

Indicator name			Version
NB39 Freshwater habitats with reported presence of key invasive non-native species (INNS)			July 2018
Indicator type:	Risk/opportunity	Impact	Action
		X	
SCCAP Theme	SCCAP Objective	CCRA risk/opportunity	
Climate Ready Natural Environment	N2: Support a healthy and diverse natural environment with capacity to adapt.	<ul style="list-style-type: none"> • BD3 Risk of pests to biodiversity • BD13 Water quality and pollution risks 	

At a glance

- Scottish Natural Heritage consider non-native species to be 'the second most serious threat to global biodiversity after habitat loss', and freshwater habitats are identified as being particularly susceptible to invasion.
- Projected climate change can facilitate the establishment of non-native species and increase the invasive threat of others.
- Prevention, control and eradication of invasive species is a major aim of Scotland's biodiversity policy and the management strategy of protected areas.

Latest Figure	Trend
<p>Number of freshwater notified habitat features with invasive non-native species¹ identified as a pressure: 77*</p> <p>This represents approximately 35% of all notified freshwater habitat features in Scotland.</p> <p>*Includes 22 features where it is not specified if the invasive species are native or non-native</p>	Increasing

Why is this indicator important?

¹ Non-native species are any animal or plant that have been introduced (deliberately or accidentally) to an area in which they do not naturally occur. Invasive non-native species (INNS) are those non-native species that have the ability to spread rapidly and become dominant in an area or ecosystem, causing adverse ecological, environmental and economic impacts.

Scotland has a substantial freshwater resource. There are approximately 125,000 km of running waters (rivers and burns), over 27,000 lochs and lochans², an estimated 198,000 ponds and 220 km of canal habitat (SEWeb, 2014). This represents around 90% of the volume of surface freshwater in the UK. By the 2080s, it is projected that Scotland is likely to be several degrees warmer than it is today, with less snow, wetter winters, drier summers and an increased risk of flooding in some areas. These changes will affect the wildlife of freshwaters, with some long-term changes in rivers and lochs already being observed. For example, the winter flow in the River Teith has increased by 91% over the past 40 years, while the average spring temperature in Loch Leven increased by 1.5°C between 1970 and 2000 (Critchlow-Watton et al, 2014).

Changes in hydrology and temperature impact upon ecological patterns and processes and alter the suitability of species habitat. As well as potentially altering the distribution of native species, this can facilitate the establishment of non-native species and increase the invasive tendency of some. There are nearly 2,000 non-native species established in Great Britain as a whole with 10-12 new non-native species becoming established every year. About 10-15% of non-native species established in GB cause significant adverse impacts (as well as damage to the environment, the cost of invasive non-natives in GB is at least £1.7 billion per year). Whilst the majority of non-native species in Great Britain are terrestrial, aquatic species have a greater tendency to become invasive (DEFRA, 2015). Scottish Natural Heritage consider non-native species to be 'the second most serious threat to global biodiversity after habitat loss' (SNH, 2018c). This is reflected in the European Union Biodiversity Strategy (European Commission, 2012) which runs until 2020, which identifies 'preventing the spread of non-native invasive species that currently threaten 22% of the EU's indigenous species' as one of its six priority targets.

Site Condition Monitoring (SCM) is Scottish Natural Heritage's (SNH) programme for monitoring the condition of nature conservation features³ of special interest on designated sites in Scotland. The monitoring determines whether the natural feature is likely to maintain itself in the medium to longer term under the current management regime and wider environmental or other influences (SNH, 2018a). An important aspect of the SCM process involves inspecting the site for factors which have the capacity to impact upon the feature in a detrimental or positive way- these factors are termed 'Pressures' and can apply to both man-made and natural activities (SNH, 2018b). The presence or changing extent of invasive species⁴ is one of the pressure categories utilised within SCM and this data forms the basis of this indicator.

Related indicators:

NB37 Area of native woodland affected by non-native invasive species

NB12 Condition of key habitats: Proportion of notified habitats in unfavourable condition

NB24 Proportion of water bodies not meeting Good Overall Status

What is happening now?

There are currently 77 freshwater notified habitat features with invasive non-native species as an identified pressure under Site Condition monitoring (Figure 1) (this includes 55 identified as non-

² A small loch

³ 'Features' are divided into Habitats, Species and Earth Science Features

⁴ SCM categories enable the distinction between native and non-native species: currently only one freshwater habitat feature (Loch Spynie) is identified as under pressure due to native invasive species

native species and 22 unspecified⁵). Although only five of these are rivers or streams (with the rest being standing water features), this represents half of all such features monitored for site condition.

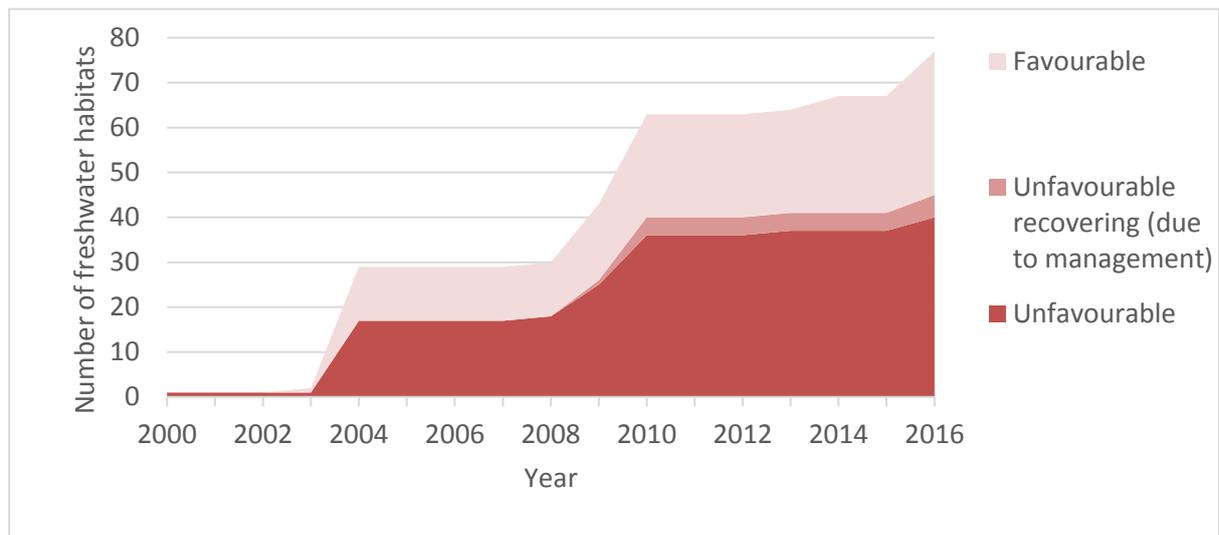


Figure1 Accumulative number of notified freshwater habitats with invasive non-native species identified as a pressure during Site Condition Monitoring. Colours indicated reported overall status of the habitats. NB graph reflects date that the pressure was first reported, whereas reported status of the sites is based on the latest assessment⁶.

Figure 1 shows that over half of the freshwater habitat features that have been identified as under pressure from invasive species are also in Unfavourable overall condition.

The species which are seen to be causing the greatest threats to Scotland's freshwater bodies include (SNH 2018d):

- North American signal crayfish (*Pacifastacus leniusculus*)
- New Zealand pygmyweed (*Crassula helmsii*)
- American mink (*Neovison vison*)
- Ruffe (*Gymnocephalus cernuus*)
- Canadian and Nuttall's pondweeds (*Elodea canadensis* & *E. nutallii*)
- Giant hogweed (*Heracleum mantegazzianum*)
- Japanese knotweed (*Fallopia japonica*)
- Parrot's feather (*Myriophyllum aquaticum*)
- Himalayan balsam (*Impatiens glandulifera*)
- Curly waterweed (*Lagarosiphon major*)

To combat the threat of INNS, Scotland's Biodiversity Strategy includes the following aims (Scottish Government, 2013):

- Prevent their establishment and spread, identify their means and routes for invasion, raise awareness of the need for biosecurity, and implement legislation and international agreements.
- Act quickly to respond to emerging threats; support early detection through monitoring programmes (including citizen science), assess risks as these arise, and develop appropriate responses.

⁵ Only one additional site is identified as under pressure due to a native invasive species

⁶ Data for 2015 is extrapolated. Plus see Limitations section of this document

- Restore terrestrial ecosystems degraded by invasive species, develop strategies to deal with established species (e.g. rhododendron and riverside invasive plants), in a coordinated and cost-effective way that engages the public, landowners and industry in tackling problems at a catchment-scale.
- Make concerted efforts to protect Scottish islands and water-dominated environments.

What has happened in the past?

SNH have identified that at least 915 non-native species and 95 non-native sub-species have become established in the wild in Scotland (SNH, 2001). Of those, where adequate data were available, since the 1950s non-natives that increased their range outnumbered those that decreased by a factor of 6 (SNH 2001).

Sixty seven per cent of non-native birds and 46% of non-native mammals showed increases in range, including species known to have serious detrimental effects on native freshwater fauna such as American mink (*Neovison vison*). Less is known about non-native invertebrates (92% unknown status), however, some species including the North American signal crayfish (*Pacifastacus leniusculus*) rapidly increased in range with a significant impact on freshwater habitats and fauna (SNH 2001).

What is projected to happen in the future?

SEPA, in their assessment of the status of Scotland's water bodies, has identified waters that are close to the bottom of a status class and therefore where careful management of pressures may be needed to prevent deterioration of status by 2027. Freshwater bodies in which ecological quality is at risk from the spread of invasive non-native species currently number 170 (107 in the Scotland basin district and 63 in the Solway Tweed district), dominated by the risk imposed by North American signal crayfish (*Pacifastacus leniusculus*) which adversely impacts native freshwater biodiversity by consuming large quantities of plants and invertebrates, or by destabilising aquatic environments by burrowing into the banks of rivers and ponds (SEPA, 2014)

There is also concern that the number of invasive species may increase, with new species arriving and establishing in Scotland. As a result, SNH conducted 'horizon scanning' in 2014 to identify potential species which may need to be monitored for.

Whilst habitat corridors will become more important to allow native species to disperse and adjust geographically to a changing climate, these may also function as invasion pathways so there will need to be careful consideration of risks and close monitoring of any new networks (Scottish Government, 2014).

Patterns of change

Whilst the impact of INNS is a significant threat to freshwater habitats, it is useful to understand the pressure that invasive species exert on Scotland's natural environment as a whole.

Invasive species have taken over from over-grazing as the dominant pressure identified across all notified features on protected sites in Scotland (SNH, 2014). Only marine and upland environments currently have less than a quarter of their notified habitat features under pressure from invasive species (Figure 2).

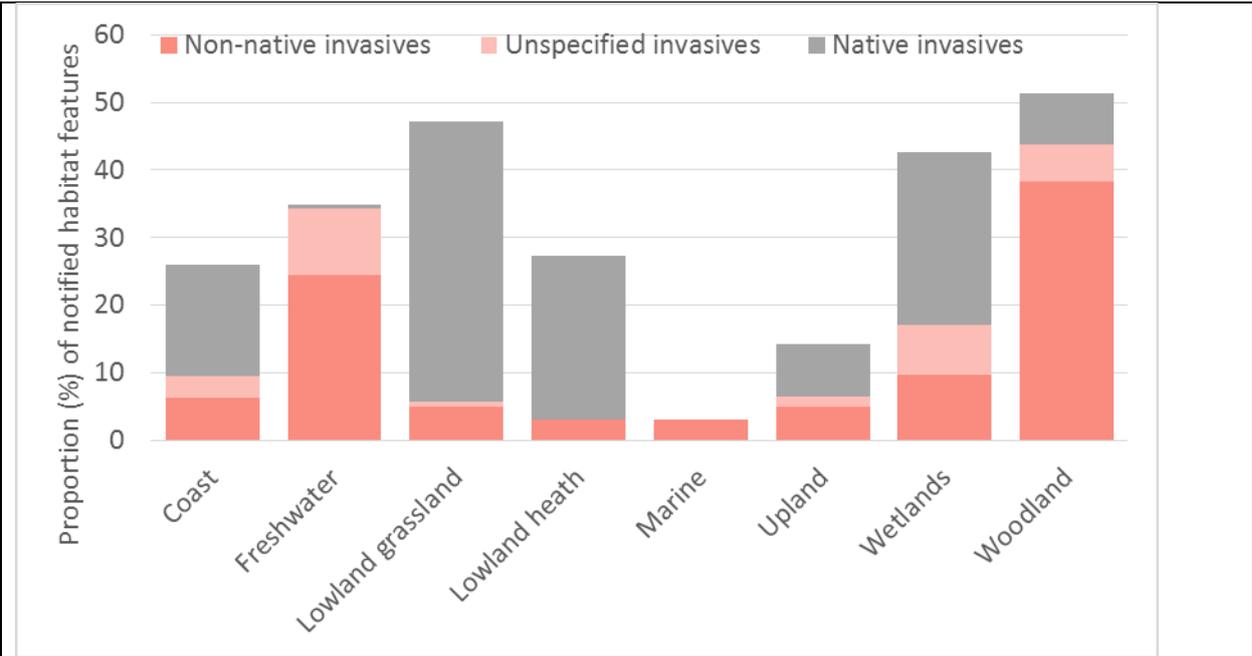


Figure 2 Proportion of notified habitat features with invasive species as an identified pressure in Site Condition Monitoring

Within Scotland’s habitats non-vascular plants and fish species are under the greatest pressure from invasive species (Figure 3).

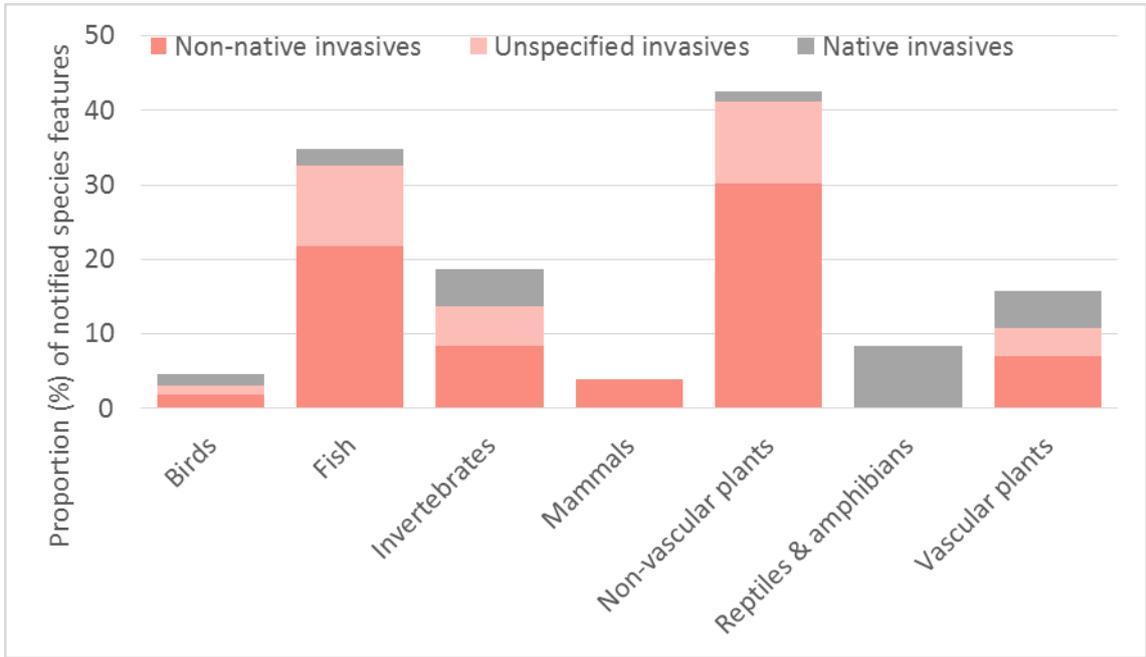


Figure 3 Proportion of notified species features with invasive species* as an identified pressure in Site Condition Monitoring (as of March 2015)

*Includes native and non-native

Different feature types appear to be affected by different types of invasive species, with woodland and freshwater habitats adversely affected mainly by non-native species (e.g. Canadian pondweed or Rhododendron), whereas lowland grassland and coastal habitats are affected by the spread of

invasive native species such as gorse, bracken and nettles. Native and non-native invasive species can have similar detrimental effects on habitats and species e.g. by competing for nutrients and light and ultimately changing the ecology of the habitat (SNH 2014).

Interpretation of indicator trends

Changes in this indicator may reflect the considerable on the ground management that is taking place across Scotland⁷. As well as the targeted on-going management of notified freshwater habitats by SNH, other management initiatives include:

- Public awareness campaigns are being used to try and reduce the intentional or accidental introduction of invasive species into freshwater bodies by giving advice on good practice relating to biosecurity e.g. Be Plant Wise (for plants) and Check, Clean & Dry (for water sports).
- The Rivers and Fisheries Trusts of Scotland (RAFTS) are leading on biosecurity in many Scottish river catchments, aiming at eradicating species such as Japanese knotweed, giant hogweed, Himalayan balsam and rhododendron. RAFTS has recently received £41,900 from the Heritage Lottery Fund to begin developing the Scottish Invasive Species Initiative (SISI) project. This will create a network of volunteers to eradicate and control several invasive non-native species across a 29,500 square km area in the north of Scotland, focusing on rivers, lochs and riparian corridors (SNH, 2015e).
- The Scottish Mink Initiative aims to protect nationally significant populations of water voles, salmonids, ground-nesting birds and other native riparian wildlife from mink (Critchlow-Watton et al, 2014).
- Public bodies are supporting SEPA's work to investigate techniques for controlling the spread of North American signal crayfish (including trials in quarry ponds undertaken by Lochaber Fisheries Trust) (Spey Fishery Board, 2015)
- Mobile phone apps are being used to provide SNH, and partners, with much-needed information about the location and spread of invasive and climate change indicator species. Once verified, the information will help agencies to monitor and control and, in some cases, eradicate the spread of invasive species (SNH, 2013).
- In October 2017, SNH announced the award of a grant of £1.59 million from the Heritage Lottery Fund for the Scottish Invasive Species Initiative project (SNH, 2017)

Whilst the number of habitat features with invasive non-native species as an identified pressure has more than doubled over the last 10 years, it is currently not possible to determine if this is entirely due to an increase in the number of sites included in later cycles of monitoring or an increase in sites under pressure per se.

Limitations

SCM: A sample of the 5335 features in Scotland undergo Site Condition Monitoring on a six-year rolling programme. This means not all features are visited and monitored every year, or every monitoring cycle. The sample for each reporting cycle is determined using a risk based random sampling model. This means that where the threat to, or vulnerability of a feature type is deemed to be low, the period between condition assessments is longer (e.g. butterfly features are monitored once every 6 years - i.e. once per monitoring cycle, whereas woodlands are monitored once every 3rd

⁷ For detail regarding local actions (as of 2012) see: http://www.sepa.org.uk/media/37375/managing-invasive-non-native-species_summary-local-actions.pdf

cycle. The sample generated by the model results in approximately 52% of features being monitored during the current monitoring cycle.

References

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Spey Fishery Board (2015) Press release June 2015 <https://www.speyfisheryboard.com/rafts-scottish-invasive-species-initiative-project-wins-heritage-lottery-fund-support/>

Further information

Invasive non-natives species:
<http://www.sepa.org.uk/environment/biodiversity/invasive-non-native-species/invasive-non-native-species-faqs/>

The Great Britain Invasive Non-native Species Strategy:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/455526/gb-non-native-species-strategy-pb14324.pdf

Acknowledgements

Bob Bryson and Brian Eardley (SNH) for supplying and advice regarding SCM data

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	NB39 Freshwater habitats with reported presence of key invasive non-native species (INNS)
Indicator contact: Organisation or individual/s responsible for the indicator	Anna Moss (CXC/ University of Dundee)
Indicator data source	SNH Site Condition Monitoring
Data link: URL for retrieving the indicator primary indicator data.	https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	SCM data includes pressures first reported 1995 until present.
Frequency of updates: Planned or potential updates	SCM: Features are monitored on a six-year rolling programme
Spatial coverage: Maximum area for which data is available	All notified features in Scotland
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	
Spatial resolution: Scale/unit for which data is collected	Notified feature site level
Categorical resolution: Potential for disaggregation of data into categories	Feature and report category; feature and pressure name
Data accessibility: Restrictions on usage, relevant terms & conditions	

Table 3 Contributing data sources

Contributing data sources
Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.



Table 4 Indicator methodology

Indicator methodology
The methodology used to create the indicator data
The indicator is based on the date that the pressure is reported at a notified freshwater habitat site as recorded by SNH’s Site Condition Monitoring.