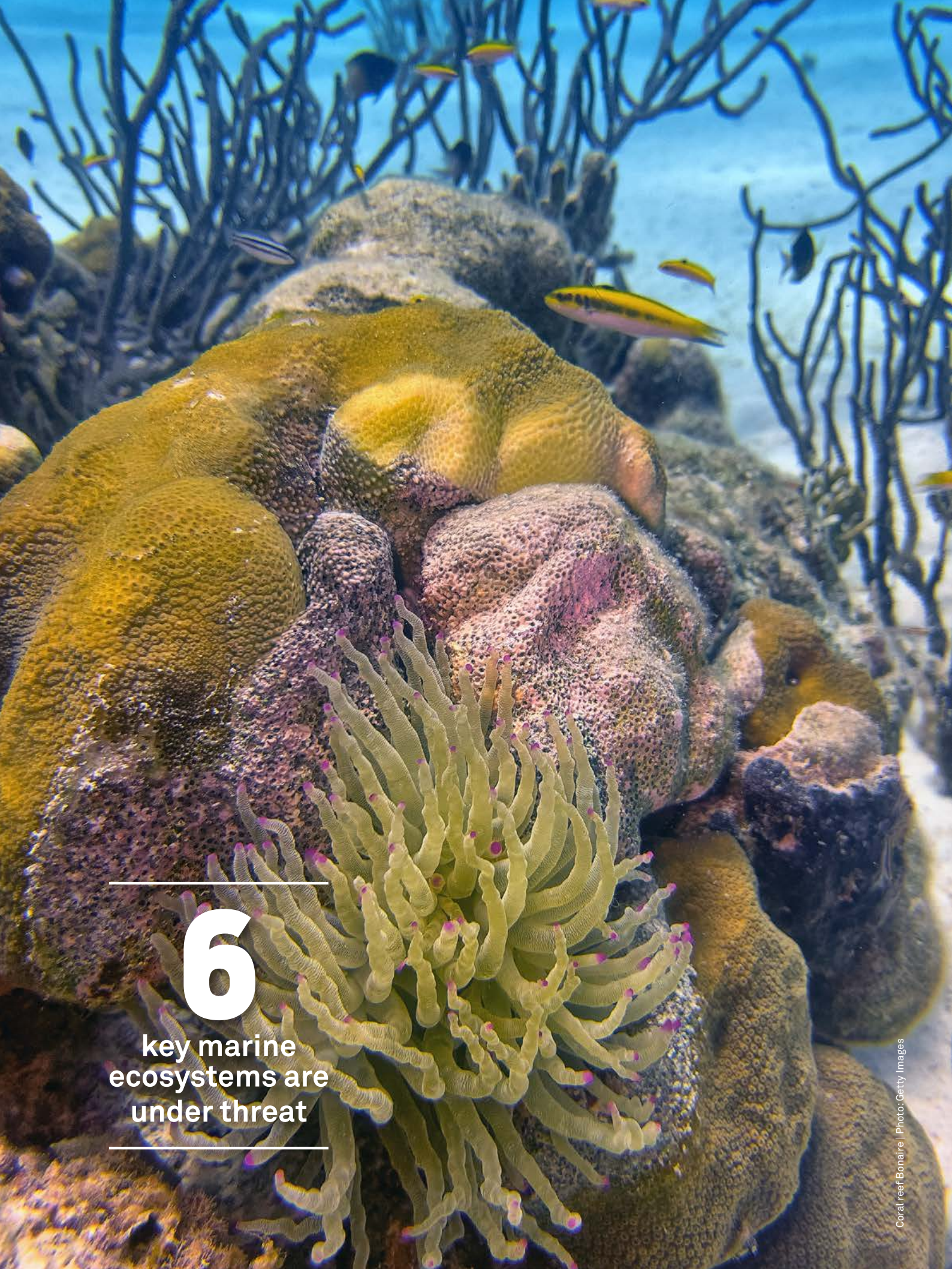
Erik Houtepen
CARMABI

Jessica Johnson
Dutch Caribbean Nature Alliance

International nature conservation treaties

International nature conservation treaties (such as the CBD, CITES, CMS, Ramsar, and the SPAW Protocol) require monitoring and reporting on species and habitats.
Since 2010, Bonaire, Saba, and St. Eustatius have been directly subject to Dutch legislation. The implementation of international obligations and nature conservation is coordinated by the island governments in collaboration with the Ministries of Agriculture, Nature and Food Quality (LVVN), the Interior and Kingdom Relations (BZK), and Infrastructure and Water Management (I&W). Aruba, Curaçao, and St. Maarten apply their own national laws and policies. In addition, a Kingdom-wide agreement ensures cooperation in the areas of marine biodiversity and fisheries among the four countries: the Netherlands, Aruba, Curaçao, and Sint Maarten.

Goats | Photo: Getty Images



6

key marine ecosystems are under threat

Coral reef Bonaire | Photo: Getty Images

CARIBBEAN UNDERWATER NATURE
A FRAGILE TREASURE TROVE

Caribbean marine ecosystems, which are crucial for coastal protection and tourism, are in an alarming state. Coral reefs, in particular, are suffering greatly. By addressing the root causes, underwater ecosystems can recover and the islands can become more resilient for the future.

Healthy marine ecosystems are essential for coastal protection, tourism, and the economy of the islands in the Caribbean part of the Kingdom of the Netherlands. However, the condition of marine biodiversity in Bonaire, Saba, and Sint Eustatius is assessed as unfavorable to poor in the State of Nature (Debrot et al., 2024), a report commissioned by the Ministry of Agriculture, Fisheries, Food Security, and Nature. This concerns both ecosystems and various species groups, such as sea turtles. It is likely that these trends and statuses also apply to Aruba, Curaçao, and Sint Maarten, as similar developments and threats are at play there.

According to current IUCN Red List statuses, at least 75 marine species in the region are now threatened, critically endangered, or vulnerable. These include stony corals, sea turtles, sharks, rays, and whales (Carpenter et al., 2008; IUCN, 2025; Debrot et al., 2024; Dulvy et al., 2014). To the best of our knowledge, there are fourteen marine and brackish water species that occur exclusively in this area (Bos et al., 2018).

Threatened ecosystems

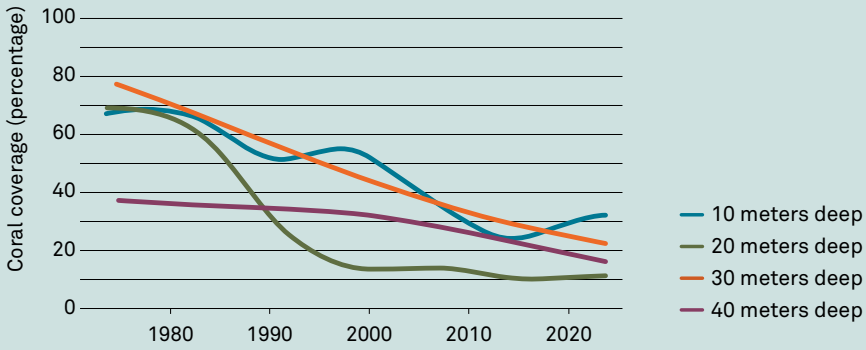
There are six major marine ecosystems in the Caribbean part of the Kingdom: mangrove forests, seagrass and algal beds, coral reefs, the open ocean, and the deep sea (deeper than 200 meters). Mangrove forests are important as nurseries for many fishes; serve as foraging, shelter, and breeding grounds for birds; prevent erosion; and protect the reef from land-based impacts. Seagrass and algal beds are important foraging areas for sea turtles, rays, and invertebrates such as squid.

Coral reefs protect the coast from wave erosion, harbor an unprecedented level of biodiversity, and are a major source of economic income for the islands.

Long-term coral coverage

1990-2020 | Karpata, Bonaire

Percentage at various depths, over a period of 45 years



Source: Erik Meesters, WMR

Over the past 45 years, however, coral reefs have declined sharply. In many places, the decline has been dramatic (Perry et al., 2025). However, there are still relatively healthy sections of reef, particularly in the Caribbean Netherlands, and as long as these core areas remain intact, there is a realistic chance of recovery.

Between one-third and two-thirds of marine biodiversity remains unknown.

The causes of the decline of coral reefs are also the greatest threats to the region's other marine ecosystems: on the one hand, rising water temperatures due to climate change, and on the other hand, local pressures such as population growth, coastal development, overfishing, and pollution from untreated sewage, chemical waste, and sediment erosion. Meanwhile, many coastal systems are also suffering from increasing tourism.
An additional concern is introduced species that can disrupt ecosystems and displace native fauna. Furthermore, the growing annual influx of massive quantities of floating Sargassum seaweed poses a threat; this seaweed is increasingly suffocating seagrass beds and mangrove forests (Van der Geest et al., 2024).

Climate Change

Ocean warming and increasing heat stress caused by climate change pose a major threat to coral reefs and continue to fuel coral mortality. It is a problem that deserves high priority but cannot be solved in the short term or at the local level (Hoegh-Guldberg et al., 2007; Hughes et al., 2017; IPCC, 2023).
What is within reach, however, are local measures to restore water quality. Coral needs clean, clear, and nutrient-poor water. This water quality is under significant pressure from sewage leaks and discharges, as well as from erosion caused by uncontrolled coastal development and grazing livestock.

In accordance with the Nature and Environmental Policy Plan for the Caribbean Netherlands (NMBP) 2020–2030, this can be addressed through measures such as stricter regulations on coastal development, and rigorous enforcement; improved management of watersheds; and structural investments in water treatment. These local measures can make the reefs more resilient. In this way, we can gain valuable time in the fight against climate change. The same measures will also have positive effects on other ecosystems and, consequently, on society as a whole.

Structure in Monitoring

Although the Caribbean waters are a treasure trove of biodiversity, we are still in the dark about many aspects. Currently, approximately 5,300 marine species

have been recorded and, as research and monitoring increase, thousands more are expected to be added. It is estimated that globally, one-third to two-thirds of all marine species have not yet been scientifically described (Appeltans et al., 2012). Consequently, new species are discovered in the Caribbean Sea every year. Existing knowledge gaps hinder effective protection and trend analyses, even though these analyses are crucial for assessing the effects of biodiversity policy and meeting international obligations.
While the European Netherlands relies on comprehensive monitoring systems, comparable structures are lacking in the Dutch Caribbean. Although significant steps have been taken through monitoring by local organizations, Directorate-General for Public Works and Water Management, and Statutory Research Tasks (WOT), a structured, standardized approach is essential.

As long as there are healthy sections of reef, there is a chance of recovery

Prevention is better than cure

Preserving existing biodiversity is far more effective, and cheaper, than trying to restore what has already been lost. The downward spiral in which marine ecosystems find themselves can only be reversed by directly addressing the underlying causes and restoring the conditions under which species thrive (Millennium Ecosystem Assessment, 2005; IPBES, 2019).

The NMBP 2020–2030 provides a comprehensive framework for this; the course has been set, and the necessary measures have been outlined. However, the ongoing decline underscores the urgent need to implement these measures. Restoration through coral cultivation, without addressing the root cause, is like rearranging the chairs on the Titanic. The urgency is clear, the knowledge is available, and the plans are in place. Their success now depends on intensifying efforts and fulfilling the commitments already made.

Lisa Becking
Naturalis Biodiversity Center

Erik Meesters
Wageningen Marine Research

Christmas tree worms | Photoo: Getty Images

Conservation Status

The most recent, "State of Nature Report for the Caribbean Netherlands 2024," covering the period 2018–2024, concludes that 61% of habitats and 71% of the species groups assessed (143 species in total) are in an unfavorable-inadequate to an unfavorable-bad conservation state (CS).

The CS is a measure of the vitality of a species or habitat type and is only calculated for the BES islands (Bonaire, Sint Eustatius, and Saba). It is assumed that the trends and pressure factors (factors that negatively affect the survival of species) for the islands of Aruba, Curaçao, and Sint Maarten are similar. Despite efforts under the Nature and Environment Policy Plan (NMBP) 2020-2030, there has not yet been any large-scale recovery.

Legend

- **Favorable** (+) The species is viable and is unlikely to decline in the near future.
- **Unfavorable-Inadequate** (±) The conservation status is insufficient but not yet poor. Recovery measures are required.
- **Unfavorable-Bad** (−) The conservation status is poor and there is a high risk of further decline. Immediate and significant intervention is necessary.
- **Unknown** (?) A judgement cannot be made due to insufficient data.

Orchids
Saba and St. Eustatius

Correll's psychilis | Michiel Boeken

Distribution	+	Habitat	+
Population	−	Prospects	−

Trees
Bonaire

Guaiacum officinale | Carel de Haseth

Distribution	−	Habitat	−
Population	−	Prospects	−

Butterflies
Bonaire, Saba, and St. Eustatius

Monarchvlinder | Getty Images

Distribution	−	Habitat	+
Population	−	Prospects	−

Terrestrial molluscs
Bonaire, Saba and St. Eustatius

Physella acuta | Gerard van Buurt

Distribution	±	Habitat	+
Population	±	Prospects	−

Lesser Antillean iguana
St. Eustatius

Lesser Antillean iguana | Rotem Zilber

Distribution	±	Habitat	±
Population	−	Prospects	−

Saba green iguana*
Saba

Saba green iguana | Michel Breuil

Distribution	+	Habitat	+
Population	+	Prospects	−

*Data quality and completeness are insufficient.

Dutch Caribbean

Bridled quail-dove
Saba and St. Eustatius

Bridled quail-dove | Frank van Spelde

Distribution	+	Habitat	±
Population	−	Prospects	±

Red-billed tropicbird
Saba and St. Eustatius

Red-billed Tropicbird | Getty Images

Distribution	+	Habitat	±
Population	±	Prospects	±

Bats
Bonaire, Saba and St. Eustatius

Langneusvleermuis | Carel de Haseth

Distribution	−	Habitat	+
Population	−	Prospects	−

Breeding birds of Bonaire

Roseate tern
Bonaire

Roseate Tern | Michiel Oversteegen

Distribution	+	Habitat	+
Population	−	Prospects	−

Common tern
Bonaire

Common Tern | Getty Images

Distribution	+	Habitat	+
Population	−	Prospects	±

American least tern
Bonaire

American Least Tern | Getty Images

Distribution	+	Habitat	±
Population	?	Prospects	±

Royal tern
Bonaire

Royal Tern | Getty Images

Distribution	+	Habitat	+
Population	+	Prospects	±

Cayenne tern
Bonaire

Cayenne Tern | Getty Images

Distribution	+	Habitat	±
Population	±	Prospects	±

Conservation Status

Breeding birds of Saba

Bridled tern
Saba

Bridled Tern | Getty Images

Distribution ⊕ | Habitat ⊖
Population ⊖ | Prospects ±

Sooty tern
Saba

Sooty Tern | Michiel Oversteegen

Distribution ⊕ | Habitat ⊖
Population ⊖ | Prospects ±

Brown noddy
Saba

Brown Noddy | Getty Images

Distribution ⊕ | Habitat ⊖
Population ⊖ | Prospects ±

Sea turtles of Bonaire

Loggerhead turtle
Bonaire

Loggerhead turtle | Getty Images

Distribution ⊕ | Habitat ±
Population ± | Prospects ±

Hawksbill turtle
Bonaire

Hawksbill turtle | Getty Images

Distribution ⊕ | Habitat ⊖
Population ± | Prospects ±

Green turtle
Bonaire

Green turtle | Marion Haarsma

Distribution ⊕ | Habitat ⊖
Population ⊕ | Prospects ±

Sea turtles of Sint Eustatius

Leatherback turtle
Sint Eustatius

Leatherback turtle | Getty Images

Distribution ± | Habitat ⊖
Population ⊖ | Prospects ±

Hawksbill turtle
Sint Eustatius

Hawksbill turtle | Getty Images

Distribution ⊕ | Habitat ⊖
Population ± | Prospects ±

Green turtle
Sint Eustatius

Green turtle | Marion Haarsma

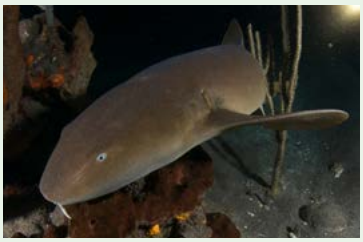
Distribution ⊕ | Habitat ⊖
Population ⊕ | Prospects ±

Dutch Caribbean

Saltwater fish

Sharks and rays coastal

Around reefs and mangroves



Verpleegsterhaai | Mark Yokoyama

Distribution	?	Habitat	−
Population	±	Prospects	−

Sharks and rays pelagic

In the open ocean

Walvishaai | Getty Images

Distribution	?	Habitat	±
Population	−	Prospects	−

Sharks and rays deep sea

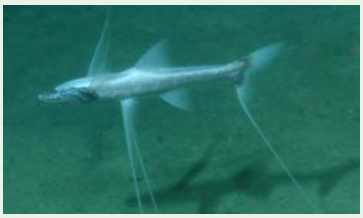
At great depths

Citroenhaai | Hans Smulders

Distribution	?	Habitat	+
Population	?	Prospects	?

Deep-water fish fauna

Bonaire, Saba and St. Eustatius



Driepootvis | Wikipedia

Distribution	+	Habitat	+
Population	+	Prospects	±


20%
of the world's biodiversity lives on islands
Bonaire | Photo: Getty Images

ISLANDS
RICH, UNIQUE, AND VULNERABLE

Islands cover only a small portion of the Earth, but, within the Kingdom of the Netherlands, the Caribbean islands alone are home to countless unique species found nowhere else. How do we protect these special ecosystems from invasive species and habitat loss?

Protecting island nature begins with understanding its role on a global scale. Islands cover just 7% of the Earth's surface, yet they are home to as much as 20% of global biodiversity. They also form the front line of the biodiversity crisis. Three-quarters of the species that (as far as we know) have become extinct since the year 1500 were native to islands. The same applies to half of the threatened species currently listed on the IUCN Red Lists (Fernández-Palacios et al., 2021).

The Caribbean islands, including the six that belong to the Kingdom of the Netherlands, are no exception. They are internationally recognized as one of the 36 so-called "Biodiversity Hotspots" in the world. These are regions with the highest concentration of unique species threatened with extinction.
Currently, 122 species from the Dutch Caribbean islands are listed on the Red List. The actual number is likely higher, as the vast majority of the islands' local flora and fauna has not yet been assessed.

Isolated history

Islands experienced a significant wave of extinctions following human colonization. When humans arrived several thousand years ago, approximately 150 mammal species lived throughout the Caribbean. Since then, at least 70 of these have become extinct. More than half, 60%, were endemic to this region (Cooke et al., 2017).

Biodiversity on islands is particularly vulnerable due to their isolated evolutionary history. Because species have evolved over millennia in an environment without natural predators or fierce competition, they have often lost their instinct to evade predators and possess an immune system that is vulnerable to new pathogens. This isolation has led to a large number of endemic species (found nowhere else in the world), but at the same time this makes island species sensitive to changes in their environment and more susceptible to extinction.

New discoveries

The Dutch Caribbean region was originally home to a small number of mammal species. Of these, apart from a few species of bats, only one native species remains: the vesper mouse, found on Aruba and Curaçao. In addition, there is one potentially native and one potentially introduced mammal: the eastern cottontail rabbit and the white-tailed deer, respectively.

The Caribbean part of the Kingdom makes a huge contribution to the total Dutch biodiversity

Despite this tragic history, the Dutch Caribbean islands still harbor a spectacular diversity of life. In 2025 alone, 9,939 species were recorded in the Dutch Caribbean Species Register. Across the six islands combined, we know of nearly 400 bird species, 18 bat species, and 72 species of lizards and snakes. The flora is also rich, with at least 2,000 recorded plant species.

The invertebrate fauna (animals without a backbone or spine) is less well known, but recent scientific research on Bonaire (Kalkman et al., 2025) has identified 600 species of invertebrates that had not previously been documented on the island.

Disappearing habitats

The natural balance on the islands is currently under particular pressure due to the introduction of invasive species and the loss of habitats. The impact of introduced species is immediately apparent in places like Bonaire and Curaçao; due to the lack of an effective defense mechanism against grazers, free-roaming goats and donkeys are severely damaging the native vegetation. The grazing away of the roots of native trees subsequently leads to soil erosion, as fertile soil washes into the sea during rainfall. This can suffocate the coral reefs.

Other introduced predators, such as rats and cats, also pose a threat (Debrot et al., 2024). Furthermore, human activity leads to landscape changes: habitats are damaged or disappear as a result of agriculture and urbanization. The rise in tourism, which in turn brings more pollution, also plays a role in this.

Endemic species

Nevertheless, the level of endemism in the Dutch Caribbean is high compared to the European part of the Kingdom of the Netherlands. There are approximately 93 endemic species on the ABC Islands alone. The SSS Islands and Saba Bank have at least 35 (Bos et al., 2018). Examples include the lesser Antillean iguana on St. Eustatius, the yellow-shouldered Amazon parrot on Bonaire, and the Aruba island rattlesnake, of which only three hundred remain in the wild. By comparison, the European-Dutch mainland is home to only two endemic subspecies, and the Wadden Islands have none.
Given the limited land area of the islands, the Caribbean part of the Kingdom thus makes an enormous contribution to the Netherlands' overall biodiversity. The flora and fauna found there show virtually no overlap with those in the European Netherlands. Moreover, the islands are home to countless species found nowhere else in the world. If these species were to become extinct, they would be lost forever on a global scale.

Strengthening resilience

Each Dutch Caribbean island is a "mini-world" in its own right. The unique character of each island calls for nature conservation activities that are coordinated locally and carried out in close collaboration with local communities.

Various NGOs and government agencies are developing programs aimed at removing non-native plants, eliminating invasive predators, and regulating livestock farming. In addition, ecotourism offers opportunities for sustainable development. Given the central role of the tourism sector in the region, initiatives that combine local economic growth with sustainable practices therefore represent a promising strategy.

Although the current situation is concerning, it is not irreversible. Scaling up available resources and actively involving local communities, offer opportunities to strengthen ecological resilience and protect many of the region's unique species and ecosystems.

Luís Lima Valente
Naturalis Biodiversity Center

Pepijn Helleman
Naturalis Biodiversity Center

Island species are vulnerable due to their evolutionary history

Crested Caracara | Photo: Getty Images


48%
less coral cover
since 1980
Photo: Getty Images

STONY CORALS
BACKBONE OF BIODIVERSITY

Stony corals in the Dutch Caribbean waters are severely threatened by climate change, overfishing, coral diseases, and water pollution. Although current nature management measures are a step in the right direction, they do not seem to be fully effective as long as other causes remain inadequately addressed.

Within the entire Kingdom of the Netherlands, the highest marine biodiversity is found on the coral reefs of the Caribbean region. This species richness is largely due to the presence of stony corals. They serve as substrate for other species (to grow on), but also as a food source and shelter. Without these stony corals, there would be no coral reefs, and thus less biodiversity. However, coral reefs are under threat. Coral cover in the Caribbean Sea has declined by 48% since 1980. During the same period, the amount of algal cover (which can suffocate coral) has increased by 85%. In addition, heat stress in 2023 and 2024 led to a historic loss of coral due to bleaching (Wicquart et al., 2025). This is dangerous for many reef inhabitants: since all kinds of snails, worms, barnacles, crabs, and shrimps depend on coral for food and shelter (van der Schoot and Hoeksema, 2024).

Societal impact

But coral die-off also has social and economic consequences. Several species of marine wildlife that live on reefs, such as certain fishes and crustaceans, serve as a food source for the local island populations (Johnson and Saunders, 2014). In addition, both coral reefs and white sand beaches (which are formed from eroded dead coral) are an important source of income because they attract tourists. The reefs also serve as a natural sea wall against high waves during storms.
There are several methods for preserving coral diversity, but the consensus is that these methods are only truly effective when underlying causes of mortality are also addressed.

Climate change and diseases

The threat comes from various sources: climate change, pollution, disease, and overfishing, all contribute to coral mortality. For example, the growing human population on the islands leads to an increase in algae in the water. These algae compete with corals and other bottom-dwelling animals for space (Vermeij et al., 2010). After all, a larger population means more sewage discharge, which causes more nutrients to end up in the water and promote algal growth. Additionally, overfishing contributes to the disappearance of fishes that graze on algae.

Brain coral | Photo: Bart Braun

Climate change also poses a threat, as warmer seawater disrupts the vital symbiotic relationship between stony corals and single-celled algae (zooxanthellae).
In addition, there is an increasing incidence of coral diseases in Caribbean waters that lead to coral mortality (Weil, 2004). The cause is unclear. Furthermore, coral reefs in the eastern part of the Dutch Caribbean are regularly affected by hurricanes, which can cause severe damage (Wicquart et al., 2023).

Parasites

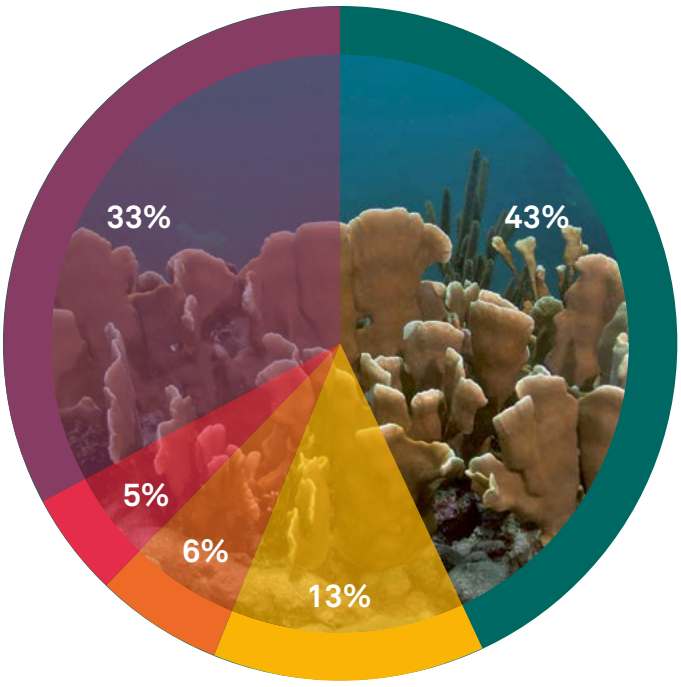
Although many boring mussels and excavating sponges damage the coral (as they make holes in the coral), this is not a major problem for the health of the coral reef as a whole (de Bakker et al., 2018). However, an increasing number of species introduced by humans are appearing, such as corals from the Indian and Pacific Oceans. These can compete for space with native species and introduce parasites that do affect coral health, such as worm snails (van der Schoot and Hoeksema, 2025).
These non-native coral species are carried into Caribbean waters on floating platforms used for oil and gas extraction (Hoeksema et al., 2023). Once there, they thrive on shipwrecks, buoys, and mooring posts, before spreading further.
Not all corals are equally threatened. Some species are more vulnerable than others. Some species are fast-growing and occur locally in greater densities than others, making them less vulnerable. And species that are common and widespread in the Caribbean Sea are less vulnerable than those that are rarer.

Red List

Corals found in shallower waters near the shoreline are easier to observe. Consequently, more is known about them than about species living on steep reef slopes in deeper water farther offshore. For instance, deep-sea species are not included in the IUCN Red List assessments. However, the threat status has been published for a total of 61 species of stony corals (Gutierrez et al., 2024) (see figure). The IUCN has determined that 44% of all reef-building coral species worldwide are now threatened with extinction. In the Caribbean region, this percentage is even higher for certain groups, as this area is more severely affected by diseases and local pollution than many other seas and oceans (IUCN, 2025).
There are various initiatives aimed at preserving or restoring coral diversity. For example, collecting corals without a permit is subject to strict control, and each of the six islands in the Caribbean part of the Kingdom has its own nature conservation agency. These organizations

IUCN Red List

2025 | 61 Dutch Caribbean coral species assessed of which **44% are threatened or may have disappeared**



- 0% Disappeared
- 33% Critically endangered
- 5% Endangered
- 6% Vulnerable
- 13% Near threatened
- 43% Least concern

Source: Bert W. Hoeksema, IUCN, 2025
Photo: Star coral | Marion Haarsma

perform essential work by managing nature parks, conducting surveillance, and providing education to both the local population and tourists.

Replanting

Another method for managing coral reefs involves transplanting coral fragments (broken-off or cut pieces of healthy coral that are grown in underwater nurseries and then reintroduced), but this is mainly effective for two fast-growing *Acropora* species in shallow water (Hodges and Hallock, 2025). Locally this promotes recovery, but it is not sufficient to counteract species loss on a larger scale, or across the entire depth range of the reef.

A promising approach is the release of corals grown from larvae. During the annual coral spawning season, eggs and sperm are collected to be fertilized in a controlled environment, after which the young larvae are released onto the reef. This method works for several species, but is still in the early stages of development. A final method involves the use of artificial reefs: man-made structures made of concrete or other materials, where corals and fish can settle. These artificial reefs typically also serve as substrates for invasive species (Hoeksema et al., 2019).

The goal to reduce nutrient levels in groundwater and coastal areas by 2030 is included in the NMBP.

Despite the dedication behind these small-scale initiatives, they cannot offset the large-scale loss of coral. To break the downward spiral of the entire reef system, it is necessary to address the causes of coral mortality on multiple fronts. The importance and concrete goals are laid out in the Nature and Environmental Policy Plan for the Caribbean Netherlands 2020–2030 (NMBP). For example, this plan includes the goal of significantly reducing nutrient levels in groundwater and coastal areas by 2030. Only by comprehensively scaling up our efforts can we give stony corals the space to continue fulfilling their role as the foundation of biodiversity and to preserve the reef ecosystem for the future.

Bert W. Hoeksema
Naturalis Biodiversity Center

The island's summit was once dominated by the mountain mahogany (*Freziera undulata*), but most of them died off thirty years ago. Since the 2017 hurricane blew away the last remaining "skeletons," only two or three of these iconic, ancient trees remain.

Mountain mahogany | Photo: Michiel Boeken

Only

14%

of the Dutch land area consists of forests and natural terrain

Hare | Photo: William Voorberg

BASIC QUALITY OF NATURE
TACKLING NATURE DEPRIVATION

Due to fragmentation and intensive land use, our nature reserves have become vulnerable "green islands." Activities outside these areas put nature under further pressure, causing species to disappear. Basic Quality of Nature (Basiskwaliteit Natuur - BKN) offers a comprehensive approach focused on restoring natural systems.

Nature in the Netherlands is fragmented. Natura 2000 sites and the National Nature Network (NNN) provide protection for vulnerable nature, but these land and sea areas cover only 26% of our landscape. In terms of land surface, only 14% of the Netherlands consists of forests and natural terrain. The surrounding areas are used for agriculture, housing, and infrastructure, which have a major impact on neighboring nature reserves. For example, agriculture extracts a lot of water, causing nature areas to dry out. In addition, manure from the immediate vicinity causes a structural nitrogen surplus, which further degrades the quality of nature. Moreover, due to this fragmentation, animal species have difficulty moving from one area to another.

Degraded natural environment

The quality of nature in the Netherlands has deteriorated to such an extent that even "common" species are declining or disappearing. Consider, for example, the hare, the house sparrow, the mallard, the cuckoo flower, and the green frog. This is a strong warning sign, as these species are generally well-adapted to changes in their environment.

Meanwhile, a lot of policy focuses on saving (rare) species, but by no means always with the desired result. For example, subsidies for agricultural meadow bird management rose from €4.2 million to €33.4 million between 2001 and 2020, while during the same period the number of breeding black-tailed godwit pairs fell from approximately 60,000 to 30,000 (Netherlands Court of Audit, 2021).

Starting at the basics

It seems, therefore, that a different approach is needed to reinforce nature. The Basic Quality of Nature concept offers an alternative. The idea is powerful in its simplicity: to make nature self-sustaining, the basic conditions must be in place. Examples include water quality, space for nature, connections between areas, ecosystem dynamics, and nutrient balance.

Instead of designing the landscape for specific species, BKN shifts the focus to restoring fundamental natural processes. By creating the right basic conditions, nature is given the space to develop on its own; the return of specific flora and fauna is then a logical result of a healthy system, rather than a predetermined goal.

To make biodiversity self-sustaining, the necessary conditions must be in place

European roe deer | Photo: William Voorberg

A practical advantage is that everyone can contribute to improving water, soil, and vegetation structure (Kwak et al., 2018). Because species cannot be controlled and do not recognize the boundaries of nature reserves, we focus on the controllable conditions of the landscape. Take the black-tailed godwit: we focus on a landscape in which the black-tailed godwit can thrive, without nature management being dictated exclusively by the specific needs of this single species.

This (BKN) approach aligns with the European Nature Restoration Law, which requires member states to restore natural values in all areas, including urban and agricultural areas. When the basic natural conditions in these areas are in order, a positive interaction with adjacent natural areas develops, which benefits overall biodiversity (Biesmeijer et al., 2021).

Abiotic factors, design, and management

The baseline quality is determined based on three factors: abiotic conditions, landscape structure, and nature management. Abiotic conditions refer to environmental factors such as water and soil quality, nutrient balance (nitrogen and phosphorus), moisture levels, the presence of toxic substances, and aspects such as tranquility, darkness, and silence (Edixhoven and Hofhuis, 2025).

Landscape structure refers to the space allocated to nature and landscape elements such as trees, hedgerows, and wooded banks. Ponds and ditches, flower-rich grasslands, field margins, and reed beds also fall into this category.

Finally, proper nature management is essential to maintaining these first two conditions. Consider, for example, how often the grass is mowed, the amount of fertilizer used, and to what extent the clippings are removed. It may seem as though nature management is unnecessary because nature can take care of itself, but without management the Netherlands would largely turn into a forest. That is nature in itself, but it comes at the expense of landscape diversity. It is precisely the unique nature of open areas, such as grasslands and heathlands, that would be lost as a result.

Each landscape type is characterized by differences in conditions and, consequently, in what we aim to achieve through the BKN framework. For example, the water management and the need for dynamism in an old stream valley differ significantly from what is required in young dunes or in a riverine landscape.

Alignment with policy frameworks

Organizations looking to implement BKN do not have to reinvent the wheel entirely on their own. There are already policy frameworks that align closely with BKN. For example, the Water Framework Directive provides clear guidelines for improving water quality, and the Nota Ruimte (the national government's long-term vision for spatial planning in the Netherlands) sets the rules for our landscape planning. For built-up areas, an initial implementation plan is now available for achieving basic quality of nature (Edixhoven et al., 2025).

A shared challenge

Above all, the BKN is a collaborative effort. Because it focuses on nature outside designated nature reserves, the approach touches a wide range of policy areas. As a result, achieving a baseline quality of nature is not solely the responsibility of nature and environmental departments, but is an integral part of land-use planning, granting permits, and subsidies.

This can lead to challenging dilemmas, such as when housing development goals clash with the need for space for nature. The approach requires the involvement of stakeholders for whom nature conservation is not the top priority, such as homeowners, business owners, farmers, and investors. Engaging these groups requires creativity, appropriate incentives, time, and money.

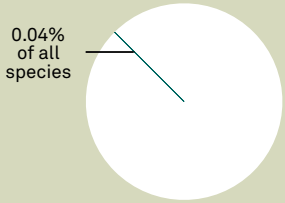
Various stakeholders are currently exploring how BKN can be integrated into spatial development projects. For example, a "nature navigator" is being developed for municipalities to assess the baseline quality of nature, enabling targeted and localized nature restoration efforts. At the same time, stakeholders in the construction and infrastructure sectors are looking for ways to measure "biodiversity net gain," so they can objectively determine whether their projects actually enhance local flora and fauna rather than merely spare them.

The strength of BKN lies in its call for an integrated approach in which different levels of government and policy areas work together. When we view nature restoration as a collective investment in our own future, BKN forms the foundation for a resilient living environment that is future-proof for both people and nature.

William Voorberg
Naturalis Biodiversity Center

Koos Biesmeijer
Naturalis Biodiversity Center

Amphibians



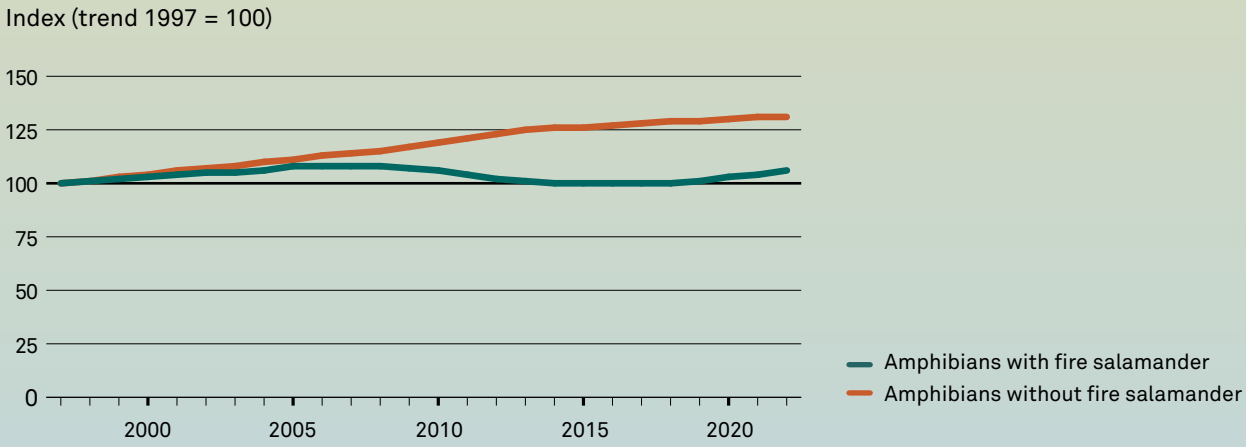
Number of species	23
Of which are non-native	5
DNA references available	22
Habitat Directive species	11
On the Red List	7 (out of 16)

Natterjack toad | Photo: Jeroen Hoek

Description	The Netherlands has four species of toads, seven species of salamanders (two non-native), and ten species of frogs (three non-native). A characteristic of all amphibians is metamorphosis, in which eggs and larvae develop in the water.

Population trends amphibians

Period 1997-2022 | 16 species evaluated



Source: NEM, RAVON/CBS, 2024 | clo.nl/nl107719

According to the most recent data, the status of amphibians in the Netherlands up to early 2025 is a story of contrasts; specialized and rare species are sometimes faring better thanks to targeted conservation efforts, while “common” species are actually declining.

Since 1997, eleven species have increased in numbers and three have remained stable. However, the crested newt and, in particular, the fire salamander are declining. The fire salamander is now critically endangered. The main culprit is a fungal disease, which is increasingly also infecting crested newt populations. In addition, habitat fragmentation and desiccation pose ongoing threats.

Red List

2023 | 16 species evaluated
44% of which are threatened or may have disappeared

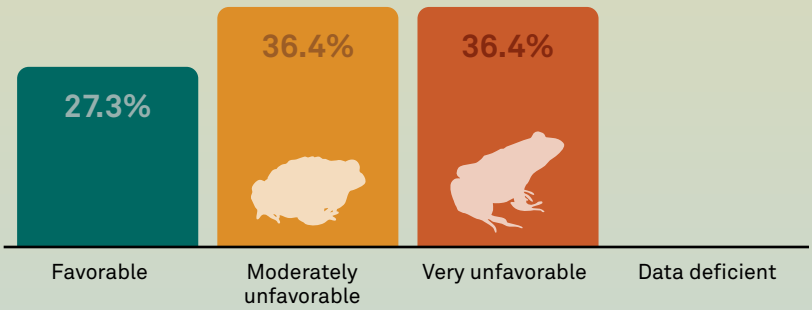
- 0% disappeared
- 6% critically endangered
- 0% endangered
- 38% vulnerable
- 0% near threatened
- 56% not threatened

Source: clo.nl/nl105219

Of the sixteen species of native amphibians, seven are listed on the Red List (44%). The tree frog, yellow-bellied toad, and common spadefoot toad are now less threatened and have therefore been placed in a less severe category than on the previous Red List. The fire salamander has been placed in a more severe category because its population has declined further.

Conservation Status

Period 2013-2018 | 11 species evaluated

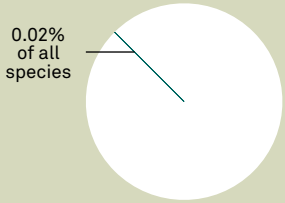


Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

Most amphibians in the Netherlands are still in an unfavorable conservation status (moderately unfavorable to very unfavorable). Although some species are recovering locally, they often still do not meet the criteria for a “favorable” status nationwide.

Great crested newt | Photo: Jan-Freerk Kloen

Reptiles



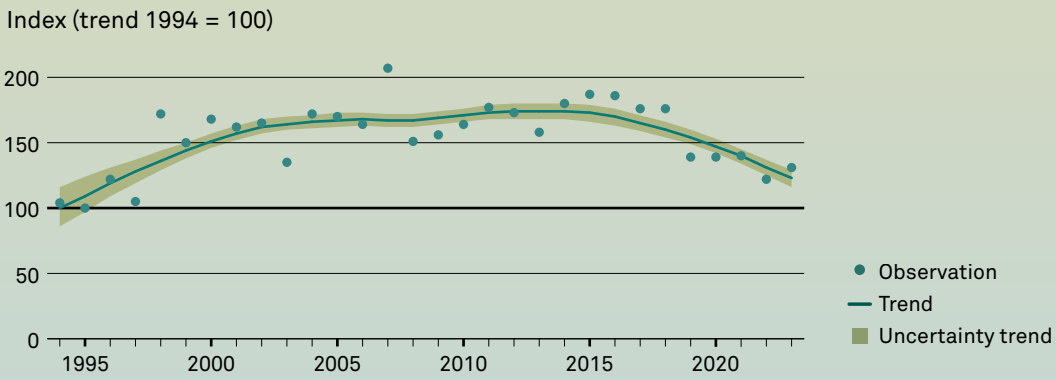
Number of species	9
Of which are non-native	2
DNA references available	9
Habitat Directive species	3
On the Red List	5 (out of 7)

Barred grass snake | Photo: William Voorberg

Description	Cold-blooded, vertebrate animals with scaly skin; almost all live on land. The Netherlands has seven native reptile species: four lizard species and three snake species.

Population trend reptiles

Period 1994-2024 | 7 species evaluated



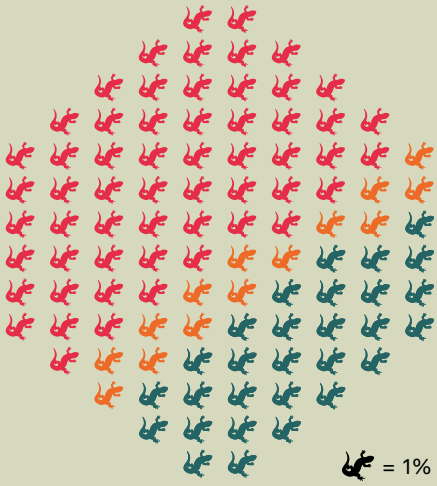
Source: NEM, RAVON/CBS, 2025 | clo.nl/nl138422

Since 1994, Dutch reptile populations have, on average, increased in both numbers and range, but a shift has become apparent over the past twelve years: population sizes are now declining. The sand lizard and the viviparous lizard, in particular, are declining sharply. The common wall lizard is an exception and is benefiting from global warming and specific conservation measures. Although earlier improvements were linked to targeted management practices, such as compost piles and connectivity corridors, the recent stagnation and decline are primarily caused by the intensification of agriculture (particularly detrimental to the viviparous lizard) and climate change. Higher temperatures lead to drought and a declining food supply (insects), putting even previously stable populations under pressure.

Red List

2023 | 7 species evaluated
71% of which are threatened or may have disappeared

- 0% disappeared
- 0% critically endangered
- 57% endangered
- 14% vulnerable
- 0% near threatened
- 29% not threatened

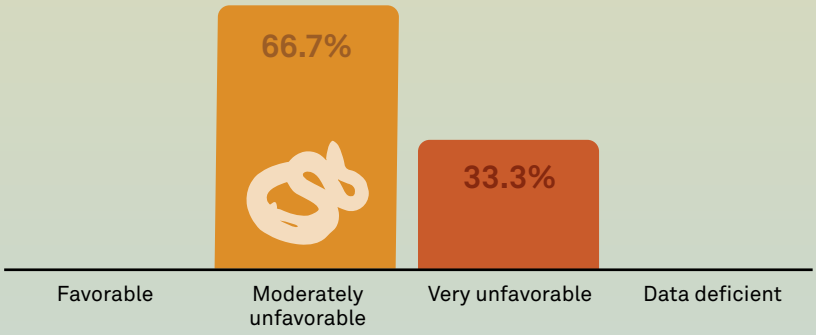


Source: clo.nl/nl105219

Of the seven reptile species, five are listed on the Red List (71%). Compared to the previous Red List of Reptiles, the common wall lizard is now less threatened and has been placed in a less critical category. The status of the other species on the list remains unchanged.

Conservation Status

Period 2019-2024 | 3 species evaluated

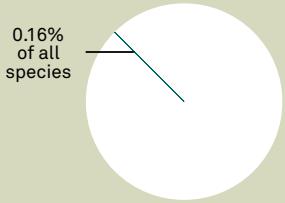


Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The smooth snake, the sand lizard, and the common wall lizard are listed under the Habitats Directive and are protected at the European level. All three show an unfavorable conservation status in the Netherlands due to a sharp decline in recent decades. Since 2000, the smooth snake has shown a decline in numbers, while the common wall lizard has actually increased sharply. The sand lizard shows an erratic pattern.

Sand lizard | Photo: Thomas Pop

Mammals



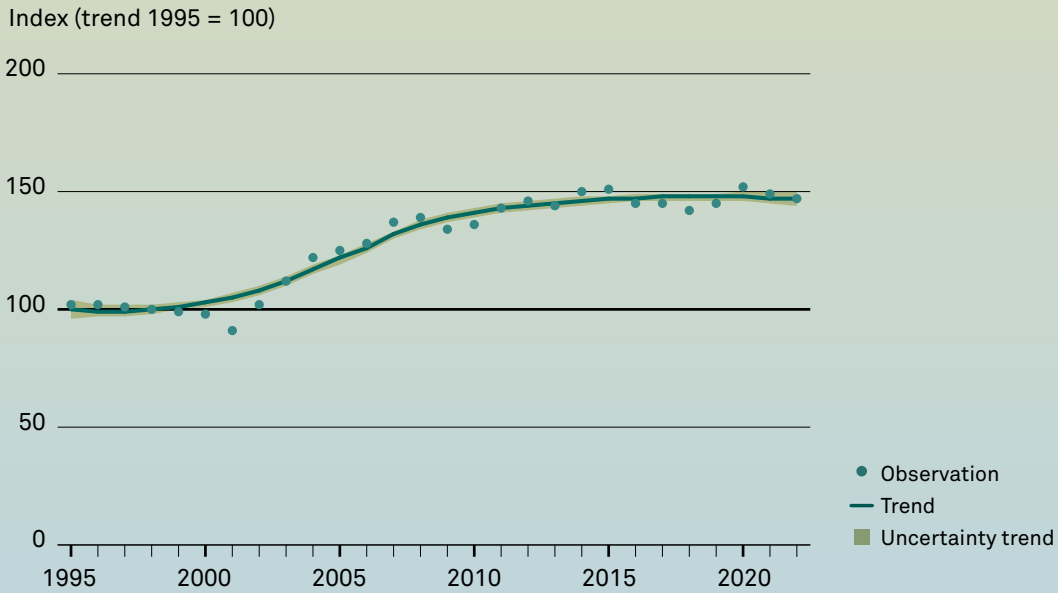
Number of species	77
Of which are non-native	10
DNA references available	71
Habitat Directive species	31
On the Red List	19 (out of 59)

Gray seal | Photo: Ton Haver

Description	Of the native mammal species in the Netherlands, three are marine mammals (harbor seal, gray seal, harbor porpoise). Additionally, incidental (marine) mammals occur.

Trends in terrestrial mammals

Period 1995-2022 | 35 species evaluated



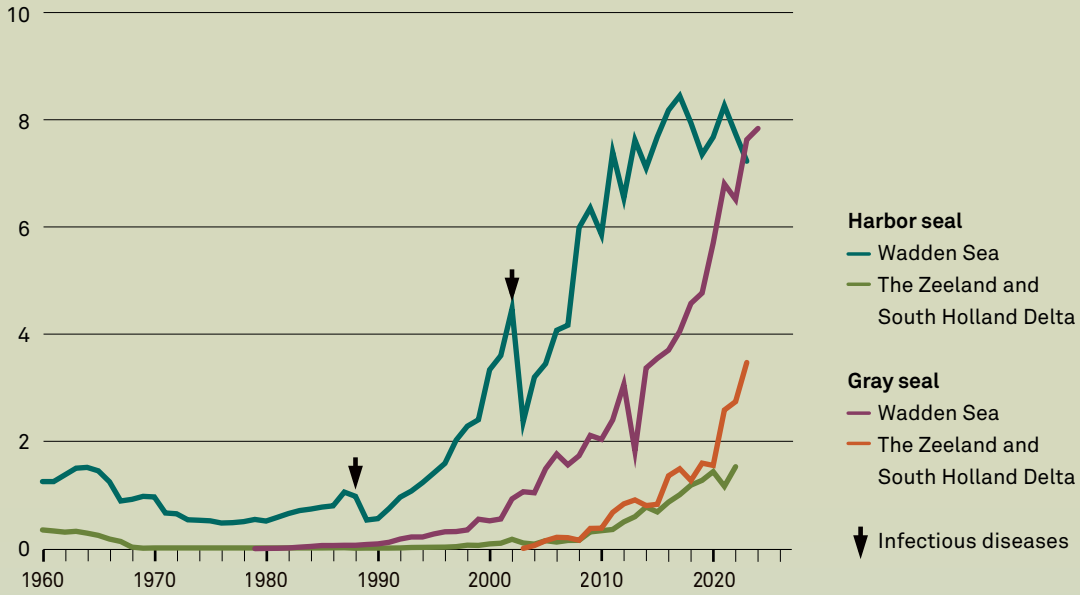
Source: NEM, Zoogdierenvereniging/CBS, 2023 | clo.nl/nl157108

The status of mammals has improved since 1990 but has stabilized since 2010. Eighteen species have increased in numbers, with significant improvements observed in species such as the otter, the beaver, the bank vole, and the long-eared bat (a bat species).

On the other hand twelve species have declined, but none of them show a significant decline. Finally, four species have remained stable, and for one species, the field mouse, the trend is unclear.

Trends seals

Period 1960-2025 | 2 species evaluated
Index (1960 = 100)



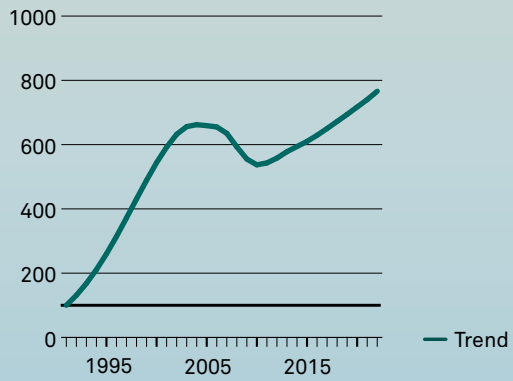
Source: WMR, Delta Projectmanagement i.o.v. RWS/Provincie Zeeland, 2025 | clo.nl/nl123122

The gray seal population has been growing steadily since 1980, mainly due to immigration from colonies in the British Isles. The harbor seal population recovered until 2013, but after a period of stagnation, this species has been declining again since 2022. The porpoise has been a regular sight since the 1990s.

Population trends porpoises in the North Sea

Period 1991-2022

Index (1991 = 100)



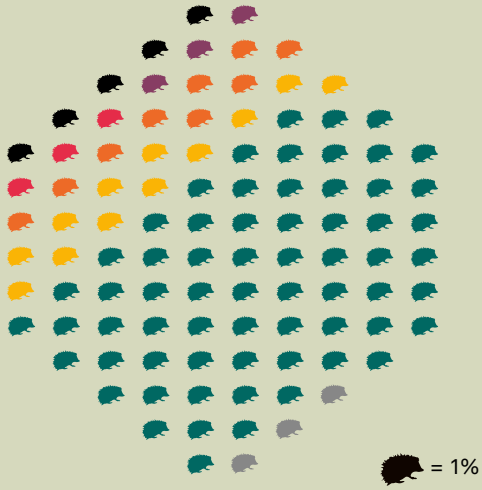
Source: Rijkswaterstaat, 2022 | clo.nl/nl125009

Harbor porpoise | Photo: Ger Meesters

Red List

2023 | 16 species evaluated
31% of which are threatened or may have disappeared

- 5% disappeared
- 3% critically endangered
- 3% endangered
- 8% vulnerable
- 12% gevoelig
- 64% not threatened
- 3% data deficient

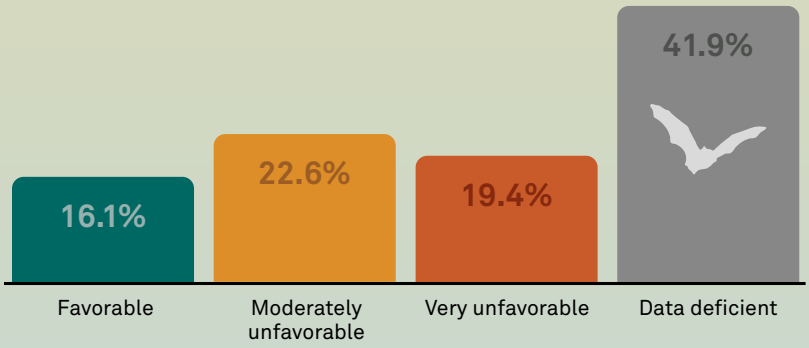


Source: clo.nl/nl105219

Bats and species that are no longer hunted are faring better. The same applies to species that benefit from improved water quality. However, mammals in agricultural areas are faring poorly, as evidenced by the fact that 11 of the 16 species living in these areas are on the Red List. The rabbit population has been in free fall since 2011, partly due to a viral disease.

Conservation Status

Period 2019-2024 | 31 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The conservation status of mammals (2019–2024) remains largely unfavorable. Although trends are showing an upward trajectory and measures are having an effect, the situation varies greatly by species. Even with a positive trend, a population or habitat may be too small to warrant a favorable assessment. As a result, many species, including terrestrial mammals and bats, remain in an unfavorable conservation status.

Harbor seal | Photo: Marion Haarsma

The Slufter | Photo: Marit Moerman

26%

of the Netherlands lies below sea level

Dune stinkhorn | Photo: Sytske Dijksen, Photo Fitis

BEACHGRASS AND FUNGI

A LINE OF DEFENSE AGAINST THE SEA

Our dunes offer natural protection against the sea. But what many people don't know is that this dune protection relies on an invisible network of fungi and biodiversity. To ensure our coastline remains resilient in the future, a deep understanding of this delicate interplay is essential.

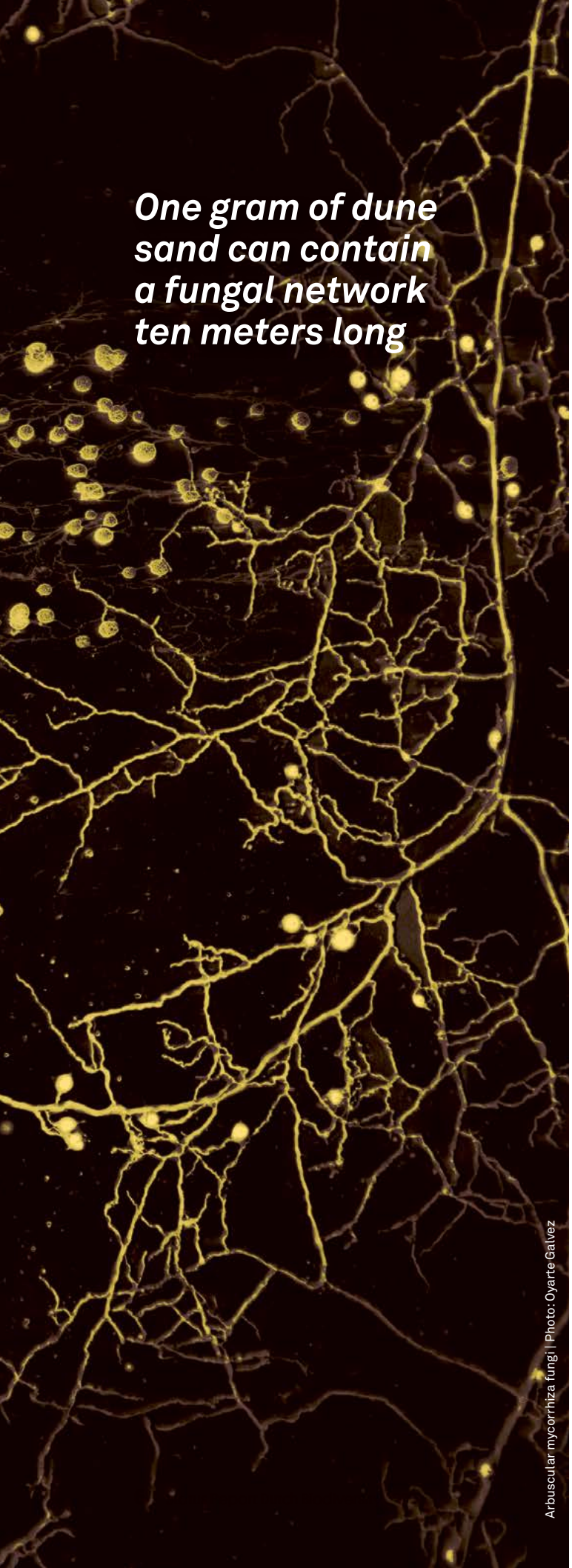
A quarter of the Netherlands lies below sea level, so protection against rising sea levels is of vital importance. Nature provides that protection in the form of a natural sea barrier: the dunes. Our dune ecosystems are well-developed systems that derive their strength and functionality largely from their natural diversity. Such well-developed dune systems are considerably rarer in other countries.

Invisible network

Both beachgrass and fungi play an important role in the ecosystem of the outer dune—the foredune. This is the part of the dunes that is almost always closed to hikers, due to its fragility. At first glance, it seems as though sea holly grows in the dunes, but in fact the dunes are formed by sea holly. Or, more precisely, by the fungi and mycorrhizal organisms found in the soil beneath sea holly plants. Sea holly roots live in symbiosis with so-called arbuscular mycorrhizal fungi, which are essential for acquiring nutrients in this extremely nutrient-poor environment.
These fungi, in particular, form an extensive network in the soil and turn the dunes into a robust line of defense. A single gram of dune sand can contain a fungal network stretching ten meters or more. The fungal hyphae, which obtain their carbon and energy from the beachgrass roots, effectively bind the sand grains together, allowing the dunes to grow in height and preventing them from blowing away. They also defend the beachgrass against predators, such as parasitic nematodes and harmful fungi.

Symbionts and decomposers

Arbuscular mycorrhizal fungi belong to the "symbionts," a category of fungi that have a mutually beneficial relationship with plants. Such symbionts are also found in trees, where they produce visible fruiting bodies—mushrooms. However, the symbiotic fungi in the dunes are not visible and consist only of microscopic spores (less than 0.1 mm) in the soil. Identifying the different species is difficult, because many fungi in our dunes are still unknown. We also do not yet have sufficient knowledge of the composition of this fungal community in neighboring countries. Identification is best done using DNA-based techniques (barcoding).



Arbuscular mycorrhiza fungi | Photo: Oyarte Galvez

It is not only these "cohabitants," however, that help stabilize the dunes. There are also the "decomposers": fungi that break down dead organic matter, in this case primarily the dead beachgrass roots. They play a similar role in protecting the land behind the dunes.
Many species of mushrooms also occur in the outer dunes, a number of which (approx. 20) live exclusively in this environment. One example is the "dune stinkhorn." The fact that the connection between fungi, beachgrass, and dunes has long been known is evident from their names: many species include the terms "beach" (14 species), "dune" (33 species), or "sand."

Research and management

For several years now, a monitoring program has been underway to count the populations of a number of specific dune fungi in the coastal dune area, but since this project is still in its early stages, no reliable figures are available yet. It is therefore too early to assess any changes in biodiversity. However, the project has already led to the discovery of new species, including a species of coral fungus.
Due to rising sea levels, it is sometimes advisable to give nature a helping hand through beach nourishment. This allows new dunes to form, a process that the sea holly and its mycorrhizal partners actively promote. For the "decomposers," however, beach nourishment may mean that the dead roots are buried deeper in the sand. This could have a (short-term) negative effect. Long-term research therefore remains necessary.

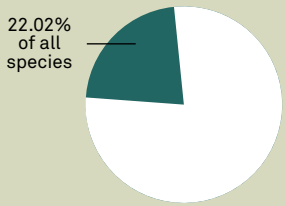
Future-proof

Due to the extreme environment in the coastal strip, the fungi found there are stress-tolerant. Pressure factors such as nitrogen deposition or climate change are expected to play a limited role in any changes to biodiversity.
It is clear that preserving the coastal strip as a line of defense against the sea goes hand in hand with preserving biodiversity in the dunes. Biodiversity here is not a luxury, but an essential part of how our dune ecosystems function. By fully understanding this complex interplay between plants, fungi, and sand, we can better support our natural line of defense and ensure its long-term sustainability.

Thomas W. Kuyper
Wageningen University

Dune brittlestem | Photo: Sander Pieterse

Fungi and mushrooms



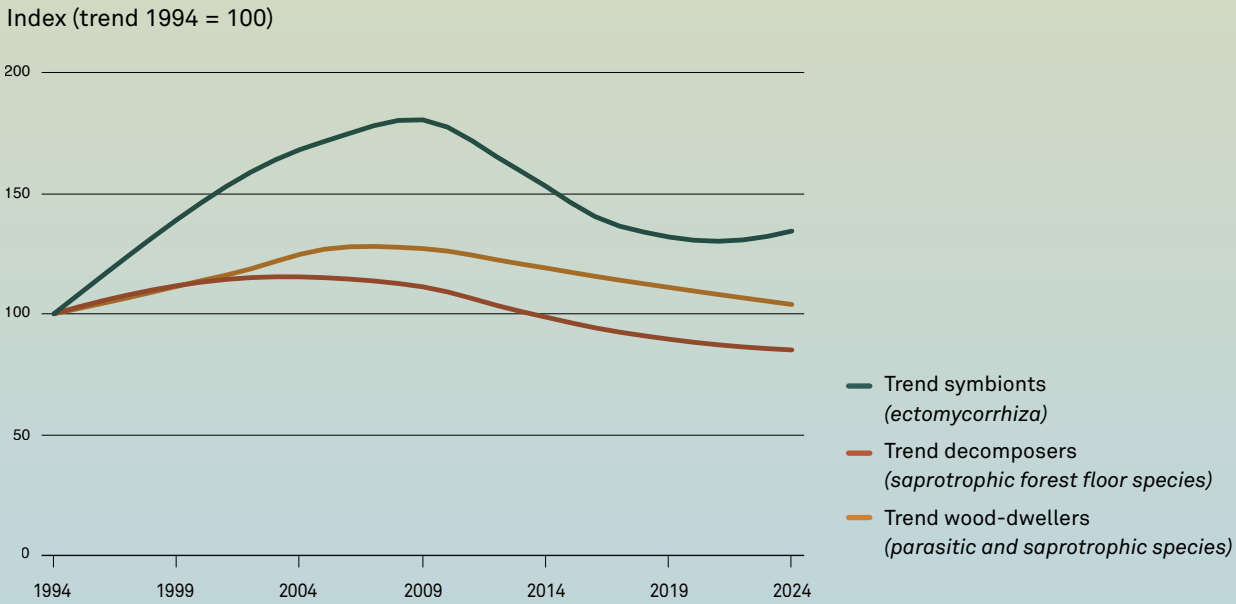
Number of species	approx. 10,600
Of which are non-native	230
DNA references available	4,808
Habitat Directive species	0
On the Red List	1,619 (out of 3,625)

Anthina flammea | Photo: Luuk Vermeer

Description	This group consists of approximately 6,300 macrofungi (mushrooms) and 4,300 microfungi. Microfungi are smaller than one millimeter; their fruiting bodies are indiscernible to the naked eye.

Distribution trends of forest mushrooms

Period 1994 - 2024 | 119 species evaluated



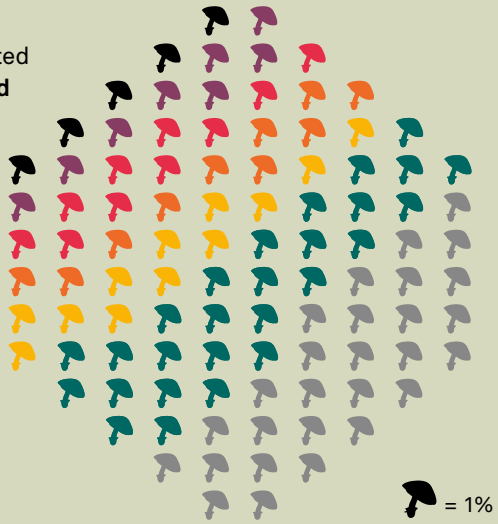
Source: CBS, NEM, Paddenstoelenonderzoek Nederland, 2026 | clo.nl/nl139013

Following a period of recovery between 1994 and 2010, the distribution of forest mushrooms has declined by one-fifth over the past fifteen years. Macrofungi (mushrooms) are a sensitive indicator of biodiversity because they respond directly to environmental changes. Environmental measures in the 1990s led to a reduction in emissions of substances such as sulfur dioxide, ammonia, and nitrogen oxides, allowing the distribution of forest mushrooms to recover. The current decline is linked to stagnating nitrogen reduction efforts and dry summers.

Red List

2009 | 3,625 species evaluated
45% of which are threatened or may have disappeared

- 5% disappeared
- 8% critically endangered
- 10% endangered
- 10% vulnerable
- 12% near threatened
- 27% not threatened
- 28% data deficient



Source: clo.nl/nl105219

Of the 3,625 mushroom species assessed, 1,448 are listed on the Red List because they are threatened to varying degrees. Additionally, 171 species have disappeared from the Netherlands, and there is insufficient data for more than a quarter (1,001) of the species.

Invisible microfungi

The state of biodiversity among Dutch microfungi is difficult to assess due to a significant gap in our knowledge. Although these organisms are present everywhere in the soil, water, and air, as well as in plants and trees, they often go unnoticed because of their microscopic size. Worldwide, there are an estimated 3.8 million species (including mushrooms), of which approximately 200,000 have been described to date. Additionally, about 2,000 new species are discovered each year.

In the Netherlands, new, undescribed species are constantly being discovered using advanced techniques such as DNA metabarcoding and laboratory isolation. This is a complex and labor-intensive task, which means that a large part of the Netherlands' fungal diversity remains hidden.

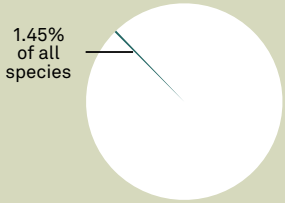
Why we keep discovering

In 2024 it became clear that we are still far from fully understanding nature. Thanks to thorough taxonomic research for Flora Agaricina Neerlandica—the "bible" for mycologists—no fewer than sixteen new mushroom species have been described from the Netherlands.
By combining physical characteristics (morphology) with modern DNA barcodes, citizen scientists, working alongside professional scientists, discovered new species of webcaps (*Cortinarius*) and various russulas. These discoveries underscore that biodiversity is constantly evolving and that there is still much to discover regarding fungi. Both webcaps and russulas are crucial because they provide trees with water and minerals in exchange for sugars. This symbiosis between trees and fungi demonstrates the complexity and ingenuity of nature, and gives our forests the resilience they need to survive.

Jorinde Nuytinck,
Naturalis Biodiversity Center

Variable webcap | Photo: Wijnand van Buuren

Bryophytes

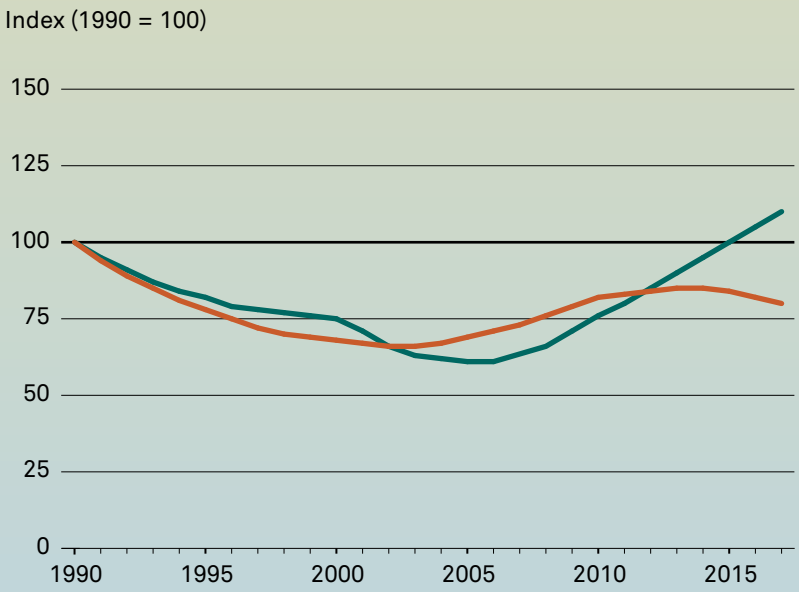


Number of species	approx. 700
Of which are non-native	10
DNA references available	551
Habitat Directive species	4
On the Red List	246 (out of 517)
Description	Small, non-flowering land plants without vascular bundles. The three main groups (mosses, liverworts, and hornworts) are collectively referred to as bryophytes.

Pincushion moss | Photo: Chris Geris

Distribution trends of pincushion moss and sphagnum mosses

Period 1990 - 2017



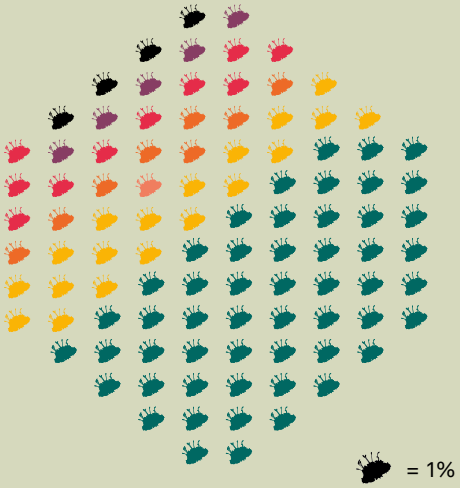
The distribution trend of pincushion moss shows a decline between 1990 and 2017, followed by an increase starting in 2006; however, according to recent data (clo.nl/nl108514), the trend over the period 1999–2022 is negative overall. The trend for sphagnum mosses is stable over the period 1990–2023, with a recent increase.

Source: NEM, BLWG /CBS, 2018 | clo.nl/nl155603

Red List

2012 | 517 species evaluated
48% of which are threatened or may have disappeared

- 4% disappeared
- 5% critically endangered
- 10% endangered
- 8% vulnerable
- 20% near threatened
- 52% not threatened

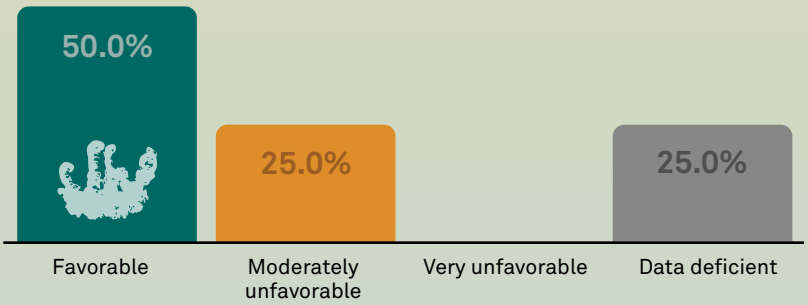


Source: clo.nl/nl105219

Of the 517 species studied, 246 (48%) are on the Red List because they are threatened to varying degrees. The main threats are fertilization and desiccation, which are causing species in nutrient-poor and in wet habitats, in particular, to decline.

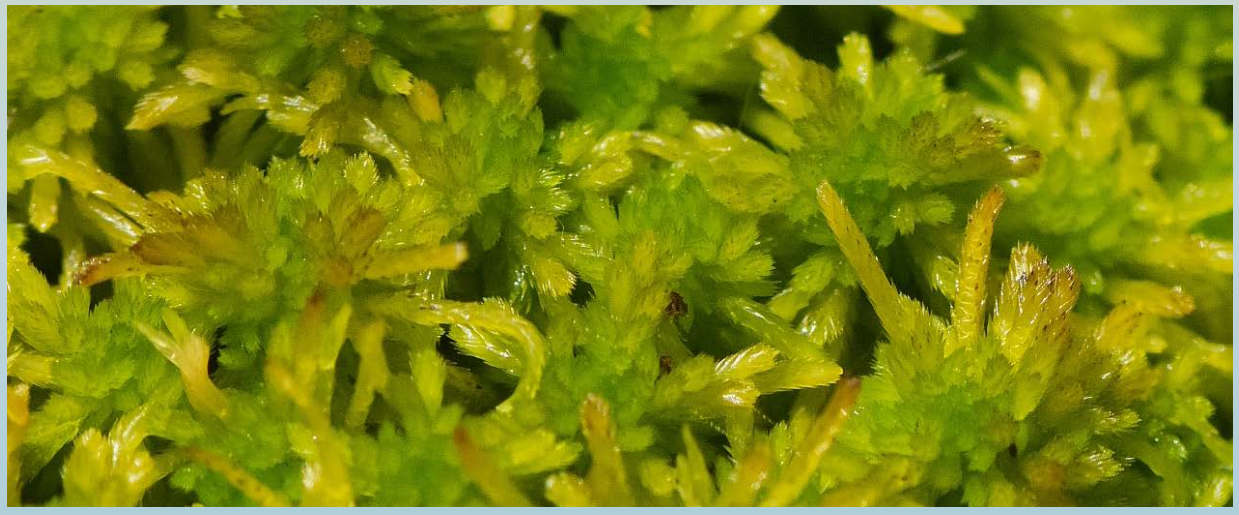
Conservation Status

Period 2019-2014 | 3 species and sphagnum mosses (30 species) evaluated



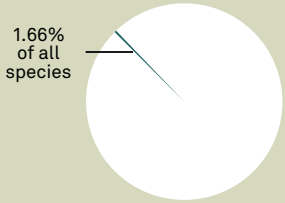
Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The conservation status for varnished hook-moss has improved to favorable in the recent report (it was moderately unfavorable for 2013–2018). For sphagnum mosses, the conservation state has remained favorable. For pincushion moss, the conservation status is moderately unfavorable for the period 2019–2024, and insufficient data was available to calculate the conservation status for Roger's bristlemoss.



Sphagnum moss | Photo: Wijnand van Buuren

Lichens



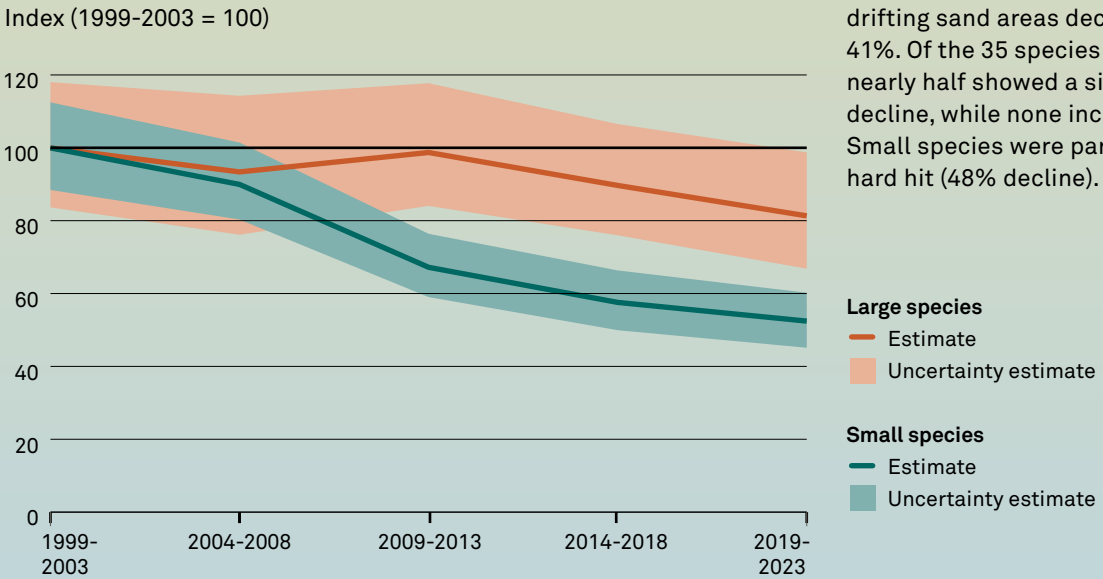
Number of species	approx. 800
Of which are non-native	13
DNA references available	518
Habitat Directive species	5 (species of reindeer lichen)
On the Red List	398 (of 727)
Description	Lichen is not a plant but a composite organism consisting of a fungus and an alga (and/or cyanobacterium) living together in symbiosis.

Green reindeer lichen | Photo: Maarten Immerzeel

Trends in lichens on heathland and drifting sand

Period 1999 - 2023 | 35 species evaluated

Between 1999 and 2023, lichen coverage in heathland and drifting sand areas decreased by 41%. Of the 35 species studied, nearly half showed a significant decline, while none increased. Small species were particularly hard hit (48% decline).



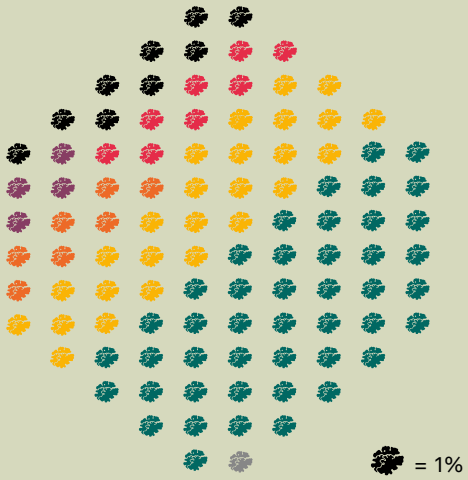
Source: NEM, BLWG/CBS, 2025 | clo.nl/nl114507

Causes include high nitrogen deposition on the soil or in the water. Nitrogen stimulates the growth of an invasive moss species, heath star moss, which displaces the lichens. Climate change, spontaneous forest development (the emergence of forest without human planting), and a decrease in wind strength are causing the disappearance of bare or sparsely vegetated sandy soils. Without intensive nature management, the habitat becomes overgrown with grass and shrubs, putting the unique lichen vegetation under pressure and risking its disappearance.

Red List

2022 | 727 species evaluated
54% of which are threatened or may have disappeared

- 9% disappeared
- 4% critically endangered
- 8% endangered
- 7% vulnerable
- 26% near threatened
- 45% not threatened
- 1% data deficient

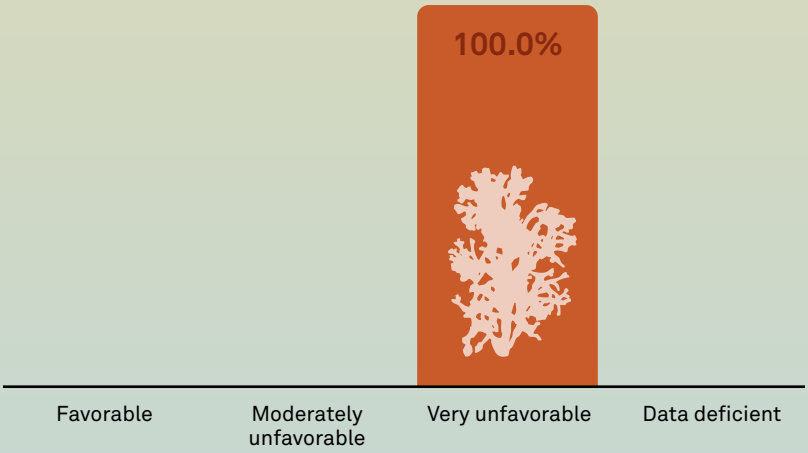


Source: clo.nl/nl1052

Of the 727 species studied, 389 (54%) are listed on the Red List because they are threatened to varying degrees. The main threats are nitrogen deposition, habitat loss, and climate change. In particular, species that live on low-calcium stones on dikes and dolmens, and species that live in oak forests and on isolated trees with acidic bark, have recently declined.

Conservation Status

Period 2019 - 2024 | 5 species of reindeer lichen evaluated

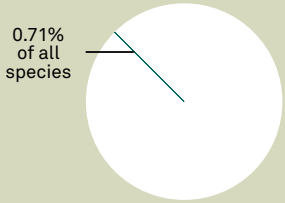


Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The conservation status of reindeer lichen has shifted from moderately unfavorable (Conservation status 2013–2019) to very unfavorable. Two of the five assessed species have not been observed in the Netherlands for a long time. The other three belong to the large species found in heathland and drifting sand, and the trend also declined in the period 2009–2023 (see trend graph).

Common powderhorn | Photo: Wijnand van Buuren

Birds



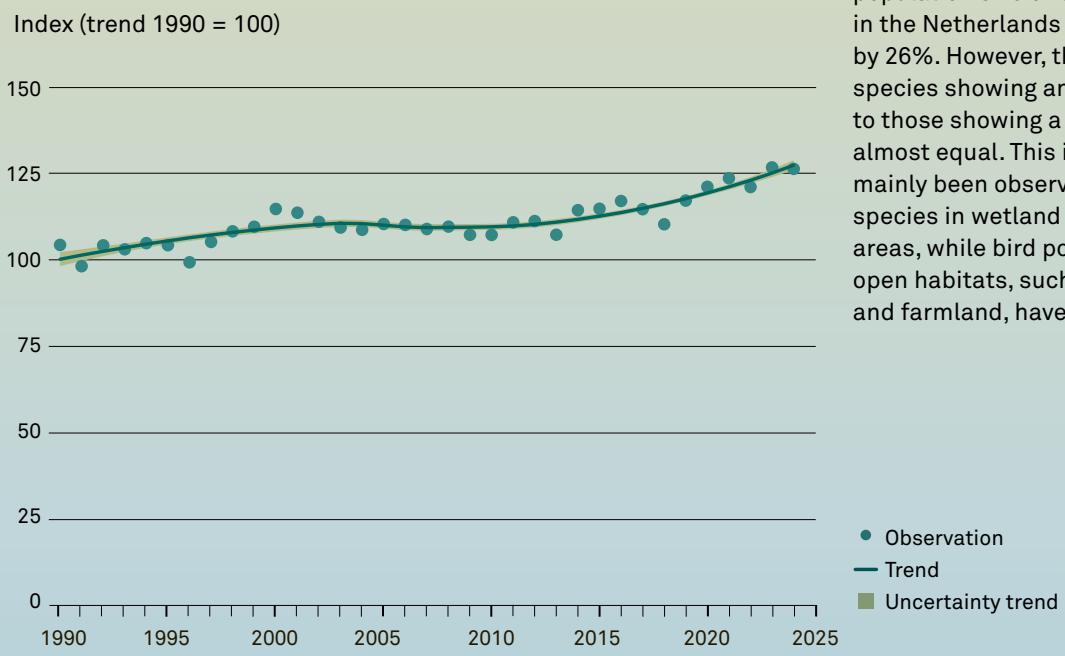
Number of species	341
Of which are non-native	19
DNA references available	215
Habitat Directive species	190 breeding birds, 18 passage migrants, and 86 winter residents
On the Red List	87 (out of 196)

Pied Avocet | Photo: Marit Moerman

Description	The Netherlands has 209 species of breeding birds as well as 132 species of passage migrants and winter visitors. In addition, vagrants and incidental non-native species occur. It is a well-studied group.

Population trend breeding birds

Period 1990-2024 | 185 species evaluated

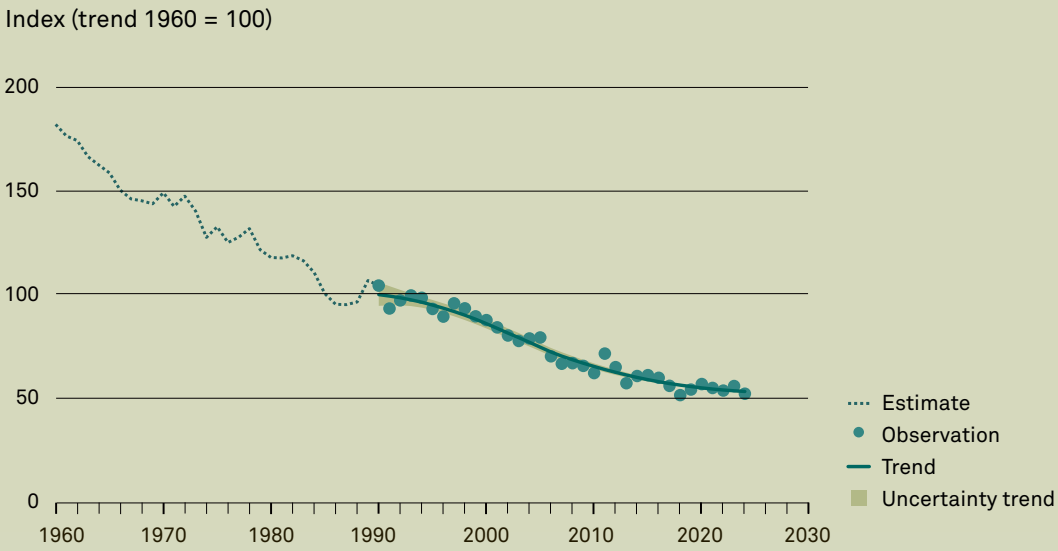


Since 1990, the average population size of breeding birds in the Netherlands has increased by 26%. However, the ratio of species showing an increase (89) to those showing a decline (82) is almost equal. This increase has mainly been observed among new species in wetland and forest areas, while bird populations in open habitats, such as heathland and farmland, have declined.

Source: NEM, SOVON /CBS, 2025 | clo.nl/nl138120

Population trend farmland birds

Period 1990-2024 | 27 species evaluated



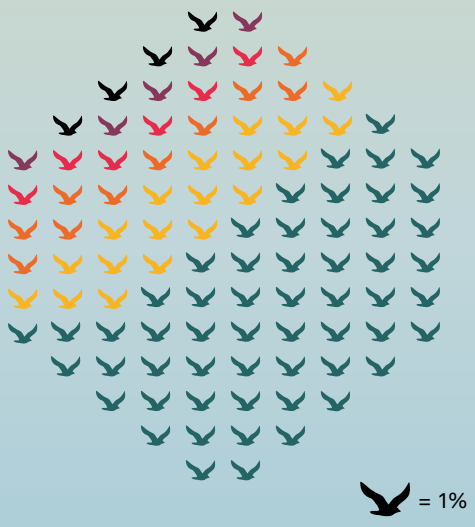
Source: NEM, SOVON/CBS, 2025 | clo.nl/nl147916

Since 1960, the population of typical breeding birds in agricultural areas has declined by an average of over 70%. Open farmland species, such as the black-tailed godwit and the northern lapwing, have been particularly badly affected. Their numbers have fallen by 85% since 1900 due to intensive farming and land cultivation (including mowing), and predation and habitat loss caused by urban expansion and infrastructure development. In contrast, the decline in birds inhabiting scrubland and farmyards has leveled off thanks to increased greening along roads and around farmyards.

Red List

2016 | 196 species evaluated
44% of which are threatened or may have disappeared

- 4% disappeared
- 5% critically endangered
- 6% endangered
- 10% vulnerable
- 19% near threatened
- 56% not threatened

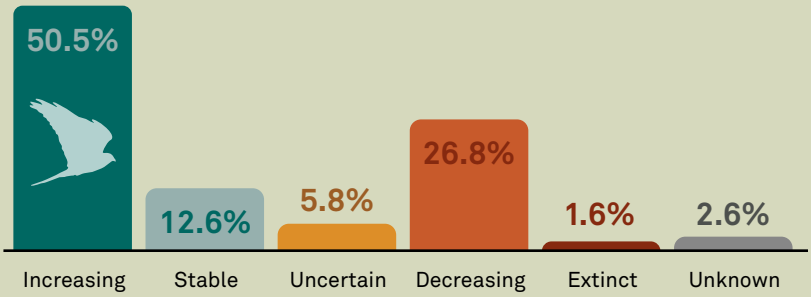


Source: clo.nl/nl105219

Of the bird species assessed, 44% are listed as threatened due to varying degrees of endangerment. These are primarily farmland birds, such as the black-tailed godwit and the Eurasian skylark, that are struggling due to intensive agriculture and habitat loss.

Population trend breeding birds Birds Directive

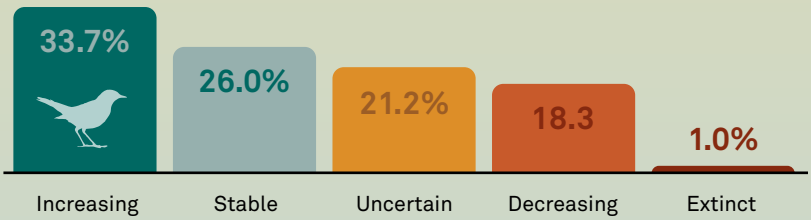
Periode 2019 - 2024 | 190 species evaluated



The 2019–2024 Birds Directive Report provides a mixed outlook on Dutch bird populations. While 50% of breeding birds show a positive short-term trend, 41% of species have declined in the long term. Some species, such as the crested lark and the tawny pipit, no longer breed in the Netherlands. Trends are more favorable for winter visitors and migrants.

Population trend non-breeding birds Birds Directive

Period 2019 - 2024 | 104 species evaluated



A major threat is nitrogen deposition from agriculture. Other threats include water management, such as desiccation, infrastructure development, and the impact of avian influenza. Although conservation measures in Natura 2000 areas are effective, pressure in agricultural areas remains high. Additional measures regarding land use and water restoration are essential for many species to ensure a favorable population status.

Source: Vogelrichtlijnrapportage 2019-2024 van Nederland status en trends van soorten | Sovon Vogelonderzoek. pub.sovon.nl/pub/publicatie/22616

NEW DISCOVERIES

Searching for species at sea

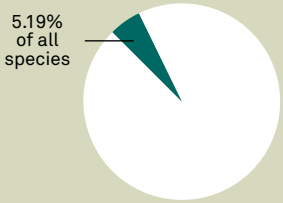
Due to the vast expanse and inaccessibility of the North Sea, researchers use a standardized method to survey bird populations. Counts are conducted by airplane, systematically recording the presence and density of seabirds along a fixed grid. This data is then extrapolated to cover the entire area.
This takes place six times a year along the coast and four times a year over the open sea. The Natura 2000 areas are also surveyed separately and in greater detail. The counts are conducted as part of the MWTL (Waterstaatkundige Toestand des Lands: Hydrological Status of the Country) and NEM (Network Ecological Monitoring) programs. Finally, the aerial observations are supplemented with precise ship-based counts by Wageningen Marine Research. This creates a comprehensive picture of bird diversity on the open sea.

Sovon Bird Research Netherlands

Razorbills | Photo: Louis Westgeest

European herring gull | Photo: Claudia Schutte

Vascular plants



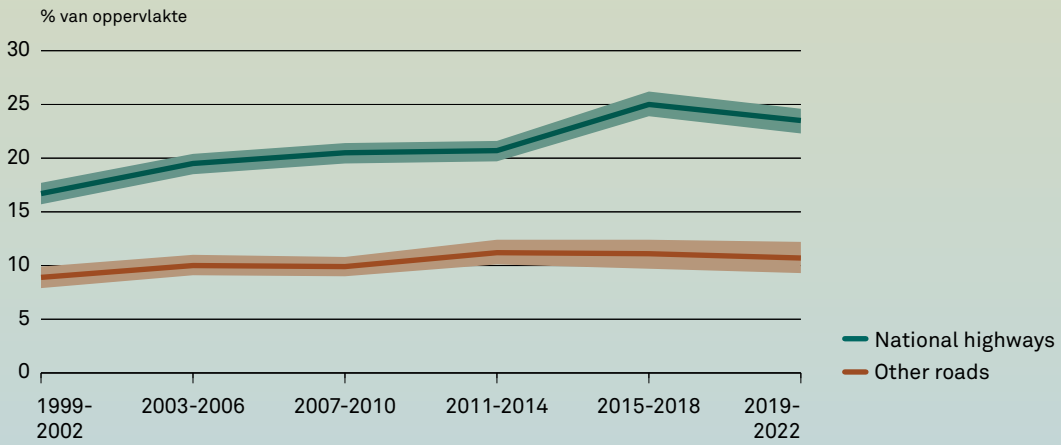
Number of species	approx. 2,500
Of which are non-native	approx. 1,000
DNA references available	1,578
Habitat Directive species	5
On the Red List	530 (out of 1,432)
Description	Plants with a vascular system for transporting water and nutrients. These include trees, shrubs, ferns, clubmosses, and horsetails.

Water mint | Photo: Fleur van Duin

Tall-herb species on roadside verges

Period 1999-2022

Index (trend 1999 = 100)



Source: LMF (CBS, RWS, provincies), 2025 | clo.nl/nl143306

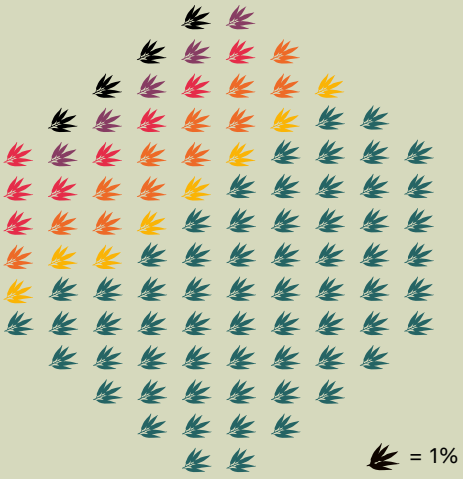
The vegetation on Dutch roadside verges shows a clear trend toward scrub encroachment. The dominance of certain "tall-herb species" is increasing. At the same time, herbaceous plant cover is decreasing. Scrub encroachment is a process in which fast-growing, tall-growing species (such as field thistle and blackberries) gain the upper hand, often at the expense of biodiversity.

Causes include high nutrient levels and milder winters due to climate change, which lengthen the growing season. Mowing and removal practices are insufficient to ensure the necessary nutrient depletion, resulting in roadside verges becoming less flower-rich and vegetation height increasing.

Red List

2012 | 1,432 species evaluated
37% of which are threatened or may have disappeared

- 4% disappeared
- 5% critically endangered
- 8% endangered
- 12% vulnerable
- 8% near threatened
- 63% not threatened

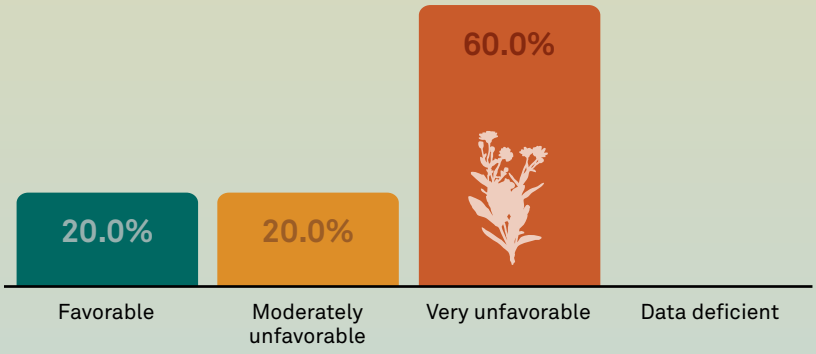


Source: clo.nl/nl105219

In 2012, 33% of the assessed species were struggling, and 4% had disappeared. At the same time, non-native species (mostly introduced by humans) and species benefiting from global warming increased. Ecologically speaking, these new species do not compensate for the loss of threatened Dutch flora. Some even pose problems for nature or water management. A revised Red List is still pending.

Conservation Status

Period 2019-2024 | 4 species and clubmoss (5 species) evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

Only a few species are listed under the European Habitats Directive. Their status varies: the inundated clubmoss benefits as a pioneer of nature restoration (turf cutting), but the blue clubmoss suffers from habitat destruction, air pollution, and disrupted soil fungi. The fen orchid suffers from drainage and the overgrowth of open dunes or marshes (succession). Although restoration efforts are achieving local successes, vulnerable species remain under pressure from environmental pollution and desiccation.

NEW DISCOVERIES

Welcome back!

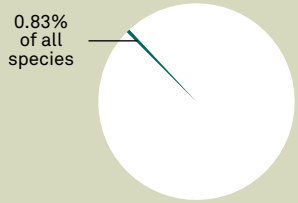
In the past year, two species thought to be extinct have been rediscovered in our country: yellow flatsedge and willowleaf lettuce. Willowleaf lettuce grows in dry areas and used to grow mainly on dikes in the Zeeland coastal region. It is possible that the species was overlooked for years, but its return also fits a trend: willowleaf lettuce has recently been rediscovered in Belgium as well. The return of yellow flatsedge is likely due to the creation of "new nature," such as open terrain with relatively nutrient-poor soil, or wet areas that are flooded in winter. More species, including those on the Red List, seem to be benefiting from these nature restoration measures.

Leni Duistermaat,
Naturalis Biodiversity Center

Willowleaf lettuce | Photo: Philmarin

Ribwort plantain | Photo: Getty Images

Flatworms



Number of species	approx. 400
Of which are non-native	8
DNA references available	188
Habitat Directive species	-
On the Red List	4 (out of 13)

Blue-spotted land planarian | Photo: Arnold Wijker

Description	A diverse group of worms characterized by a smooth and shiny body. These can be flat or round. They live in fresh and saltwater and on land

Red List

2003 | 13 species evaluated
31% of which are threatened or may have disappeared

- 0% disappeared
- 0% critically endangered
- 15,5% endangered
- 15,5% vulnerable
- 0% near threatened
- 54% not threatened
- 15% data deficient

Source: clo.nl/nl105219

Flatworms have only been studied to a limited extent. Many new species are still expected to be discovered, particularly in the marine meiofauna (among sand grains in the sea). Freshwater and terrestrial flatworms have been better documented. Of the thirteen assessed freshwater flatworms, four are on the Red List. This underscores the vulnerability of native populations. It is also clear that since 2012, the number of non-native terrestrial flatworms reported in the Netherlands has been increasing, primarily due to the trade in (potted) plants.

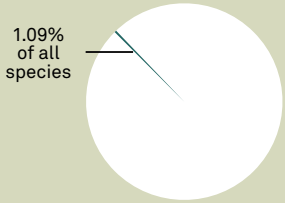
Monitoring

For several years, scientists from Radboud University and EIS Kenniscentrum Insecten have been working to gain insight into the spread and potential effects of non-native terrestrial flatworms in the Netherlands. They do this with the help of citizen scientists who report their observations on Waarneming.nl.

List of Invasive Alien Species of Union concern

Four land flatworms are listed on the European Union List of Invasive Alien Species. Two of these have not yet been found in the Netherlands, and the third has only been found in greenhouses. However, the Obama flatworm is spreading rapidly and has been found in gardens on multiple occasions. Because these invasive species eat earthworms, they pose a threat to soil fertility and local ecosystems.

Segmented worms



Number of species	525
Of which are non-native	12
DNA references available	439
Habitat Directive species	1 (European medicinal leech)
On the Red List	-


European medicinal leech | Photo: M. Vos-Jaspers

Description A group of segmented worms living in terrestrial soils and in fresh and saltwater sediments. This group includes saddle-bearing worms (such as earthworms, potworms, and leeches) and bristle worms, which live primarily in the sea.

Earthworms and potworms

Both earthworms (approx. 30 species) and potworms (approx. 100 species) play an important role in soil health. The highest numbers of earthworms and potworms (*Enchytraeidae*) are found in well-maintained grasslands, but there is insufficient data to determine their overall status. Earthworms are, however, monitored as an indicator of soil health and foraging value for meadow birds; they promote water permeability and are a protein-rich food source for meadow birds. This is primarily done by the Louis Bolk Institute. Potworms promote the decomposition of organic matter and, unlike earthworms, are highly resistant to soil acidification. Potworms are not monitored.


Gray worm | Photo: John van den Brink

Bristle worms

Since 1989, the total number of bristle worms in the North Sea, the Southern Delta, and the Wadden Sea has declined, although this may vary by species. The status of species is primarily influenced by the quality of the seabed and the impact of fishing (such as bottom trawling). Most species live in sediment where they drive seabed processes. Within the five marine Natura 2000 habitat types designated in Dutch waters, bristle worms are among the most important *characteristic* species of this area. Monitoring data is primarily collected by the Dutch Ministry of Infrastructure and Water Management.


Purple fan-worm | Photo: Marion Haarsma

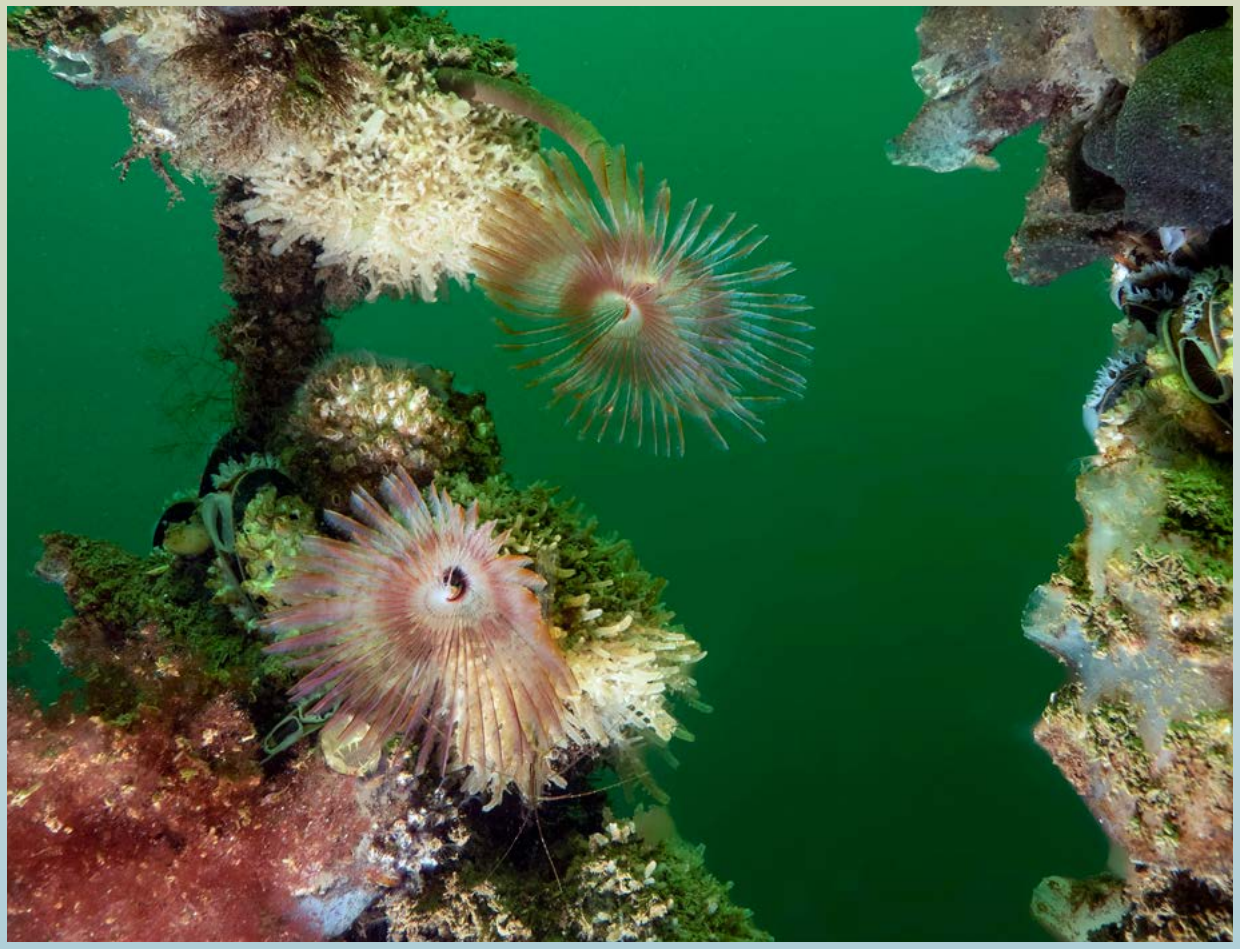
Conservation Status

Period 2019-2024| 1 species evaluated (European medicinal leech)

Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

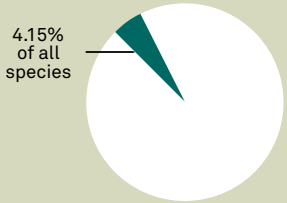
One protected leech

The Netherlands is home to 31 leech species, one of which—the European medicinal leech—is protected under the European Union's Habitats Directive. The species has declined sharply due to habitat destruction and intensive harvesting for medicinal purposes. Today, it is used in the production of the anticoagulant hirudine and in plastic surgery.



Peacock worm | Photo: Marion Haarsma

Nematodes



Number of species	approx. 2,000
Of which are non-native	50
DNA references available	418
Habitat Directive species	-
On the Red List	-

Nematode | Photo: Getty Images

Description Nematodes are roundworms (also known as eelworms) that are very important in the food web of soil and aquatic sediments. Due to their diversity, they are excellent bioindicators.

Distribution unknown

Although a great deal of research has been conducted on nematodes in the Netherlands, there is no comprehensive overview of their distribution. Using DNA techniques, new species are still regularly being discovered in the Netherlands. Due to climate change, there appears to be an influx of species new to the Netherlands from southern Europe. Some species cause serious damage to agriculture and horticulture. To limit this damage, farmers regularly have their soils tested for nematodes. The EU enforces strict rules regarding which nematodes are not permitted in agricultural soils or products. In the Netherlands, the NVWA (Dutch Food and Consumer Product Safety Authority) oversees this.

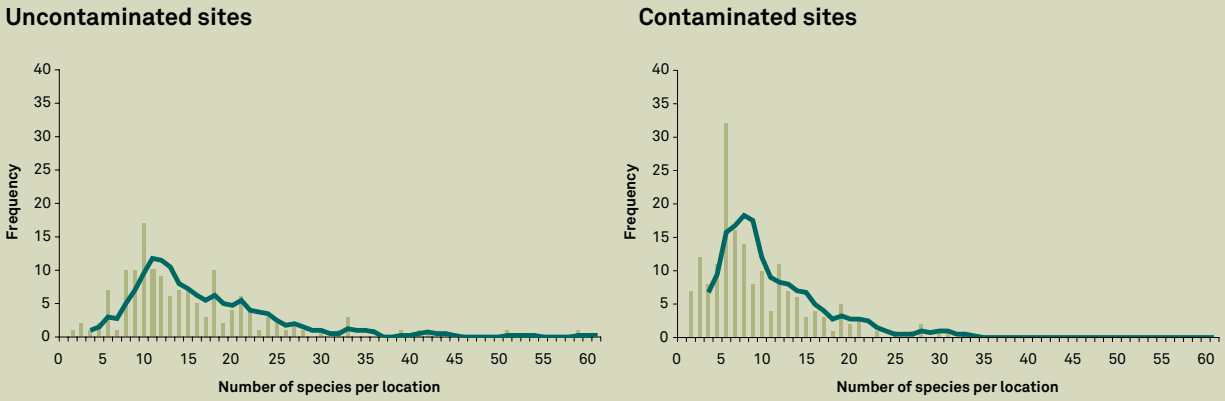
Originally aquatic animals

Nematodes are also found in aquatic sediments. They are even found in the most polluted sediments. Rijkswaterstaat (Ministry of Infrastructure and Water Management) has developed an assessment tool for freshwater sediments to evaluate sediment quality using nematodes. Most species found in freshwater sediments also occur in terrestrial soils. Only a small number of species are strictly confined to freshwater sediments or very wet soils. The situation is different for marine sediments. The species found there are not found in terrestrial soils; however, there are species that live in brackish water sediments.

Important for the soil food web

Nematodes are important in the soil food web. Species that feed on other organisms take up more nitrogen than they need. This excess nitrogen is released and becomes available to plants and bacteria. They also influence the growth and biomass of the fungi and bacteria they consume. Nematodes are therefore important for the proper functioning of ecosystem services and soil biodiversity.

Comparison of nematode diversity in clean and contaminated sand sediments



Source: Rijkswaterstaat working document 2004.039x

Comparison of the number of nematode species at clean and contaminated sandy sites. The x-axis shows the number of species (taxa), and the y-axis shows the number of sites where this number of species was found. The solid black line represents the moving average of four sites at a time. Higher numbers of species are found more frequently at the clean sites.

NEW DISCOVERIES

A new indicator for the seabed?

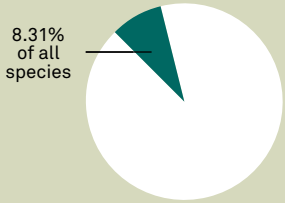
Marine nematodes are microscopic worms that live in the seafloor sediment and make up a major part of marine biodiversity. They deserve attention because they are not only abundant and diverse, but can also serve as indicators of the ecosystem's condition. In recent research, scientists used nematode DNA from around offshore platforms in the North Sea to develop a new, nematode-based ecological quality index called nema-gAMBI. Because this index closely reflects pollution gradients, marine nematodes show strong potential as a new tool for monitoring biodiversity and environmental quality.

Jan Macher,
Naturalis Biodiversity Center

Nematode | Photo: Arjan Portengen

Diatoms | Photo: SGetty Images

Microalgae



Number of species	approx. 4,000
Of which are non-native	10
DNA references available	-
Habitat Directive species	-
On the Red List	-

Desmid | Photo: Mario Renden

Description

Microalgae comprise various taxonomic groups (generally single-celled organisms). Diatoms (siliceous algae) are the largest group (approximately 2,245 species in fresh/brackish water). The total number is greater than has been recorded to date.

Assessment of water quality: algae

Water Framework Directive 2024

Source: IHW (Water Boards, IWS), edited by the PBL | www.clo.nl/nl142006

Biological water quality, based on the presence of phytoplankton (algae), aquatic plants, fish, and macrofauna (insects), shows a slow upward trend between 2015 and 2024. However, only 15% of water bodies meet the desired quality standards under the Water Framework Directive, meaning a significant effort is needed to achieve the 2027 targets.

Microalgae are a type of phyto-plankton, the plant component of plankton that performs photosynthesis. The largest group, diatoms, play an important role as a biological indicator of water quality because they respond quickly to changes in their environment. In flowing waters, diatoms are monitored nationwide in accordance with the Water Framework Directive. In standing waters, this is more often done on a project basis.

500,000

dives are made in the Oosterschelde every year

Tompot blenny | Photo: Marion Haarsma

HARD SUBSTRATE

OPPORTUNITIES IN THE OOSTERSCHELDE

Hard substrate is important for biodiversity. Many species settle on this hard surface. However, just as in the open sea, biodiversity in the Oosterschelde is declining due to changes in the seabed, materials used by humans, and competition from newcomers.

Originally, the seabed of our river delta consisted of sand and finer sediment particles, but over the centuries humans have added all kinds of hard and solid materials, such as stones for dikes, steel from shipwrecks, and materials used for piers and jetties. This so-called hard substrate enriches biodiversity. Animals and plants settle on the solid materials, where they are able to mate as well as find food and shelter.

Consequently, there is a great diversity of species on and around the underwater banks of the Oosterschelde, which attracts many divers. In this Natura 2000 nature reserve, no fewer than half a million dives are made each year.

However, despite the area's protected status, its species composition has changed over the past thirty years. In 2025, Statistics Netherlands (CBS) published the trend analysis results of diving surveys (including those from the Underwater Shore Monitoring Project, in which "citizen" scientists systematically collected underwater observations), which show that there have been significant changes in species occurrence in the Oosterschelde (CLO156302). Based on these trends, the ecological functions in the Oosterschelde (such as its role as a nursery, food source, and shelter for many species) appear to have deteriorated.

Changes in biodiversity

The changes are evident in species that attach to hard substrates, such as sponges, tunicates, and cnidarians, as well as in species that live on or around hard substrates, such as the common cuttlefish, the cloud crab, and various species of fish.

Between 1994 and 2023, several fish species declined (including European plaice, cod, pollock, and eel), while a few increased (black goby, rock gunnel, sand smelt, greater pipefish, and lesser pipefish). The same applies to mobile benthic animals (crabs and lobsters) and to sessile (non-moving) species: among others, the mermaid's glove and mussels declined, while the European flat oyster has shown some recovery (after decades of absence). Also see the article: "Flat oysters, hidden in the North Sea," p. 106.

Under the European Habitats Directive, characteristic species and typical species are monitored. Characteristic species indicate the physical building blocks of a habitat, and typical species serve as qualitative indicators of ecological health; both groups have shown a downward trend in the Oosterschelde since 1994.

Marine life on and around hard substrates | Photo: Dutch Maritime Productions

In addition, native species in particular are declining on and around the hard substrate, while newcomers are partially outcompeting the old flora and fauna. The causes appear to lie in a combination of factors.

Distorted picture due to introduced species

Climate change and established invasive species pose a growing problem. Warmer seawater has caused many southern species to expand their range northward. In addition, non-native species have been introduced through shellfish farming and ships' ballast water. Some of these species then proliferate and displace or threaten other species.

Although it may seem, in terms of species numbers and biomass, that our marine fauna is not changing much, the newcomers are clouding the picture. Several new species are opportunists that expand at the expense of native species, competing with them for food and space. This leads to a decline in the native flora and fauna and a loss of genetic diversity within species. Here, quantity comes at the expense of quality.

Use of steel slag and mastic asphalt

Another point of concern is the change in the materials that have been used for hard substrate in the Oosterschelde over the past few years. Whereas large basalt blocks were previously used for purposes such as reinforcing dikes, now much smaller steel slag is often chosen, and mastic asphalt is widely used in the intertidal zone. This material offers fewer hiding places and may release chemical substances, which almost certainly affects biodiversity.

Smart management of hard substrate

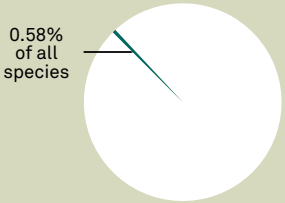
There is still a lot of uncertainty regarding the exact causes of these changes in biodiversity. However, direct influences such as substrate loss and human activities provide concrete starting points for corrective action. One obvious opportunity lies in the smart use of hard substrate; by capitalizing on this, biodiversity can be enhanced and the degradation of marine ecosystems can be counteracted. Factors such as climate change and the emergence of invasive species, on the other hand, pose a more complex and persistent problem.

Rykel de Bruyne
ANEMOON Foundation

The choice of material for hard substrate is a point of attention

Marine life on and around hard substrates | Photo: Dutch Maritime Productions

Seaweeds



Number of species	approx. 280
Of which are non-native	45
DNA references available	202
Habitat Directive species	-
On the Red List	-

Forkweed | Photo: Mick Otten

Description	Seaweeds, also called macroalgae, are a diverse group that include green, red, and brown algae. They occur predominantly in saltwater, but a few species also live in freshwater.

Increasing biodiversity

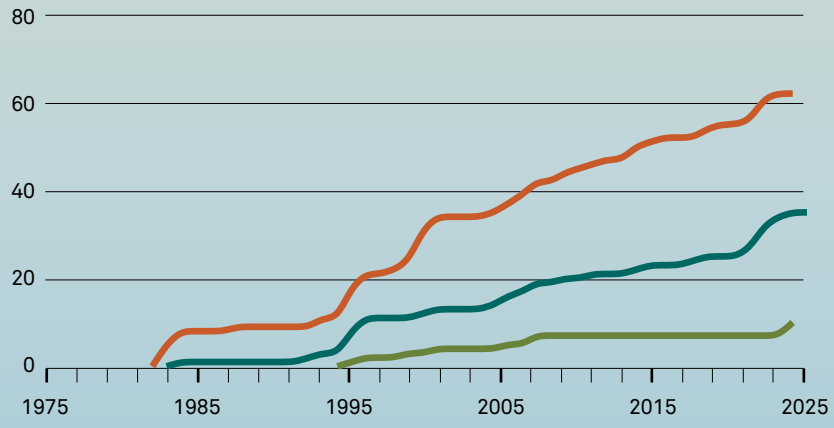
The status of seaweed (macroalgae) in Dutch waters is characterized by increasing biodiversity, a strong presence on artificial hard substrates such as dikes, and a growing interest in seaweed cultivation.

Monitoring

Both scientists and volunteers (citizen scientists) monitor seaweeds through diving projects such as the Underwater Shore Monitoring Project (MOO); the Beach Wash-up Monitoring Project (SMP), using wash-ups in the coastal zone; and the Littoral Inventory and Monitoring Project (LIMP) in the intertidal zone. Since the publication of the Seaweed Field Guide in 2021, observations by citizen scientists have increased significantly.

The (cumulative) number of newly observed seaweed species

Period 1980-2025



Seaweeds are becoming increasingly common in the Netherlands. Since 1993, 34 non-native seaweed species have been found. The Southern Delta, in particular, is a hotspot for new, non-native species. Thanks to new DNA techniques, new sightings can be identified more and more quickly.

Source: Luna van der Loos, Naturalis Biodiversity Center

DNA research reveals new seaweeds

Sea lettuce and gutweed (of the genus *Ulva*) are familiar sights along our coast, but they are nearly indistinguishable to the naked eye. Recent DNA research by Naturalis, Ghent University, and the ANEMOON Foundation has thoroughly mapped the Dutch species. What did they find? Of the sixteen identified species, three are new to our country: Californian sea lettuce, fine gutweed, and Chinese gutweed.

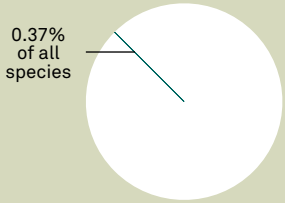
The latter is particularly remarkable: this freshwater species was discovered by chance during a swim in Almere. The study also looked back in time. Analysis of herbarium collections revealed that nearly 70% of historical identifications were incorrect; the forms are simply too variable. Thanks to modern DNA techniques, we now have a better understanding of sea lettuce and seaweed biodiversity.

Luna van der Loos,
Naturalis Biodiversity Center

Thread weed | Photo: Nathalie De Somer

Chipolata weed | Photo: Mick Otten

Fishes



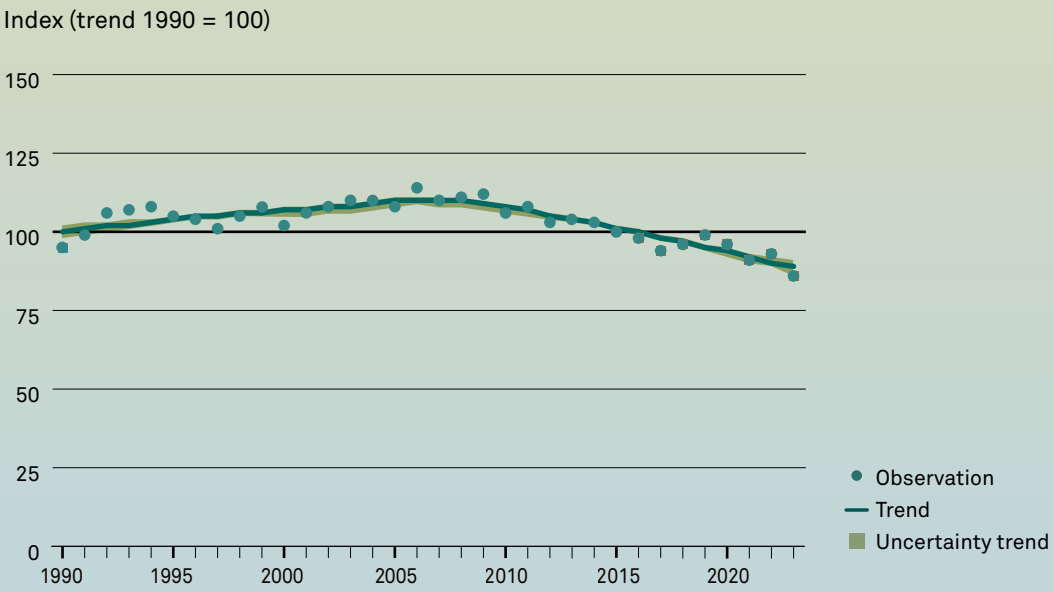
Number of species	approx. 180
Of which are non-native	36
DNA references available	107
Habitat Directive species	13
On the Red List	34 (out of 99)

Greater weever | Photo: Marion Haarsma

Description	This group of cold-blooded, vertebrate animals includes native freshwater, saltwater, and migratory fish. The Netherlands has 180 species, 59 of which are saltwater fish.

Distribution trends of freshwater fish

Period 1990-2023 | 25 species evaluated

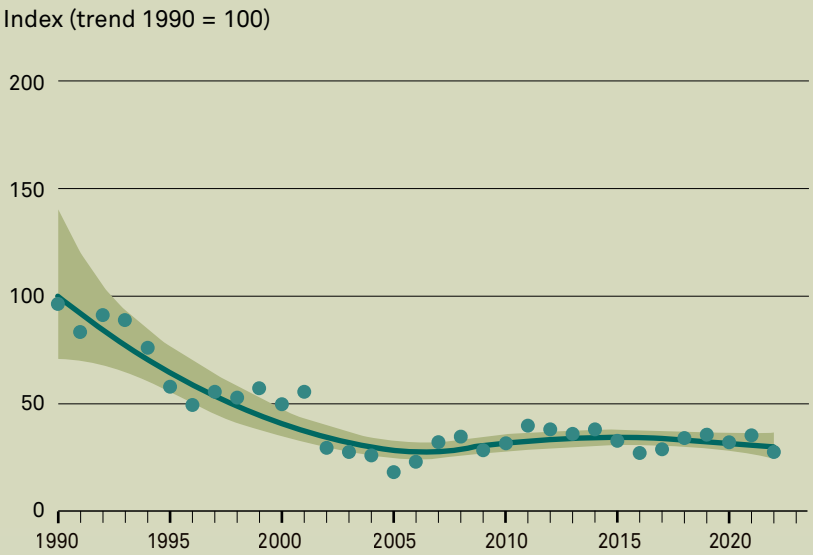


Source: NEM, RAVON /CBS, 2025 | clo.nl/nl157806

In the 1960s and 1970s, discharges and the straightening of streams led to a decline in freshwater fish populations. Thanks to environmental measures and stream restoration, fish populations improved significantly, but since 2012 there has been another decline, particularly among species that depend on clean water systems (freshwater where biological, chemical, and physical conditions are in balance). Causes include water pollution from sources such as pharmaceutical residues, the presence of non-native gobies, and drought, which reduces the dilution of toxins. Many water bodies still do not meet the requirements of the Water Framework Directive (WFD).

Population trends of saltwater fish in coastal areas

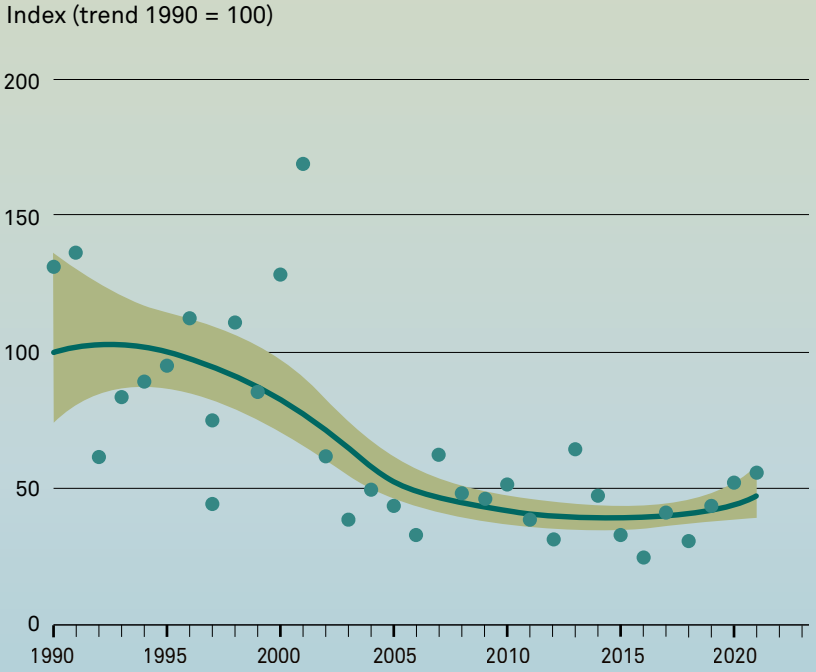
Period 1990-2022 | 25 species evaluated



Source: WMR, 2024 | clo.nl/nl159602

Nursery species in coastal areas

Period 1990-2021 | 8 species evaluated



Source: WMR, 2024 | clo.nl/nl160202

Since 1991, fish populations in the North Sea have shown a moderate decline, such as gobies and lesser weever. The coastal zone of the North Sea, the Wadden Sea region, and the Delta region serve as important nurseries, meaning that young fish grow up in these areas.

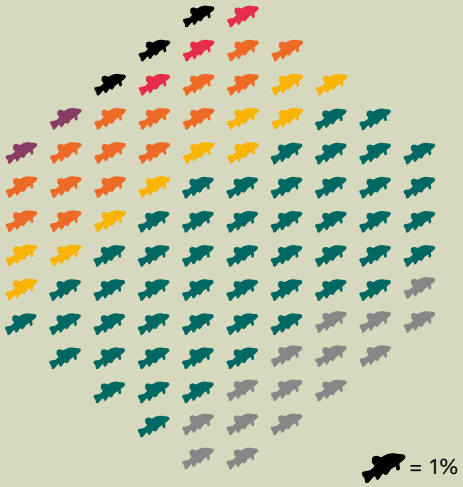
Of the species discussed above, eight are “nursery species,” including plaice and common dab. These nursery species are declining sharply, particularly in the Wadden Sea. The cause is the warmer water temperature resulting from climate change. This accelerates the metabolism of young fish, increasing their food requirements. When food is scarce, they leave the nurseries sooner than they did in the past for cooler, deeper waters in the North Sea. Exceptions are southern species such as sole and whiting, which actually thrive in the warmer water.

- Observation
- Trend
- Uncertainty trend

Red List

2011 | 99 species evaluated
34% of which are threatened or may have disappeared

- 3% disappeared
- 2% critically endangered
- 3% endangered
- 15% vulnerable
- 11% near threatened
- 52% not threatened
- 14% data deficient

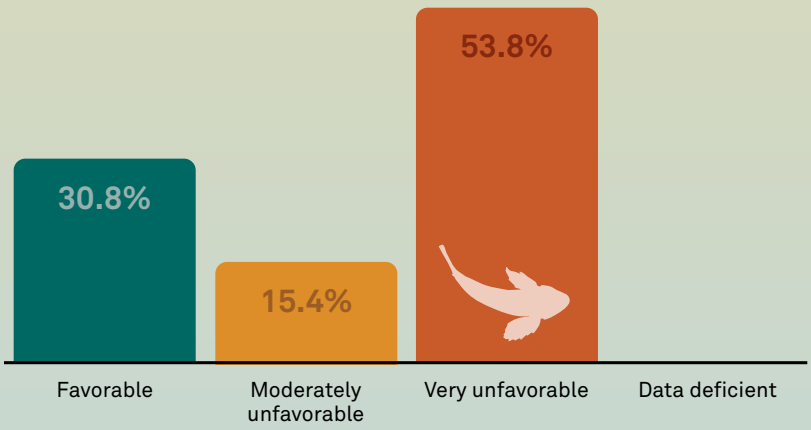


Source: clo.nl/nl132306

Of the more than 40 freshwater fish species that reproduce in the Netherlands, nearly half are listed on the Red List. Since 2016, marine fish (such as cod and whiting) have also been included in the assessment for the first time. In total, 34% of all assessed fish species are threatened to some degree.

Conservation Status

Period 2019-2024 | 13 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

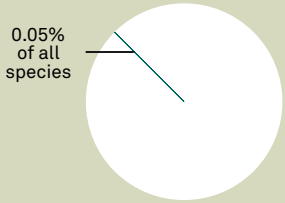
A number of fish species are protected at the European level under the Habitats Directive. The conservation status of many Dutch species remains unfavorable, even in the most recent report (2019–2024). Barriers such as locks and pumping stations hinder migration. Additionally, a persistent lack of natural dynamics (current) and habitat quality plays a role. Although recovery is visible locally for some species, a favorable conservation status has not yet been achieved for 9 of the 13 assessed species.

Two-spotted goby | Photo: Marion Haarsma

Lumpsucker | Photo: Marion Haarsma

Marine life on shipwreck remains, including plumose anemones | Photo: Dutch Maritime Productions

Echinoderms



Number of species	25
Of which are non-native	0
DNA references available	22
Habitat Directive species	-
On the Red List	-


Serpent's table brittlestar | Photo: Marion Haarsma

Description	This group includes starfish, sea cucumbers, and sea urchins. These animals live on or in the seafloor, on both hard and soft substrates.

Typical species of Natura 2000 areas

Two echinoderms are characteristic species of marine Natura 2000 sites: the serpent star (indicator species for habitat type: “permanently flooded sandbanks”) and the common heart urchin (indicator species for habitat type: “large inlets and bays”). Due to a lack of data, no reliable trends can be identified for these species.


Common heart urchin | Photo: Dick Belgers

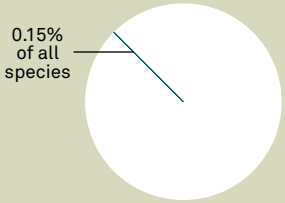
Monitoring

Recreational divers from the ANEMOON Foundation monitor five species of echinoderms in the Southern Delta. In the Oosterschelde, these species remained stable or declined in number between 1994 and 2018. Data from the Dutch Ministry of Infrastructure and Water Management primarily concern species that live on and in soft seabeds (such as sand and silt).

Predator and food source

Species within this group that burrow into the seabed feed on organic matter. This helps to make nutrients available again and supply oxygen to the sediment (bioturbation). They play an important role as predators on mussel beds and themselves serve as a food source for fish and crustaceans, among others.

Bryozoans



Number of species	71
Of which are non-native	12
DNA references available	51
Habitat Directive species	-
On the Red List	-


Hornwrack | Photo: Mick Otten

Description Small, invertebrate, aquatic organisms that live in colonies. They occur predominantly in marine and brackish water environments and, to a lesser extent, in freshwater.

Decline of native species

In the Dutch (and Belgian) North Sea and the Zeeland Delta, the hornwrack (*Flustra foliacea*) has declined sharply since the early 20th century. The primary cause is beam trawl fishing (a method in which fishing nets are dragged along the seabed). Many other bryozoan species that live as epibionts on the leafy bryozoan have also seen their numbers decline sharply as a result.
The number of non-native species, however, has increased. These species were introduced through shellfish imports, as fouling organisms on ship hulls, or via drilling platforms.
Reintroducing oysters and installing artificial reef structures around wind turbines (carried out by various conservation organizations with the goal of restoring the sea's role as a nursery) can increase bryozoan biodiversity. However, reintroducing oysters carries the risk of unintentionally introducing non-native species.


Purple bryozoan (non-native) | Photo: Mick Otten

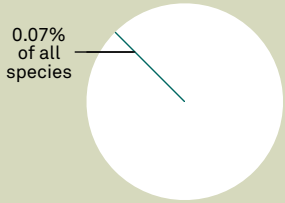
No policy monitoring

Although no policy-driven monitoring is taking place, recreational divers from the ANEMOON Foundation are monitoring nine species of bryozoans in the Zeeland Delta. Additionally, through the Beach Wash-up Monitoring Project (SMP), another five species of bryozoans are being monitored. In this citizen science project, lifeguards and volunteers record all washed-up organisms or their remains every two weeks to track, among other things, population changes and new (potentially invasive) species.

Ecosystem engineers

Bryozoans (*Bryozoa*) are ecosystem engineers; they form colonies that attach to various surfaces (substrates) such as rocks, shells, seaweed, and shipwrecks. This provides a substrate and shelter for other micro- and macro-organisms. In addition, they filter the water (they are filter feeders), thereby directly and indirectly influencing biodiversity in their habitat.

Sea squirts



Number of species	33
Of which are non-native	9
DNA references available	17
Habitat Directive species	-
On the Red List	-


Light-bulb sea squirt | Photo: Oscar Bos

Description	Sea squirts (tunicates) occur exclusively in marine environments. They usually grow on hard surfaces, either solitary or in colonies that form a crust.

Dependent on hard substrate

The presence of sea squirts, both solitary and colonial, is highly dependent on the availability of hard substrates to attach to. Populations and species diversity are also influenced by the arrival of non-native species via, for example, shipping (through ballast water or fouling on ships).


Light-bulb sea squirt | Photo: Mick Otten

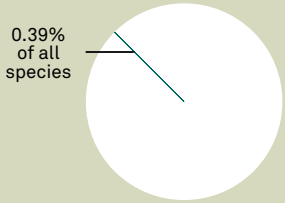
Zeeland Delta

In the Zeeland Delta, recreational divers from the ANEMOON Foundation monitor ten species of sea squirts, seven of which are non-native. In the Oosterschelde, between 1994 and 2018, three species declined in number, four species remained stable, and three species increased. The species that increased are colony-forming sea squirts with non-native status that were first found in the Netherlands between 1977 and 1999.

Wadden Sea and North Sea

In the Wadden Sea, non-native species are monitored, and the data is summarized in the *Wadden Sea Quality Status Report*. Five non-native sea squirts occur in this area. There is insufficient data available for the North Sea to determine trends.

Cnidarians, comb jellies



Number of species	approx. 190
Of which are non-native	10
DNA references available	123
Habitat Directive species	-
On the Red List	-


Dahlia anemone | Photo: Marion Haarsma

Description The group of cnidarians includes true jellyfish, hydroids, soft corals, and sea anemones. They are characterized by their stinging cells. Comb jellies (five species in the Netherlands) resemble cnidarians but do not possess stinging cells.

Increase in introduced species

In general, jellyfish and comb jellies are doing well in Dutch waters, but this is partly due to the presence of non-native species. For example, the American comb jelly has been present in the Netherlands since 2006. It is native to the Atlantic coast of North America and is a highly effective plankton feeder. In various parts of the world, its arrival has had adverse effects on fish stocks and fisheries. In the Netherlands, no significant consequences have been observed yet, and the species is not currently listed on the EU list of invasive alien species.


Warty comb jelly | Photo: Marion Haarsma

Monitoring

Monitoring of cnidarians and comb jellies is primarily carried out by diving volunteers through projects such as the Underwater Shore Monitoring Project (MOO); the Beach Washup Monitoring Project (SMP), using washups in the coastal zone; and the Littoral Inventory and Monitoring Project (LIMP) in the intertidal zone. The identification and tracking of non-native species is also largely carried out by citizen scientists.


Compass jellyfish l | Photo: Marion Haarsma

Zeeland Delta

In the Zeeland Delta, recreational divers and volunteers from the ANEMOON Foundation monitor 21 species of cnidarians and 3 species of comb jellies. In the Oosterschelde, an increase was observed in six species between 1994 and 2018. Eight species remained stable, while eight species declined in number. The Metridium senile, a typical species of the large bays to which the Oosterschelde belongs, showed a stable trend.

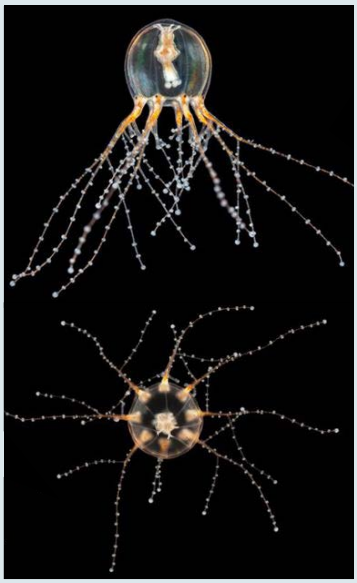
North Sea

Although sandy bottoms dominate the Dutch North Sea area, there are also areas where hard substrate (solid ground) is present, such as the Borkum Stones and the Klaverbank. These are suitable habitats for, among others, dead man's fingers (a soft coral) and dahlia anemone (a sea anemone). Scattered throughout the North Sea, these species can also be found on non-natural solid substrates, such as shipwrecks, offshore industry installations, and in wind farms.

New Cnidarian in the Netherlands

Since May 2025, the Netherlands has a new resident: the aquarium medusa (*Cladonema radiatum*). Although this tiny creature had previously appeared mysteriously in tropical marine aquariums, its origin remains a mystery. However, it has now been officially confirmed that the species lives in the wild in the Netherlands. A snorkeler discovered nearly 20 specimens among the seaweed in Lake Veere. Although the aquarium medusa resembles a small jellyfish, it is a hydrozoan in its reproductive stage. With their branched tentacles and jerky, rocket-like leaps, they seem almost otherworldly. Scientists suspect that higher water temperatures in the winter make the establishment of this "climate shifter" possible. A word of warning: despite their size of just a few millimeters, these newcomers can deliver a vicious sting!

Marco Faasse,
Marine ecology expert



Aquarium medusa | Photo: Mick Otten

There is only

1

known reef with flat oysters in the Dutch North Sea

Flat oyster | Photo: Joost van Uffelen

EUROPEAN FLAT OYSTERS
HIDDEN IN THE NORTH SEA

The vast European flat oyster reefs in the North Sea have disappeared, but the flat oyster itself still appears to be present. Divers and researchers are increasingly finding them on shipwrecks, at the base of wind turbines, and on other man-made structures.

Until the mid-19th century, the reefs of the native European flat oyster (*Ostrea edulis*) covered nearly a third of the Dutch section of the North Sea. They were comparable to coral reefs: they provided a habitat for approximately 190 species of macrofauna, served as a nursery, and contributed to water filtration and CO_2-storage (Thurstan et al., 2024; zu Ermgassen et al., 2025).
At the end of the 19th century, oysters were widely consumed, and oyster fishing increased significantly. The transition from sailboats to steamships accelerated the decline of the reefs, which resulted in the species largely disappearing from the North Sea.
It is now assumed that flat oysters are ecologically extinct further offshore (Smaal et al., 2015). According to the IUCN Red List for Ecosystems, the type of ecosystem built by this species has collapsed (zu Ermgassen et al., 2025).

In the Dutch section of the North Sea, only one small mixed reef is currently known, it is located near the Brouwersdam and consists of European flat oysters, mussels, and Pacific oysters. Given the ecological importance of oyster reefs, there are various restoration projects aimed at reintroducing them, often by restocking with farmed flat oysters.

Out of sight

Oyster larvae need a hard substrate, such as shells or stones, on which they can settle. Therefore, this hard material offers the best chance of finding an oyster. However, the Netherlands lacks a government-run national monitoring program for hard substrates in the sea.
Until recently, offshore sightings of living flat oysters in Belgium and the Netherlands could be counted on one hand (Kerckhof et al., 2018). However, in 2019, marine ecologists found live flat oysters at a few shipwrecks during dives. This discovery led to increased attention for the species. Flat oysters tend to be very well camouflaged with various other species and are found, for example, on vertical or overhanging surfaces; this is why they are often not spotted by many divers who often only look downward. Since 2019, only a few divers have found the species, mainly because they knew what they were looking for (Olie, 2024).

Flat oysters | Photo: The Rich North Sea

Live oysters have now been observed 42 times at 34 different locations within the Dutch North Sea (Observation.org, 2025). Per sighting, one to nine oysters were found, varying in size and shell thickness. These factors indicate a diverse age distribution. Additionally, three dead oysters (empty shells) attached to a wreck have been reported within Dutch waters.
In addition to wrecks, European flat oysters have also been found on granite stones, both during diving surveys and via underwater cameras near wind turbines (Leewis et al., 2024). This suggests that wind farms, which use granite stones to prevent erosion, may serve as suitable starting locations or stepping stones for flat oysters.
In Belgian waters as well, (young) flat oysters are increasingly being observed on measuring instruments and other artificial structures (Kerckhof & Kerkhove, 2025).

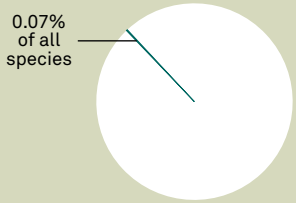
Many questions

It is unclear whether these populations have emerged recently. It is also unknown whether they consist of remnants of earlier populations and whether they are genetically related to one another. Furthermore, we do not know whether the parasite *Bonamia ostereae* is present in these wild oysters, which is particularly important for restoration initiatives.
The limited number of sightings appears to be primarily due to a lack of targeted monitoring. Most wreck divers have a focus other than searching for oysters and record few systematic observations. Furthermore, the presence of the Pacific oyster (*Magallana gigas*) makes reliable identification difficult, especially because the shells are covered with other organisms.
The lack of sightings in certain areas does not necessarily mean that flat oysters are not present. Rather, it reflects the fact that lately few or no dives have been conducted in these areas. Recent discoveries show that the species (still) exists in the Dutch part of the North Sea, but many questions remain unanswered.

Renate Olie
The North Sea Foundation

Photo: Getty Images

Sponges



Number of species	32
Of which are non-native	4
DNA references available	31
Habitat Directive species	-
On the Red List	-


Ashy horny sponge | Photo: Floris Bennema

Description Multicellular animals with a porous (sieve-like) body. In the Netherlands, calcareous and siliceous sponges are the most common, both in the sea (27 species) and in freshwater (five species). The third group, glass sponges, lives only in the deep sea.

Rare sightings

In the Zeeland Delta, recreational divers and volunteers from the ANEMOON Foundation monitor eleven species of sponges. They occur in varying numbers, but trends are difficult to identify because several species are rarely observed.

Human impact on species numbers

More than half of the sponges in our country were first observed here after 1977. This is partly because advances in diving techniques have made it easier to search for species. But new species have also been introduced. This has occurred naturally, via ballast water and fouling on ship hulls, as well as through the transport of oysters and mussels. Another human influence, the warming of seawater, has likely also played a role in the appearance of “southern” species.

Medicinal Properties

Sponges cover a significant portion of the hard substrates (particularly the man-made hard surfaces along our dikes and on shipwrecks in the North Sea). To protect themselves from being overgrown by other species, they produce a wide range of bioactive substances. The pharmaceutical industry is studying these substances intensively for the development of antibiotics.

Newcomer: the Mycale sponge

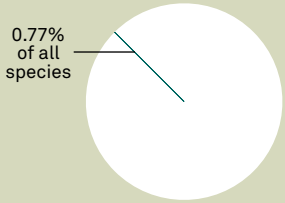
Dutch underwater nature has gained a new species. In November 2024, diver Mick Otten encountered a dozen sponges in the Oosterschelde (Plompe Toren site) that looked distinctly different from the sponges he was familiar with. He was actually searching for the pink myxilla at a depth of sixteen meters, but the structure of this find was clearly differed. Because sponges are difficult to identify, a sample was taken. Microscopic examination of the unique silica skeleton needles by fellow diver Mikkel Suijker, later confirmed by experts from Naturalis, provided the answer. It is the Mycale sponge (*Mycale contarenii*): a species that normally lives further south, from the British Isles to the Gulf of Guinea. A unique first sighting for our country.

ANEMOON Foundation (Mick Otten and Mikkel Suijker)

Mycale contarenii | Photo: Mick Otten

Purplish tube sponge | Photo: Mick Otten

Mollusks



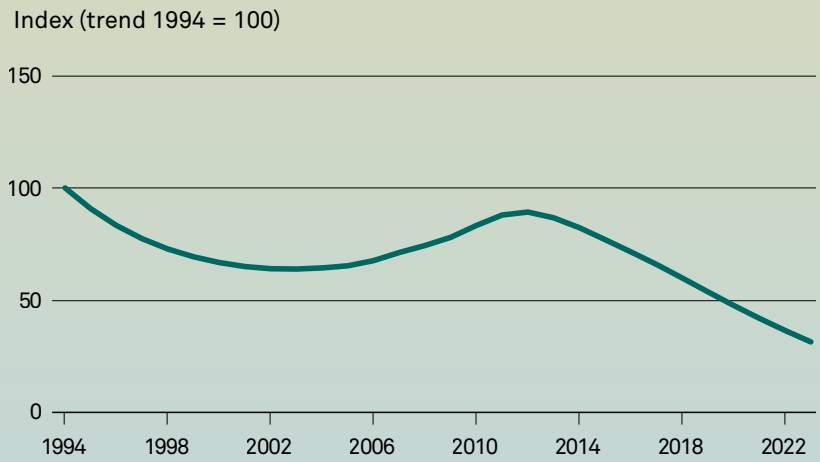
Number of species	370
Of which are non-native	43
DNA references available	342
Habitat Directive species	4
On the Red List	68 (out of 169)

Rough-mantled doris | Photo: Marion Haarsma

Description	A diverse group of invertebrates with soft bodies, including snails (land, freshwater, and saltwater), bivalves (such as mussels and cockles), and cephalopods.

Population trend nudibranchs Oosterschelde

Period 1994-2023 | 16 species evaluated



The trend for marine nudibranchs (sea slugs) has been declining since 2012. Many marine sea slugs depend on a specific food source. For example, the population of the orange-brown aeolid is declining because its food source—the orange anemone—has decreased. The increase in the chestnut-coloured nudibranch is linked to the increase in the (exotic) violet tunicate.

Source: NEM, Stichting ANEMOON/CBS, 2025 | clo.nl/nl156302

Monitoring

Monitoring of mollusks is carried out by both scientists and volunteers. Within the Network Ecological Monitoring (NEM), the Underwater Shore Monitoring Project (MOO) maps underwater nature with the help of recreational divers. The HabSlak Monitoring Network focuses specifically on snails protected under the Habitats Directive. Coordination is handled by the ANEMOON Foundation, in close collaboration with the Dutch Malacological Society (NMV).

Red List

2003 | 169 species evaluated
40% of which are threatened or may have disappeared

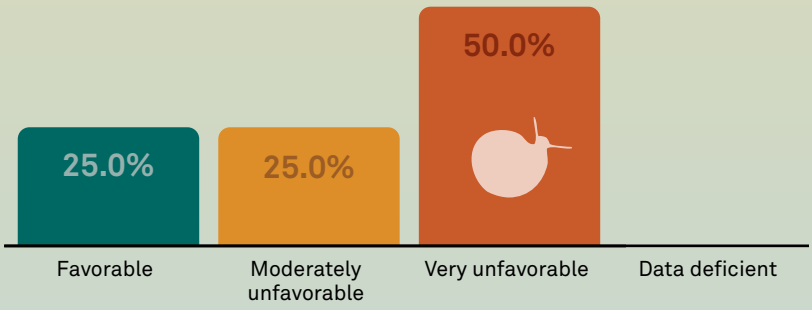
- 3% disappeared
- 4% critically endangered
- 11% endangered
- 18% vulnerable
- 4% near threatened
- 55% not threatened
- 5% data deficient

Source: clo.nl/nl105219

A Red List for terrestrial and aquatic mollusks was compiled in 2004. It includes three aquatic species that were observed in the Netherlands until 1980 but are now considered extinct (the fine-lined pea mussel, the thick-lipped spire shell, and the thick-shelled river mussel). On land, the sandbowl snail (1977) and the plaited snail (1977) have disappeared from the Netherlands.

Conservation Status

Period 2019-2024 | 4 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

Four mollusks found in the Netherlands are protected at the European level under the Habitats Directive: the narrow-mouthed whorl snail, the Desmoulin's whorl snail, the Roman snail (land snails), and the little whirlpool ramshorn snail (freshwater snail). The Netherlands reports on these species every six years, and three of the four are declining in numbers. A fifth European-protected species, the thick-shelled river mussel (freshwater mussel), disappeared from the Netherlands long ago.

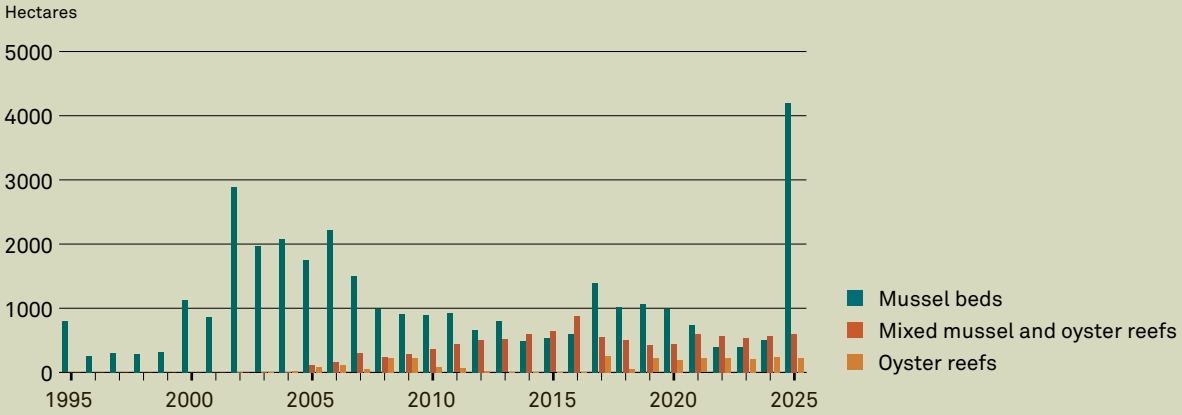
Mussel and oyster beds are bio-builders

Mussel and oyster beds form complex structures that promote biodiversity and trap sediment. They also filter water, thereby influencing the amount of microalgae in the water. In addition, mussels are a direct food source for shellfish-eating birds, such as the oystercatcher. Oysters, particularly the invading Japanese oysters, primarily provide protection and settlement sites for mussels, crabs, and crustaceans.

Pacific oyster | Photo: Hannco Bakker

Area of mussel and oyster beds in the eastern Wadden Sea

Period 1995-2024



Source: Wageningen Marine Research | clo.nl/nl155910

After mussel beds virtually disappeared in the early 1990s, the area recovered and now fluctuates around 2,000 hectares. Thanks to a massive seed fall in 2024 (a natural phenomenon in which an enormous number of young mussels attach themselves to the bottom simultaneously), the area even increased spectacularly in 2025, bringing the target value* of 2,000 to 4,000 hectares within reach.

* The protection of mussel beds is included in the Water Framework Directive (KRW) and in the Water Act. It is also part of the Trilateral Monitoring and Assessment Programme (TMAP) between the Netherlands, Germany, and Denmark.

NEW DISCOVERIES

What's in a name?

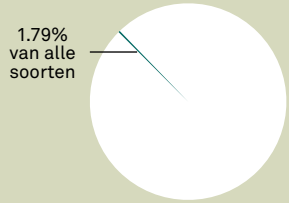
New research has shown that two species previously considered separate are in fact one and the same species. With the scientific name change to *Mercuria tachoensis*, two populations in Portugal and several others on the Iberian Peninsula are now classified as the same species as the Dutch one. These additional habitats expand the total range in Europe, which could lead to the "Tachoensis mud snail" (common name: swollen spire snail) being assessed as less threatened. In the Netherlands, however, its status remains unchanged: this mud snail remains as threatened and unique as ever.

Rykel de Bruyne,
Mollusk expert

Swollen spire snail | Photo: Rykel de Bruyne

Mussels | Photo: Marion Haarsma

Crustaceans



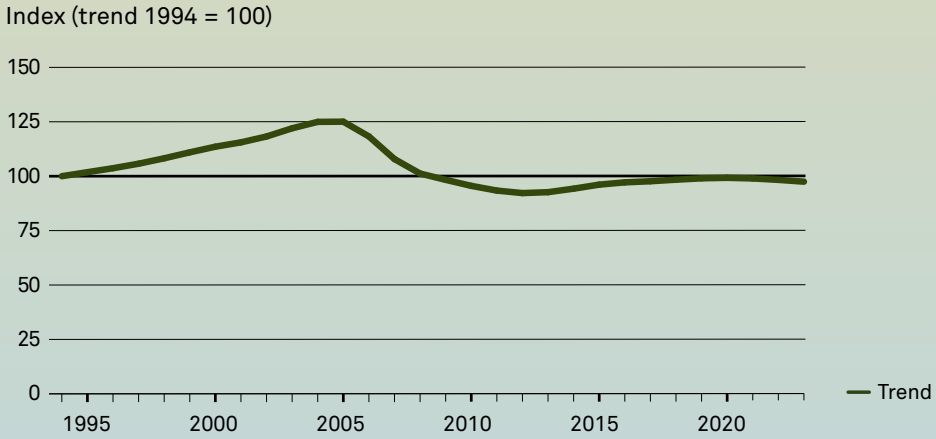
Number of species	862
Of which are non-native	55
DNA references available	9
Habitat Directive species	1 (crayfish)
On the Red List	-

European green crab | Photo: Marit Moerman

Description	A diverse group of arthropods living in fresh, salt, or brackish water and on land. Well-known species in this group are crabs, lobsters, shrimp, krill, woodlice, water fleas, and barnacles.

Trend crustaceans Oosterschelde

Period 1994-2023 | 21 species evaluated



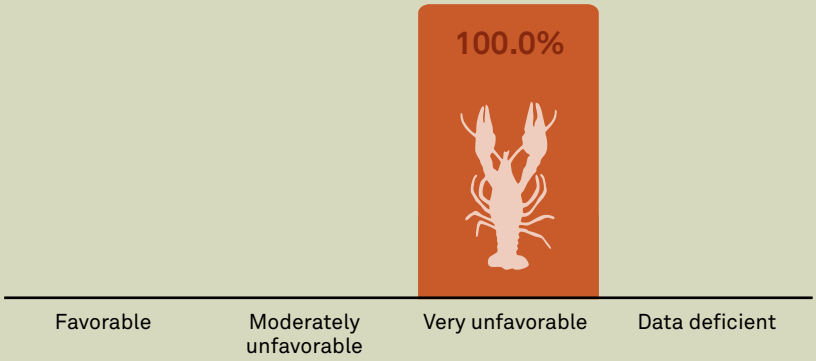
Source: NEM, Stichting ANEMOON/CBS, 2025 | clo.nl/nl156302

Although the trend appears stable through 2023, there has been a decline in several crustacean species in the Oosterschelde in recent years. In 2023—outside the scope of the CBS trend analysis—a large number of dead and weakened lobsters and other crustaceans were suddenly observed. By 2024, their numbers had fallen sharply. Despite extensive research, the cause has not yet been determined. In particular, the decline in the populations of lobsters and common hermit crabs remains steep and significant.

A notable detail is that the native common hermit crab has virtually disappeared (and its population has also declined outside the Oosterschelde), while three non-native hermit crab species have been observed in the Oosterschelde in recent years: the hairy hermit crab, Prideaux's hermit crab, and the long-clawed hermit crab. The latter is an exotic species from North America. (Source: ANEMOON Foundation)

Conservation Status

Period 2019-2024 | 1 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The conservation status of the European crayfish was very unfavorable in the period 2013–2018. In the most recent Habitats Directive report covering the period 2019–2024, the status of the European (freshwater) crayfish remains unchanged. The causes are crayfish plague and habitat loss. There is currently only one remaining location where the species lives.

Monitoring and policy

The status of crustaceans such as crayfish, crabs, and shrimp is fairly well known. Other crustaceans, such as copepods, are more difficult to assess due to a lack of taxonomic knowledge.
Populations are changing; on the one hand, species are disappearing due to habitat loss, while on the other hand, "climate shifters" (in response to climate change) and non-native species (species introduced by human activity) are arriving. Policy regarding the crayfish focuses primarily on controlling the invasive non-native species that threaten the native crayfish.

More knowledge, more species

For certain groups, such as water fleas, copepods, cumaceans, isopods, and amphipods, the number of species has increased in recent years due to advances in our understanding. It is expected that the number of crustacean species will continue to rise as our knowledge expands.

NEW DISCOVERIES

"Climate shifters" on the rise

The toothed circular crab crab is on the rise. This southern species was still rare ten years ago, but now washes ashore by the hundreds after storms. The toothed circular crab has now colonized the entire coastal area. The driving force? Warming seas are luring this species northward. Wind farms also provide perfect "stepping stones" due to the artificial hard substrate surrounding the turbines' foundations.
Is this good news? For our native fauna, it poses challenges. The toothed circular crab grows remarkably large here and may be competitive, intensifying the struggle for food and space within the ecosystem. Through citizen science projects such as the national Beach Washup Monitoring Project (SMP), this "climate shifter" is being closely monitored. Time will tell whether our marine biodiversity will change irreversibly with the arrival of this (and other) newcomers.

Toothed circular crab | Photo: Alie Postma

Mick Otten and Mikkel Suijker,
Strandwerkgemeenschap (Beach work community) / ANEMOON Foundation

7

invasive crayfish species have established themselves in the Netherlands

Red swamp crayfish | Photo: Rick van Duijn

LIVING WITH CRAYFISH

Even though invasive crayfish are being controlled, they are not yet under control. Nature-friendly riverbanks, opportunities for predators to establish themselves, and a reduction in nitrogen and phosphate levels help make water systems resilient against these invasive species.

Invasive crayfish hinder efforts to improve water quality. They have been controlled for years, but it is unrealistic to think they will disappear from the Netherlands. We must learn to live with them.

The approach is therefore shifting from *control* to *management*. The primary eradication method is still removal, but this appears to have limited effectiveness. Crayfish are cannibalistic, so when large, older crayfish are removed, smaller, younger individuals have a better chance of growing. Furthermore, a female crayfish carries hundreds of eggs under her tail, meaning that a few stragglers or newcomers can quickly restore the population. As well as this, many waterways are interconnected, allowing new crayfish to easily reach areas where others have been removed.

To manage the population, "system-oriented" measures, rather than continuously trapping the animals, are preferred. In other words: focusing on the resilience of the entire aquatic ecosystem. In a robust aquatic ecosystem aquatic life is resilient, and ecological systems maintain water quality, even in the presence of invasive crayfish.

It is unrealistic to think that the invasive species will disappear

Burrowing behavior damages banks

Only one species of crayfish is native to the Netherlands. This species has now virtually disappeared due to declining water quality and competition from invasive species. Non-native crayfish eat almost anything and pose a major threat to aquatic plants and animals. Their burrowing behavior damages banks and revetments. Furthermore, the disturbance in riverbeds disrupts the chemical balance of the aquatic ecosystem, as nutrients in the sediment (such as nitrate and phosphate) are released back into the water.

In a robust aquatic ecosystem, the water remains healthy and clear, even when there are many crayfish

Crayfish may even accelerate the spread of invasive aquatic plants. There is evidence that the red swamp crayfish promotes the spread of variable-leaf watermilfoil. The crayfish feeds on the leaves and rips it up, causing floating pieces of plant material to spread for miles.
The variable-leaf watermilfoil displaces other species and blocks sunlight from reaching other plants. The watermilfoil also likely has a better defense mechanism against being eaten by crayfish.

Warm, nutrient-rich ditches

The non-native species that have established themselves in the country over the past few decades appear to benefit from the "unnatural" Dutch water management practices: ditch banks are constantly cleaned (cleared of vegetation) and kept at an artificial water level. These practices result in relatively warm ditches, rich in food. Of the seven invasive crayfish species in the Netherlands, only one is native to Europe: the Turkish crayfish. The other six originate from North America. Their impact varies by species, but, in general, they play a pivotal role in the ecosystem.

Because it is virtually impossible to remove all crayfish, it is important to increase the resilience of the aquatic system. This can be partly achieved by reducing the inflow of phosphate and nitrogen from fertilization and peat decomposition.
In waterways there is a "tipping point" between a clear, healthy state, with abundant aquatic plants, and a murky, algae-dominated state. This tipping point is reached more quickly when large numbers of crayfish churn up the bottom of the waterways and cut off aquatic plants. But if there is less phosphate and nitrogen in the bottom, the water can remain clear and healthy, even if there are invasive crayfish.

Natural predator

Of course, preventing the introduction of new crayfish, through the aquarium trade for example, is important. Finally, the design and management of the waterways can enhance the resilience of the ecosystem. One example is promoting opportunities for predators to establish themselves, as they help keep the crayfish population under control.

Such a "system approach" is already being investigated in practice. For example, researchers reintroduced water soldier on a large scale in Polderlab Vrouw Venne (Van Duin et al., 2026). This native aquatic plant was once widespread in the lowland peatland area and has dense vegetation that provides an important habitat for aquatic life.
This vegetation also helps keep the sediment from being stirred up, which reduces water turbidity. Furthermore, the chemicals released by the crabgrass help prevent harmful algal blooms.

All of this improves water quality, but more is needed to decrease the crayfish population. Research is also being conducted into nature-friendly bank design. The sloping transition from land to water is an important habitat for plants and animals. Plant roots hinder the crayfish's burrowing behavior, and in the shelter of vegetation, predatory fish can lay their eggs and herons can hunt more effectively. These are all ways in which the crayfish population can be managed.

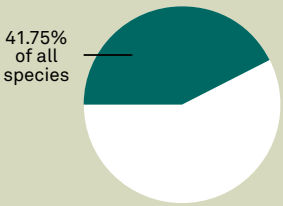
Fleur van Duin
Naturalis Biodiversity Center

Bram Koese
EIS Kenniscentrum Insecten

Water soldier | Photo: Fleur van Duin

Green-veined white and the Footballer hoverfly | Photo: William Boonzaaijer

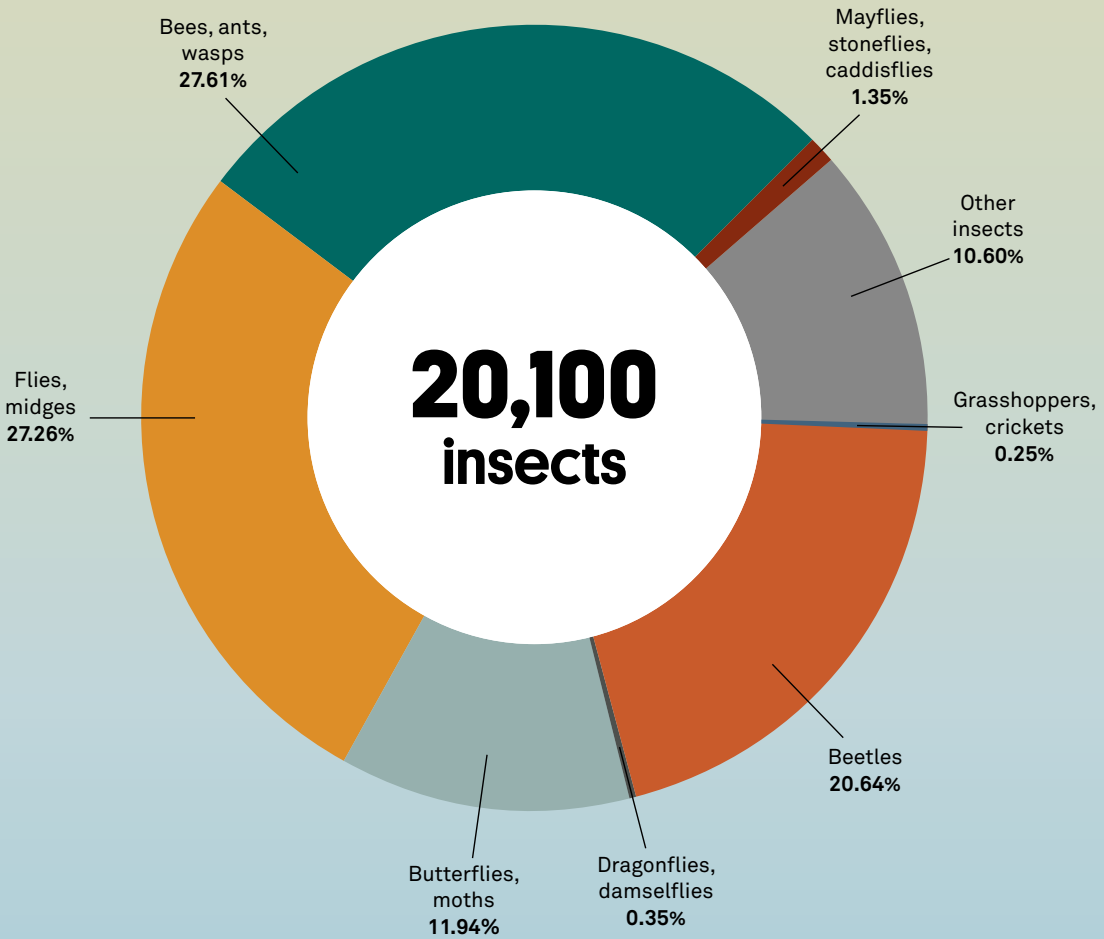
Insects



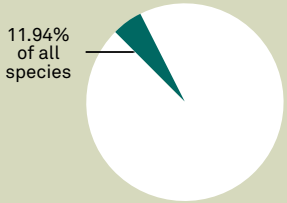
Number of species	20,100
Of which are non-native	283
DNA references available	16,900

Water strider | Photo: Nico van Egmond

Description	Invertebrates with six legs and external mouthparts. Insects are of crucial importance to ecosystems as pollinators, pest controllers, decomposers, and as a food source for other animals. It is a large group. We specifically cover the species groups of the Red List and the Habitats Directive.



Butterflies, moths



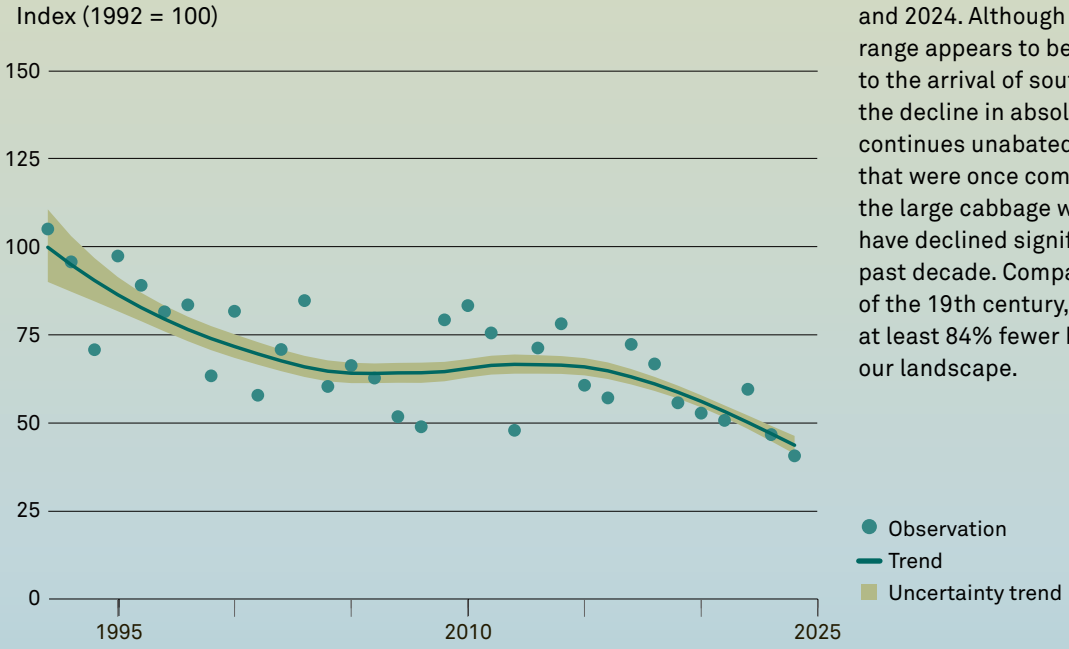
Number of species	approx. 2,400
Of which are non-native	30
DNA references available	2,222
Habitat Directive species	5
On the Red List	47 (of 76 butterflies)

Common blue | Photo: Wijnand van Buuren

Description This group includes butterflies and a much greater number of moths. Although butterflies have been observed for over a hundred years, there is still much to discover about moths.

Butterfly population trends

Period 1992-2024 | 54 species evaluated



The Dutch butterfly population declined by 56% between 1992 and 2024. Although the decline in range appears to be stabilizing due to the arrival of southern species, the decline in absolute numbers continues unabated. Even species that were once common, such as the large cabbage white butterfly, have declined significantly over the past decade. Compared to the end of the 19th century, there are now at least 84% fewer butterflies in our landscape.

Source: NEM, Vlinderstichting /CBS, 2025 | clo.nl/nl138621

Red List Butterflies

2019 | 65 species evaluated
62% of which are threatened or may have disappeared

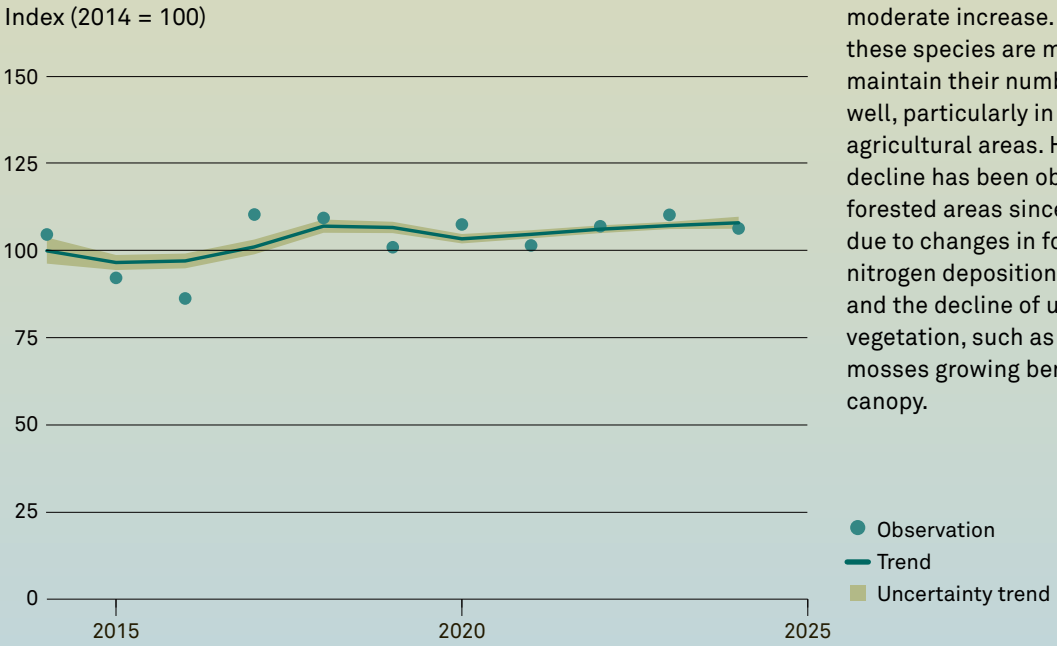
- 20% disappeared
- 16% critically endangered
- 13% endangered
- 9% vulnerable
- 4% near threatened
- 38% data deficient

Although 62% of the 76 butterfly species considered are threatened to some degree, a few species show a different pattern. For example, forest butterflies on the Red List are faring better. These species are likely benefiting from the warmer climate and the improved quality of our forests.

Source: clo.nl/nl105219

Moth population trends

Period 2014-2024 | 90 species evaluated

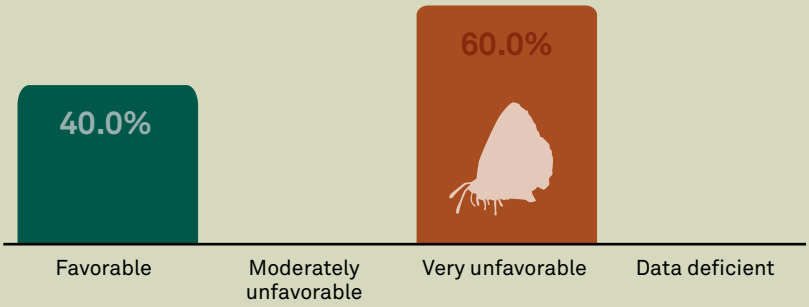


The population trend for 90 common moth species shows a moderate increase. On average, these species are managing to maintain their numbers reasonably well, particularly in urban and agricultural areas. However, a decline has been observed in forested areas since 2020, possibly due to changes in forest structure, nitrogen deposition, drought, and the decline of understory vegetation, such as shrubs and mosses growing beneath the tree canopy.

Source: NEM, Vlinderstichting /CBS, 2025 | clo.nl/nl301901

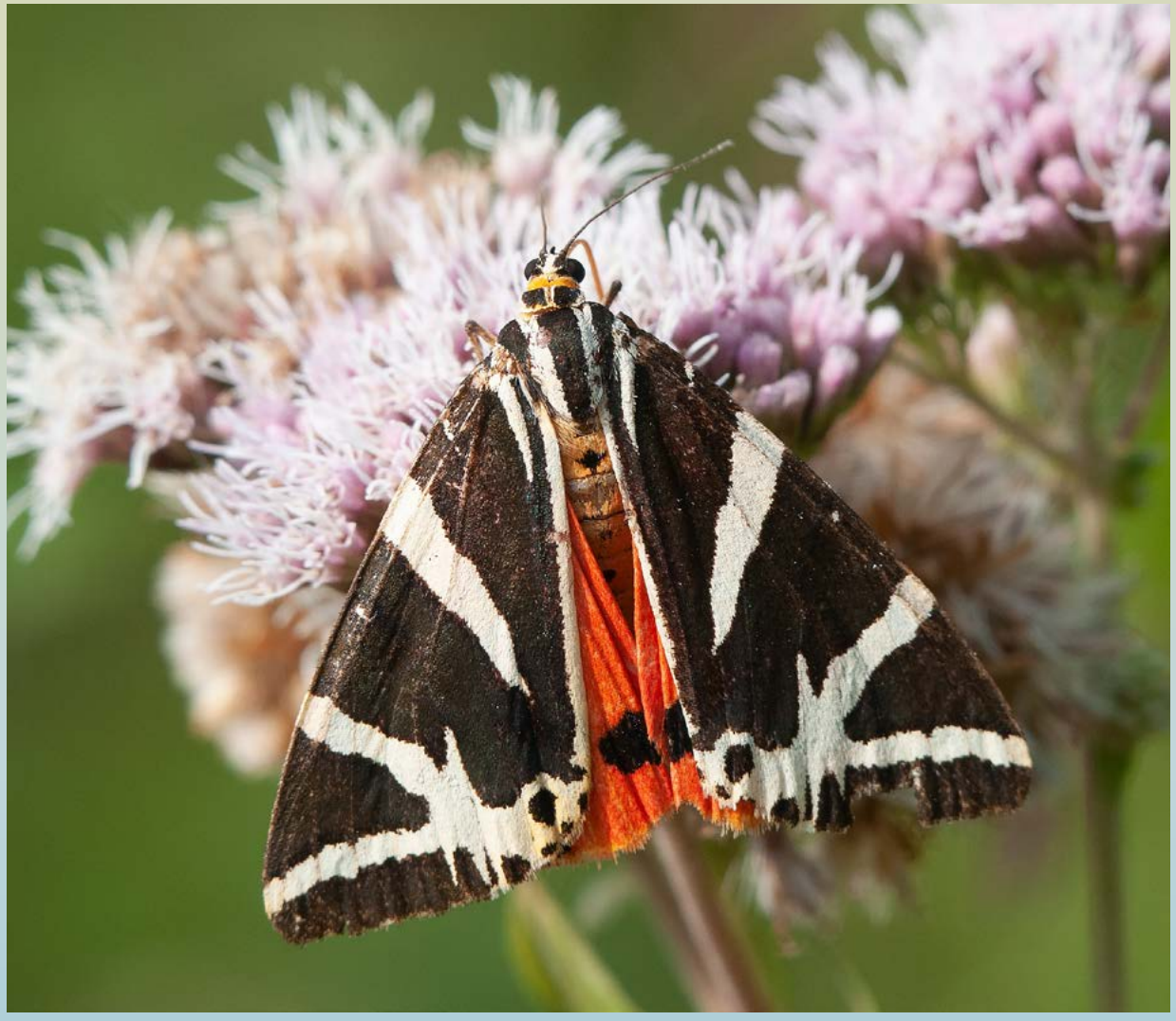
Conservation Status butterflies and moths

Period 2019-2024 | 5 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

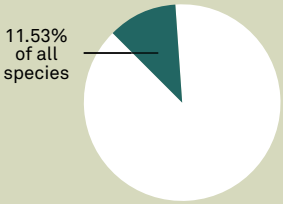
Of the species assessed under the Habitats Directive, three are butterflies and two are moths. The two moth species, the Jersey tiger moth and the willowherb hawk-moth, are rare but are expanding their range further north due to global warming. Of the three butterflies, the conservation status is very unfavorable. Three butterfly species disappeared from the Netherlands in the 20th century: the marsh fritillary, the large blue, and the scarce heath.



Jersey tiger moth | Photo: Kees Venneker

Sand wasp | Photo: Cees Determann

Bees, ants, wasps



Number of species	approx. 5,550
Of which are non-native	approx. 90
DNA references available	4,212
Habitat Directive species	-
On the Red List	181 (out of 331 bees)


Furrow bee | Photo: Cees Determann

Description	Characterized by two pairs of soft, transparent wings and chewing mouthparts. This group includes parasitic wasps (~4,000), sawflies (~500), bees (~350), ants (~100), and other wasp groups. The status of most of these species is not well known.

Ants

Of the native ant species, 42% are threatened (Boer et al., 2018); nine species are at risk of extinction, and one has already gone extinct. Red wood ants are protected solely through the Forest Management Code of Conduct. In contrast, exotic species such as the Argentine ant and the Mediterranean ant (*Tapinoma nigerrimum*-complex) sometimes cause problems in urban areas.
Six internationally threatened ant species occur in our country. For example, the Netherlands bears responsibility for the rock ant, which is common here in the dunes, and the very rare “Kutter’s stinging ant” (*Myrmica bibikoffi)*.


Blood-red ant | Photo: Wijnand van Buuren

Wasps

Little is known about sawflies. The same applies to most parasitic wasps, except for the species used in horticulture as natural pest control. Of the other aculeate wasps (approximately 350 species assessed), at least 45% have declined or even disappeared over the past century (Peeters et al., 2004). The invasive Asian hornet has now established itself throughout the Netherlands. It feeds on various insects, including honeybees kept by beekeepers.


Figwort sawfly | Photo: Claudia Schutte

Bees

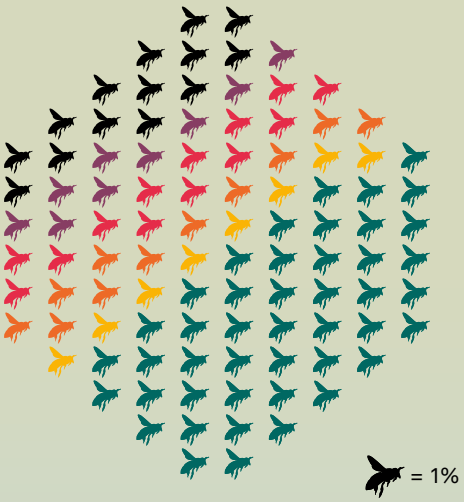
There are approximately 350 species of wild bees in the Netherlands. Together with hoverflies and other pollinators, they are responsible for pollinating 75% of our food crops (IPBES 2016). Starting in 2027, there will be a European obligation to monitor (Article 10 of the Nature Restoration Regulation). Last year (in 2025), a pilot project was launched under the framework of the Nature Restoration Law the National Bee Strategy, and the Vestering Motion.

Red List

2018 | 331 species evaluated
55% of which are threatened or may have disappeared

- 14% disappeared
- 9% critically endangered
- 13% endangered
- 11% vulnerable
- 8% near threatened
- 45% not threatened

Source: clo.nl/nl105219



More than half of the wild bee species in the Netherlands have disappeared or are endangered; 46 solitary bee species and 7 bumblebee species have already disappeared. Bees are important because they pollinate wild plants and food crops. They are covered by the European Nature Restoration Law. Starting January 1, 2027, the Netherlands is required to monitor populations, and by 2030 at the latest the decline must be legally reversed towards recovery.

NEW DISCOVERIES

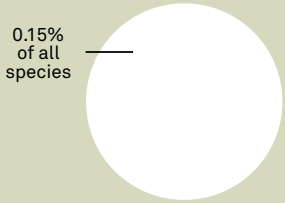
A new mud dauber wasp for the Netherlands

The Netherlands has gained a new species of wasp: the black-and-yellow mud dauber wasp (*Sceliphron destillatorium*). This southern European beauty was discovered in the summer of 2025 by insect enthusiast Rob Schouten in his urban garden in Zoetermeer. Thanks to automatic image recognition on Waarneming.nl, the wasp—which stands out due to its elongated yellow waist—was identified as a unique find. The species hunts spiders and builds mud nests in sheltered spots. Its nesting habits likely explain its arrival in the Netherlands; shipping containers or vehicles that remain stationary for long periods are ideal nesting sites for "hitchhikers." Additionally, climate change is pushing the natural range of this wasp further and further north.

Martijn Kos,
EIS Kenniscentrum Insecten

Black-and-yellow mud dauber
Photo: Rob Schouten

Dragonflies, damselflies



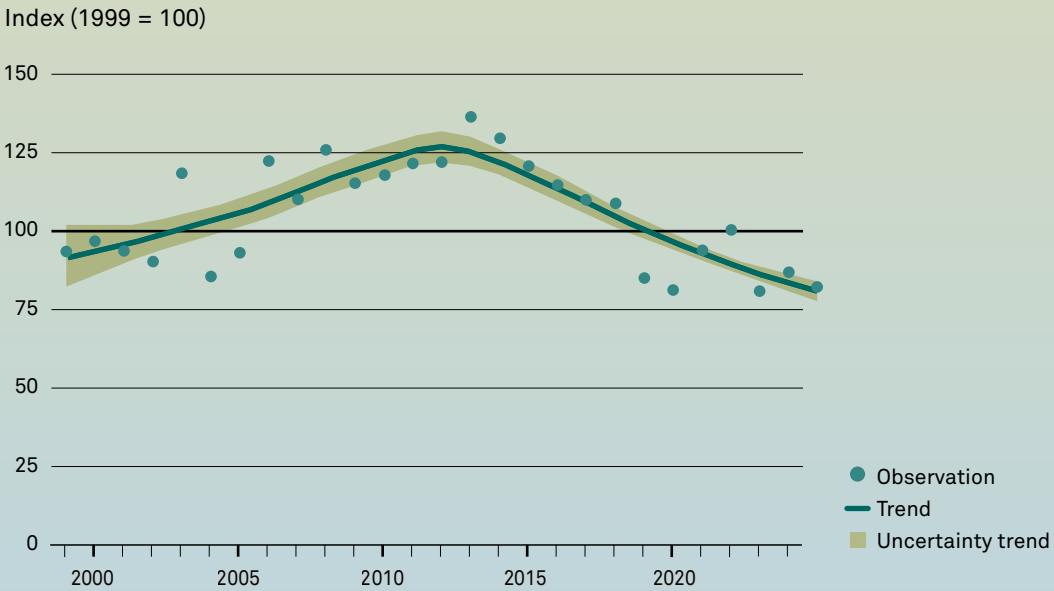
Number of species	70
Of which are non-native	1
DNA references available	66
Habitat Directive species	6
On the Red List	23 (out of 69)

White-faced darter | Photo: Kees Venneker

Description Predatory insects that spend their larval stage in or near water. Damselflies also belong to this group; unlike dragonflies, they fold their wings. Both hunt mosquitoes and flies while in the air.

Population trends dragonflies, damselflies

Period 1999-2025 | 47 species evaluated



Source: NEM, Vlinderstichting/CBS, 2026 | clo.nl/nl138721

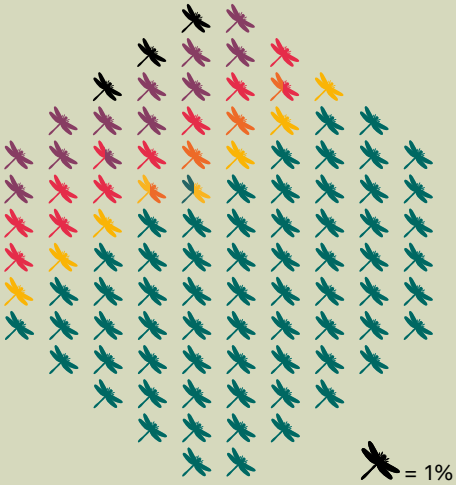
Dragonflies initially benefited from improvements in water quality, but a clear reversal of this trend has been evident since around 2010. Between 2010 and 2025, dragonfly populations in the Netherlands declined by an average of 34 percent. This negative trend affects more than just niche species. Common species have also been declining since 2010.

One example is the blue-tailed damselfly, which is widespread in the Netherlands but is declining significantly in numbers. Notable examples of specialized species that depend on fens and raised bogs include the crescent bluet and the common hawker.

Red List

2024 | 67 species evaluated
33.5% of which are threatened or may have disappeared

- 3% disappeared
- 11.5% critically endangered
- 10% endangered
- 3% vulnerable
- 6% near threatened
- 66.5% not threatened

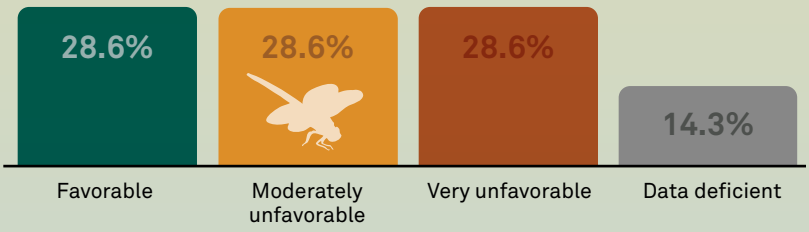


Source: clo.nl/nl105219

Of the 69 dragonfly species, 23 are listed as threatened to varying degrees. The 2024 IUCN European Red List confirms a declining trend for this group across Europe. This aligns with Dutch population data through 2024, as illustrated in the graph from the Environmental Data Compendium (see graph on the left).

Conservation Status

Period 2019-2024 | 7 species evaluated



Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

Seven of the nine Dutch dragonfly species listed in the European Habitats Directive are still found in our country. The conservation status of four species is unfavorable to very unfavorable. Possible causes of the decline in species include climate change (cold-loving species are declining while warm-loving species are increasing) and the accumulation of toxic substances.

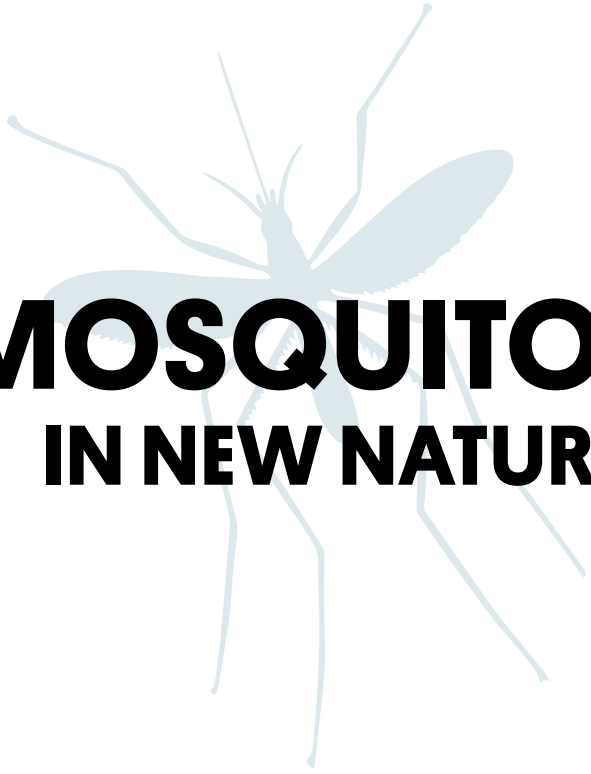
Emerald damselfly | Photo: Marit Moerman

The smooth newt eats more than

35

mosquito larvae a day

Mosquito larvae | Photo: Getty Images



MOSQUITOES
IN NEW NATURE

New, wetland nature areas in the Netherlands provide the ideal breeding ground for mosquitoes. Although these insects make an important contribution to biodiversity, they also pose risks to public health. That is why extensive research is currently underway to determine how a biodiverse ecosystem with natural predators can control the nuisance caused by mosquitoes.

When creating new nature areas in the Netherlands, an important group of insects is often overlooked: mosquitoes. While mosquitoes seem to thrive in the wet environments that develop when an area is made climate-resilient, this also poses risks to public health. Although mosquitoes are part of biodiversity and serve as a food source (the larvae) and sometimes as pollinators (the adult mosquitoes), they can pose a societal problem when present in large numbers. This is not only due to the nuisance caused by their buzzing and the itchy bumps from their bites, but also because they transmit diseases.

Native species, such as the common house mosquito, are increasingly acting as vectors of West Nile and Usutu viruses, which have been emerging more frequently in the Netherlands in recent years (Munger et al., 2025).
Non-native species also pose a risk. The Asian tiger mosquito, which hitches rides with vacationers and on cargo shipments, is expected to establish itself in Dutch cities within five years (Minister of Health, Welfare and Sport, 2025). The tiger mosquito can transmit viruses that our native mosquitoes do not currently spread, such as dengue, chikungunya, and Zika virus.

Natural enemies

Climate adaptation measures often create temporary, shallow bodies of water in which mosquitoes sometimes thrive. In their immature stages, they take advantage of this stagnant water, where there are typically few natural predators present. This applies to large-scale projects such as Room for the River, as well as to small-scale adaptations like a “wadi” (a shallow, natural water retention area) in an urban neighborhood, if water remains stagnant for a long period.
To prevent these new, wet natural areas from unintentionally becoming breeding grounds for mosquitoes, active consideration is needed regarding ways to give

Eendrachtspolder | Photo: Pandemic & Disaster Preparedness Center (PDPC)

natural predators access to these water features (Carlson et al., 2004).
In water buffers as well, it is desirable to ensure a healthy ecosystem with high biodiversity, where natural predators (such as fish, dragonfly larvae, water bugs, and beetles) have the opportunity to effectively suppress mosquito larvae. A potential additional benefit is greater public acceptance of climate adaptation and greening: if there are fewer mosquito larvae, this will lead to less nuisance.

Public health implications

However, the relationship between biodiversity and viruses transmitted by mosquitoes is highly complex. The viruses transmitted by the common house mosquito all have birds as their natural hosts (the virus lives in the birds). The exact consequences of climate adaptation and greening for public health remain unclear. For example, new natural areas may actually attract animals that carry viruses, such as birds. However, a larger and more diverse pool of hosts (animals bitten by mosquitoes) can also create a "dilution effect," reducing the transmission of a virus more quickly. The literature is not unanimous on this point (Mercat et al., 2025).
That is why it is important to conduct more research into the relationship between biodiversity, climate adaptation, and public health. This is currently being done, for example, in the Eendragtspolder water buffer north of Rotterdam, led by the Pandemic & Disaster Preparedness Center (PDPC) in collaboration with ten other institutions. By experimentally flooding part of the polder, researchers are investigating how biodiversity responds to such flooding. The goal is to understand how mosquitoes, their natural predators, as well as potential virus carriers—such as (migratory) birds and small mammals—behave in a water buffer area. By understanding which factors lead to larger mosquito populations or an increased risk of viral outbreaks, we can design (new) areas more effectively. In this way, the planning of new nature reserves can safeguard public health while simultaneously maximizing opportunities for local biodiversity.

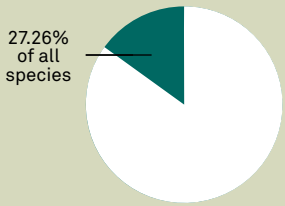
Jordy van der Beek
Naturalis Biodiversity Center

Reina Sikkema
Erasmus MC

Koos Biesmeijer
Naturalis Biodiversity Center

Common house mosquito | Photo: Getty Images

Flies, midges



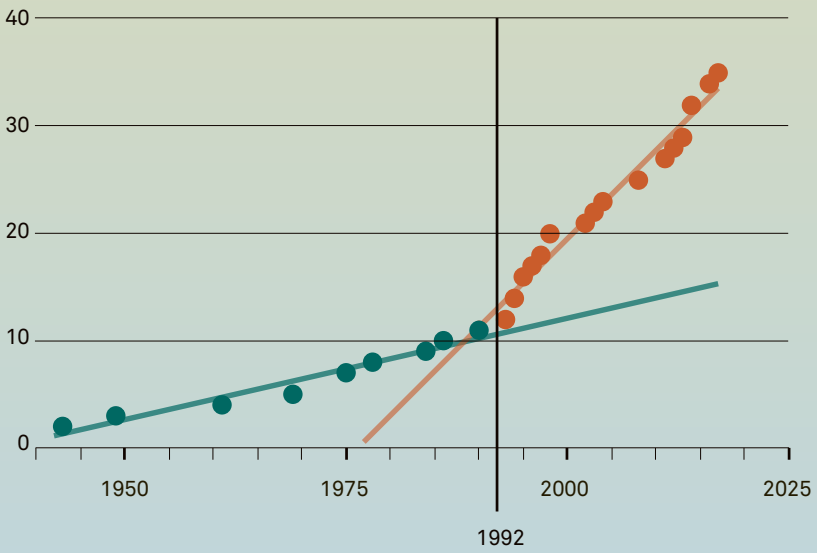
Number of species	approx. 5,480
Of which are non-native	approx. 20
DNA references available	4,541
Habitat Directive species	-
On the Red List	146 (van 317 zweefvliegen)

Marmalade hoverfly | Photo: Claudia Schutte

Description	Characterized by one pair of functional wings. This group includes 340 hoverflies which, along with bees, are our most important pollinators.

Number of extinct species of hoverflies

Cumulative by year of last observation
Period 1940-2018 | 315 species evaluated



The hoverfly data has been split into periods before and after the 1992 trend break.

Pre-trend break
Observation
Trend

Post-trend break
Observation
Trend

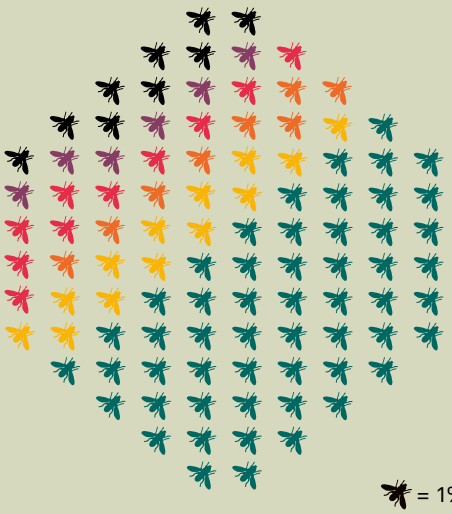
Source: EIS Kenniscentrum Insecten

Since around 1990, there has been an acceleration in the decline of hoverflies. Pesticides are a major suspect as the cause of this decline. Other causes include intensified land use and agriculture, eutrophication (where nitrogen and phosphate enter the water due to overfertilization), acidification (due to excessive nitrogen and sulfur deposition), and climate change. Because these causes are nationwide in scope, measures on a national scale are also needed to halt the decline of hoverflies.

Red List Hoverflies

2024 | 317 species evaluated
46% of which are threatened or may have disappeared

- 9% disappeared
- 6% critically endangered
- 10% endangered
- 8% vulnerable
- 13% near threatened
- 54% not threatened



Source: clo.nl/nl105219

In 2024, a Red List for hoverflies was compiled for the first time. It revealed that 46% of native species in the Netherlands are threatened or have even already disappeared. Not only is species diversity under pressure, but hoverfly populations are also in decline. A forty-year study in the Veluwe shows that there are now 80% fewer hoverflies flying around there than in the 1980s.

Hoverflies

Hoverflies have been included in nature conservation policy since 2024. Starting in 2027, there will be a European requirement to monitor them (Article 10 of the Nature Restoration Regulation). Last year (in 2025), a pilot project was launched as part of the Nature Restoration Law, the National Bee Strategy, and the Vestering Motion.

Mosquitoes, gnats, and midges

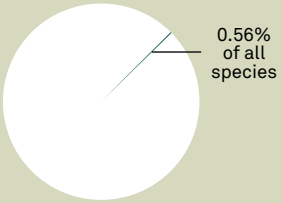
We still don't know much about the vast majority of mosquitoes, gnats, and midges, but some families are being studied in greater detail. Biting mosquitoes and midges are monitored by the NVWA's Vector Monitoring Center, primarily because these species can cause nuisance and transmit diseases.

Tachinid flies

Tachinid flies (*Tachinidae*) parasitize caterpillars as well as other insects and play an important role in controlling pests. In addition, some tachinid flies also act as pollinators. Over the past 40 years, 40% of our species have declined, while 20% have increased. In particular, flower-visiting species that parasitize bugs have increased. Species that parasitize sawflies and crane flies have declined even more sharply than average.

Tachinid fly | Photo: Wim Rubers

Mayflies, stoneflies, caddisflies



Number of species	272
Of which are non-native	0
DNA references available	266
Habitat Directive species	-
On the Red List	143 (out of 261)

Stonefly | Photo: Daan Drukker

Description

Mayflies, stoneflies, and caddisflies are aquatic insects that are sensitive to changes in their environment, such as temperature, oxygen levels, and pollution. For this reason, they are used—for example, by water authorities—as indicators of water quality. The term EPT, used for these indicators, comes from *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), and *Trichoptera* (caddisflies). The 2003 Red List for these three taxonomic groups is being revised this year, with freshwater flatworms also included.

Mayflies

Number of species: 62 | 60 DNA references available

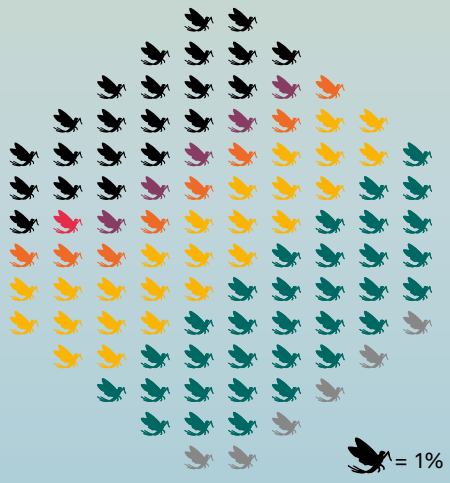
Mayflies have aquatic larvae and are unique in that they have two short-lived winged stages. Although they thrive in clean, flowing waters, some species also occur in stagnant water.

Mayfly | Photo: Daan Drukker

Red List

2003 | 64 species evaluated
61% of which are threatened or may have disappeared

- 22% disappeared
- 5% critically endangered
- 1% endangered
- 8% vulnerable
- 25% near threatened
- 33% not threatened
- 6% data deficient



Source: clo.nl/nl132306

Due to habitat destruction and deteriorating water quality, 26 species disappeared from the Netherlands in the second half of the 20th century. As water quality improved slightly after the 1980s, two species have returned. Additionally, two others have recently been observed as vagrants. The total number of established species in the Netherlands currently stands at 62.

Stoneflies

Number of species: 28 | 26 DNA references available

Winged, usually brown insects with net-like wing venation.
The larvae live exclusively in clean, oxygen-rich water.

Red List

2003 | 21 species evaluated
90% of which are threatened or may have disappeared

- 42% disappeared
- 5% critically endangered
- 5% endangered
- 33% vulnerable
- 5% near threatened
- 5% not threatened
- 5% data deficient

Source: clo.nl/nl132306

Of the 28 species in the Netherlands, only 12 remain. This decline is due to pollution and the straightening of streams and rivers by humans (for example, to facilitate shipping). In most places with flowing water, only one species remains: the common stonefly. Stoneflies live primarily in and on the higher sandy soils and the hilly landscape of South Limburg. The Springendalse Beek (Overijssel) and several streams in South Limburg are relative hotspots with up to three species. Thanks to the restoration of the river Roer, one species has returned and a new species (since 2010) has become abundant. The rediscovery of the late pine stonefly (2024) indicates some recovery of the river Geul.

Caddiesflies

Number of species: 182 | 180 DNA references available

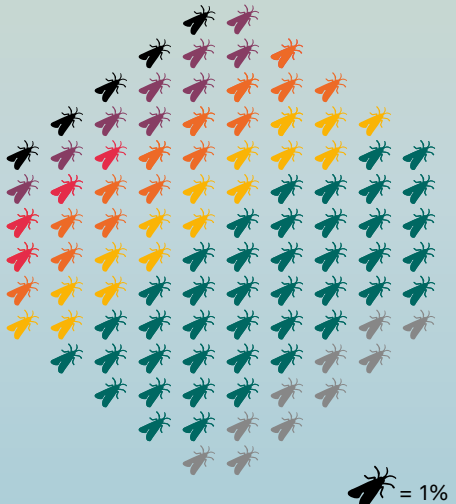
Insects with hairy wings that bear some resemblance to moths.
The larvae are called caddisworms. After pupation, the insect leaves its aquatic habitat as a caddisfly.

Caddisfly | Photo: Cees Determann

Red List

2003 | 176 species evaluated
48% of which are threatened or may have disappeared

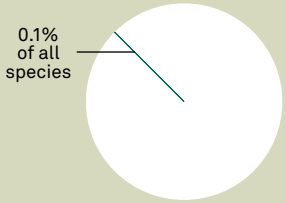
- 5% disappeared
- 9% critically endangered
- 4% endangered
- 14% vulnerable
- 16% near threatened
- 42% not threatened
- 10% data deficient



Source: clo.nl/nl132306

No fewer than nine species have disappeared from the Netherlands since 1758 (the start of Linnaean taxonomy), likely due to habitat destruction and eutrophication. The lowland peatlands and the hilly landscape of South Limburg are the richest in species. Some species that had disappeared from the Netherlands have recently reappeared due to improvements in water quality.

Grasshoppers, crickets



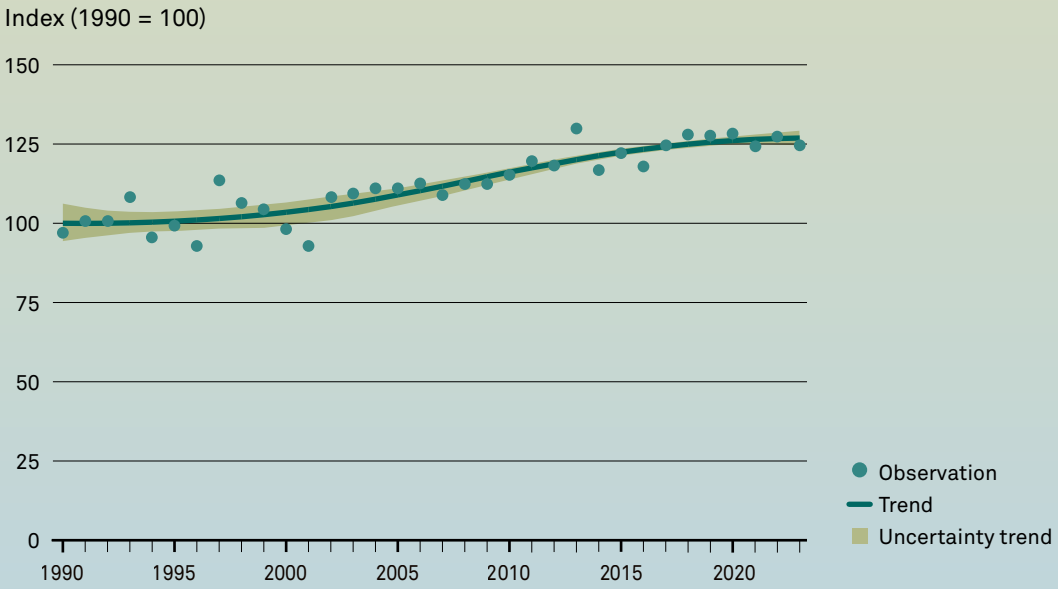
Number of species	50
Of which are non-native	5
DNA references available	50
Habitat Directive species	-
On the Red List	14 (out of 44)

House cricket | Photo: Jeroen Hoek

Description Insects with straight wings and greatly enlarged hind legs for jumping. The group is divided into two main groups: longhorned orthopterans (including bush-crickets and crickets) and shorthorned orthopterans (including grasshoppers and groundhoppers). For convenience, they are further referred to here under the term grasshoppers.

Grasshoppers, population trends

Period 1990-2023 | 35 species evaluated



Source: NEM, EIS/CBS, 2025 | clo.nl/nl302001

Since 1990, twelve new species of grasshoppers have been found in the Netherlands. Most are “climate shifters” that are moving northward due to global warming. This positive trend in distribution is an exception, as most insect groups actually show a negative trend.

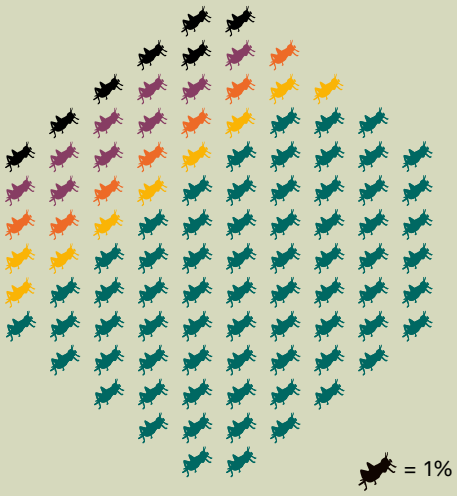
Due to a lack of systematic counts by the Ecological Monitoring Network, there are no robust figures available regarding population trends. It is therefore quite possible that the total number of grasshoppers has actually declined.

Red List

2012 | 44 species evaluated
32% of which are threatened or may have disappeared

- 7% disappeared
- 9% critically endangered
- 0% endangered
- 7% vulnerable
- 9% near threatened
- 68% not threatened

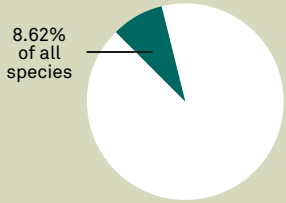
Source: clo.nl/nl105219



The 2012 Red List includes twenty species of grasshoppers. Of these, three were considered extinct: the migratory locust, the rattle grasshopper, and the two-spotted groundhopper. However, the latter species was rediscovered again in the Veluwe in 2012.

Large marsh grasshopper | Photo: Niek Haak

Beetles



Number of species	4,148
Of which are non-native	75
DNA references available	3,765
Habitat Directive species	5
On the Red List	-

Water beetle (*Graphoderus bilineatus*)
Photo: Tim Faasen

Description A diverse group with important ecological roles. They break down organic material (dung beetles, carrion beetles, fungus beetles), hunt insects (ladybugs, ground beetles), and eat plants (leaf beetles).

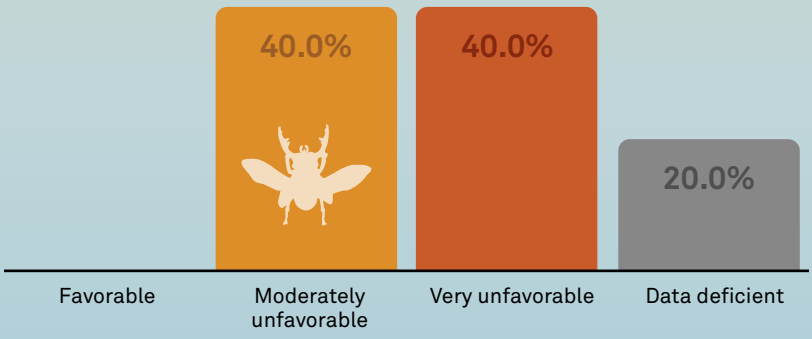
Beetle trends in the Netherlands

In addition to butterflies and dragonflies (which are covered separately), a number of beetle species are listed under the Habitats Directive. However, fewer hard data are available than for butterflies and dragonflies. Since 1966, 380 beetle species (9%) have not been found in the Netherlands. On the other hand, 477 species have been added since that year. This is often due to climate change, but many beetles have also benefited from the increased amount of dead wood in Dutch forests. The number of species is thus showing a slight increase, but there are indications that certain groups are declining sharply in number.

Leaf beetle | Photo: Cees Determann

Conservation Status

Period 2019-2024 | 5 species evaluated

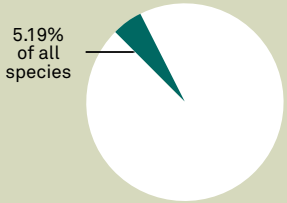


Source: natura2000.nl/rapportage-vogel-en-habitatrichtlijn

The stag beetle, our largest beetle, has a moderately unfavorable conservation status, as does the striped water beetle. The broad-bordered diving beetle appeared to be extinct but was rediscovered in 2005 in three ponds. However, during the most recent monitoring in 2022, it was found in only one of these ponds. The hermit beetle now appears to have disappeared. In 2020, a population was found in a dead tree in Kerkrade, but with the decay of that tree, this population has been lost. No other populations are known.

Green immigrant leaf weevil | Photo: Marit Moerman

Arachnids



Number of species	approx. 2,500
Of which are non-native	65
DNA references available	1,389
Habitat Directive species	-
On the Red List	-


Ornate dog tick | Photo: Jur Heijnen

Description	A group of eight-legged creatures including spiders (705), mites (approx. 1,557), pseudoscorpions, and harvestmen. Tropical whip scorpions are found exclusively in greenhouses (numbers unknown).

Spiders

Spiders are not protected under the Habitats Directive, and there is no official Dutch Red List for this group. The only exception is the great raft spider: due to its "vulnerable" status on the international IUCN Red List, this species does enjoy legal protection. Although this spider is rare internationally, it still occurs in Dutch lowland peat bogs and waterways.

Thanks to citizen observations on platforms such as Waarneming.nl, it is becoming increasingly clear that southern spider species are moving northward. Species such as the wasp spider and the false wolf spider are now fully established. A more recent newcomer is the *Enoplognatha mandibularis*, which normally occurs around the Mediterranean Sea but has now been officially recorded in the Netherlands (and Belgium) as well. In contrast, some native species are struggling due to drought and habitat loss. For example, populations of the iconic European garden spider are declining. Today's newcomers are primarily cobweb spiders and jumping spiders.


Great raft spider | Photo: Peter J. van Helsdingen

Mites

Mites do not enjoy official protection in the Netherlands under the Habitats Directive or a Red List. This is partly due to their microscopic size and the perception of some species as harmful organisms. Legislation focuses on control, while groups such as moss- and soil mites are essential for the decomposition of organic material.

Thanks to specific research, water mites (274 species) and moss mites (375 species) have been relatively well documented. Water mites are good indicators of water quality and are included in the Water Framework Directive. Their complex life cycle and sensitivity to pollution make them highly suitable for macrofauna research by water authorities. It is known that twelve species of water mites have already disappeared from the Netherlands, but the total number of recorded species in the Netherlands is expected to increase as more research is conducted on these groups.

Water mite | Photo: Wim Langbroek

NEW DISCOVERIES

Citizen science enriches the Dutch spider list

Citizen scientists play a crucial role in monitoring Dutch biodiversity. Although scientists generally prefer physical museum specimens (voucher specimens) for taxonomic identification, digital platforms such as Waarneming.nl are proving their value. Recent research by Peter J. van Helsdingen (2025) identified as many as sixteen spider species with significant updates for the Dutch fauna through these channels. A notable success is the identification of an exotic spider that had been waiting unidentified in a museum collection since 1959, following its discovery among bananas (Rivera-Quiroz et al., 2025). These results underscore how citizen observations and scientific collections keep our knowledge of Dutch biodiversity up to date.

Jeremy Miller,
Naturalis Biodiversity Center

Wandering spider | Photo: Jeremy Miller


WHAT WE
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WE CAN BETTER
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