

Early detection of non-native and invasive species using eDNA in Southampton Water



Dr Cathy Lucas

Non-native and Invasive species

Non-native species (NNS)

Species living outside their native range, having been spread to another region by human activities, either deliberately or accidentally.

Invasive species

NNS that spread rapidly and cause harm to native biodiversity, damage economic interests, or endanger human health.

Southampton Water - a hotbed for non-native species



Mercenaria mercenaria



Crassostrea gigas



Didemnum vexillum



Botrylloides diegensis



Styela clava



Crepidula fornicata

Historical sampling in Southampton Water

- Benthic and pelagic studies since the late 1950s / early 1960s
- Funded research projects
- Monitoring for stakeholders
- BSc, Masters and PhD projects
- UoS boat practical sessions for >30 years
- UoS annual field course since 2024

Recent observations of non-native species

Yoldia limatula



iNaturalist (pfenberg) - 10 Jul 2025
Lower estuary



iNaturalist (robinsomes) - 7 Feb 2025
~150 specimens nr Container Terminal

- Native to cold-temperate Pacific and Atlantic coasts of N. America
- First detected in Europe in 2019 in Western Scheldt estuary
- First recorded in UK in November 2020 in Tees estuary (Barry et al., 2024)

Recent observations of non-native species

Charybdis hoplites

Journal of the Marine
Biological Association of the
United Kingdom

cambridge.org/mbi

Marine Record

Cite this article: Goatley C, Seaby R, Somes R, Kamanli SA, Clark B and Clark P (2026) First record of the swimming crab *Charybdis* (*Archias*) *hoplites* (Wood-Mason, 1877) (Portunidae) in the Atlantic. *Journal of the Marine Biological Association of the United Kingdom* **106**, e19, 1–9. <https://doi.org/10.1017/S0025315426101131>

Received: 18 November 2025

Revised: 8 January 2026

Accepted: 19 January 2026

Keywords:

ballast water, invasive species, Southampton Water, swimming crab, United Kingdom

Corresponding author:

Christopher Goatley;
Email: c.goatley@soton.ac.uk

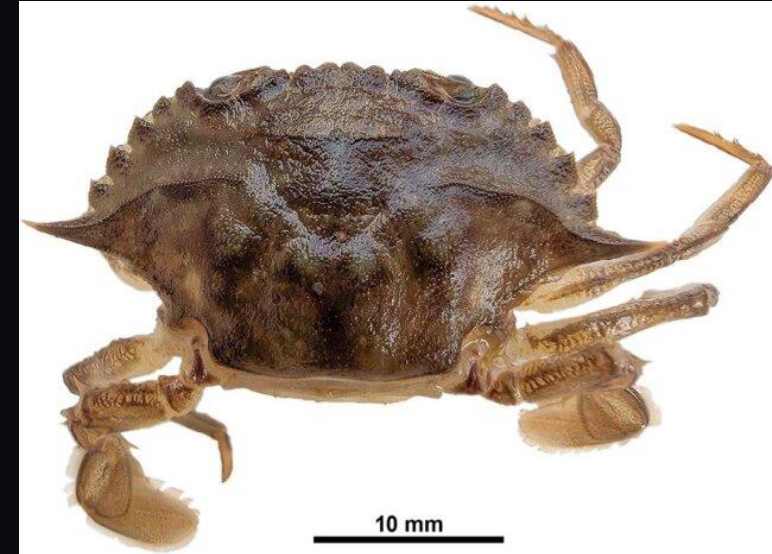
First record of the swimming crab *Charybdis* (*Archias*) *hoplites* (Wood-Mason, 1877) (Portunidae) in the Atlantic

Christopher Goatley^{1,2} , Richard Seaby³, Robin Somes³, Seyit Ali Kamanli⁴, Brett Clark⁵ and Paul Clark⁶

¹School of Ocean and Earth Science, University of Southampton, National Oceanography Centre, Southampton, UK; ²Australian Museum Research Institute, Australian Museum, Sydney, Australia; ³Pisces Conservation Ltd, Everton, UK; ⁴Department of Biology, Faculty of Art and Science, Burdur Mehmet Akif Ersoy University, Burdur, Turkey; ⁵Science Innovation Platforms, The Natural History Museum, London, UK and ⁶Department of Life Sciences, Natural History Museum, London, UK

Abstract

Portunid crabs of the genus *Charybdis* De Haan, 1833 are among the most frequently reported marine invaders worldwide. Here, we report the first record of *Charybdis* (*Archias*) *hoplites* (Wood-Mason, 1877) outside its native Indo-West Pacific range, collected from the Test Estuary, Southampton Water, United Kingdom. Morphological and molecular analyses confirm the specimen's identity and clarify diagnostic features useful for distinguishing *C. (A.) hoplites* from closely related taxa. This represents the northernmost record of any *Charybdis* species and suggests a long-distance dispersal event, associated with shipping activities in the Port of Southampton. Environmental data indicate that salinity and turbidity at the collection site are within known tolerances for *Charybdis* spp., although low winter temperatures may limit survival and establishment. The detection of this warm-water species in a major international port highlights the ongoing need to monitor non-native marine fauna.



- Warm water species from Indo-West Pacific
- Single specimen recorded at Marchwood power station in July 2025
- Identified using molecular and morphological analyses

Project rationale and aims

There is a considerable knowledge base of marine organisms in Southampton Water, including those that are non-native and invasive species.

BUT

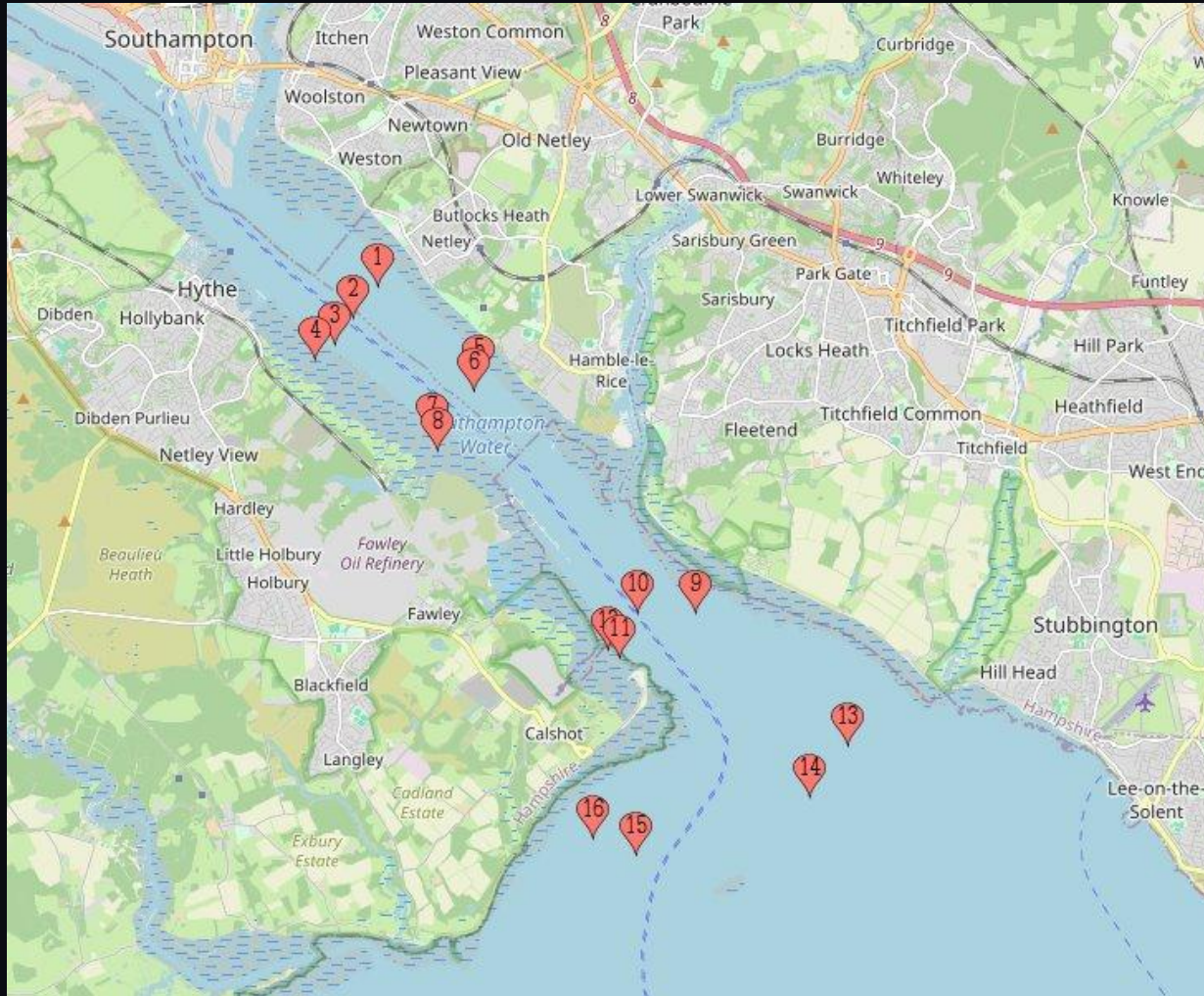
Observational records are patchy and consistent early detection of invasive species is not possible, posing a threat to the native biodiversity in this high-risk region.

AIMS

Supplement existing annual field sampling and traditional taxonomic identification with eDNA sampling and next-gen sequencing to increase the sensitivity and resolution of community composition data.

- 1) Rapidly detect the arrival on NNS
- 2) Identify whether the incidence of NNS is increasing with human activity and climate
- 3) Inform local stakeholders for management purposes

Student field course



16 sites
Van Veen grab
Taxonomic ID
Environmental data



Species identified in benthic grab samples

2024 -

83 species, including *Crepidula fornicata*, *Ruditapes philipinarum*, *Styela clava*

2025 -

94 species, including NNS and *Yoldia limatula* for the first time

2026 -

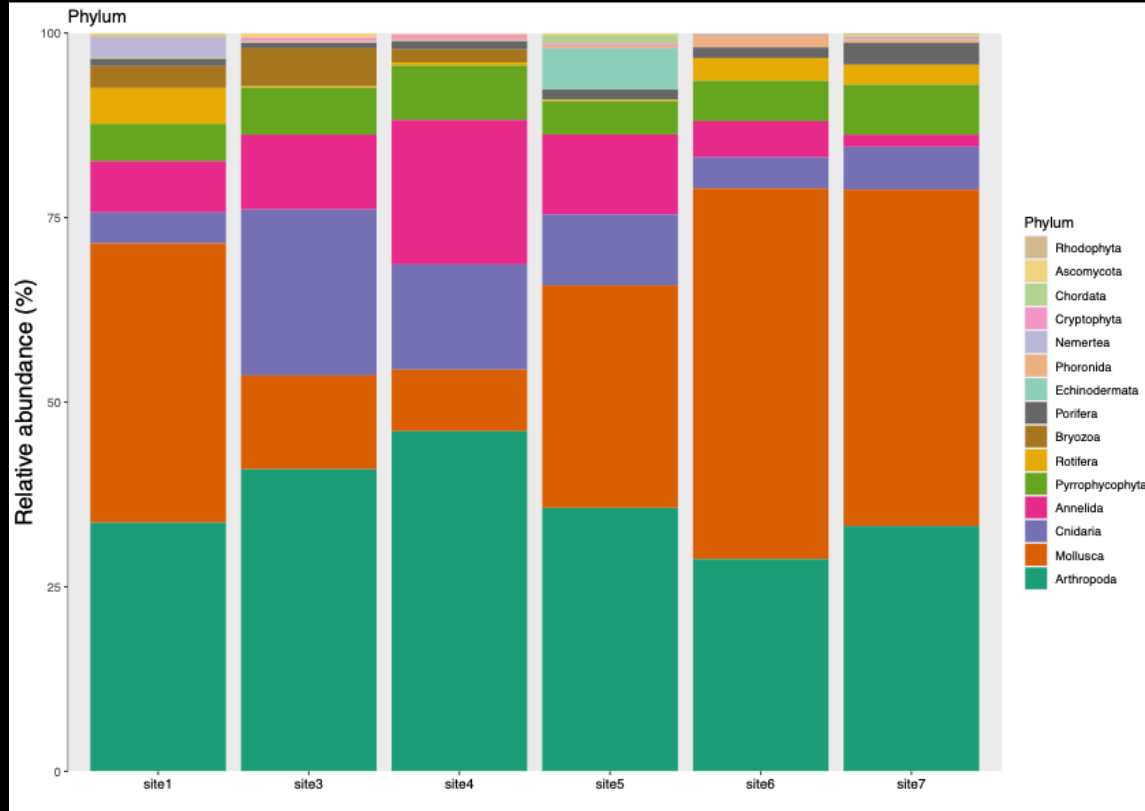
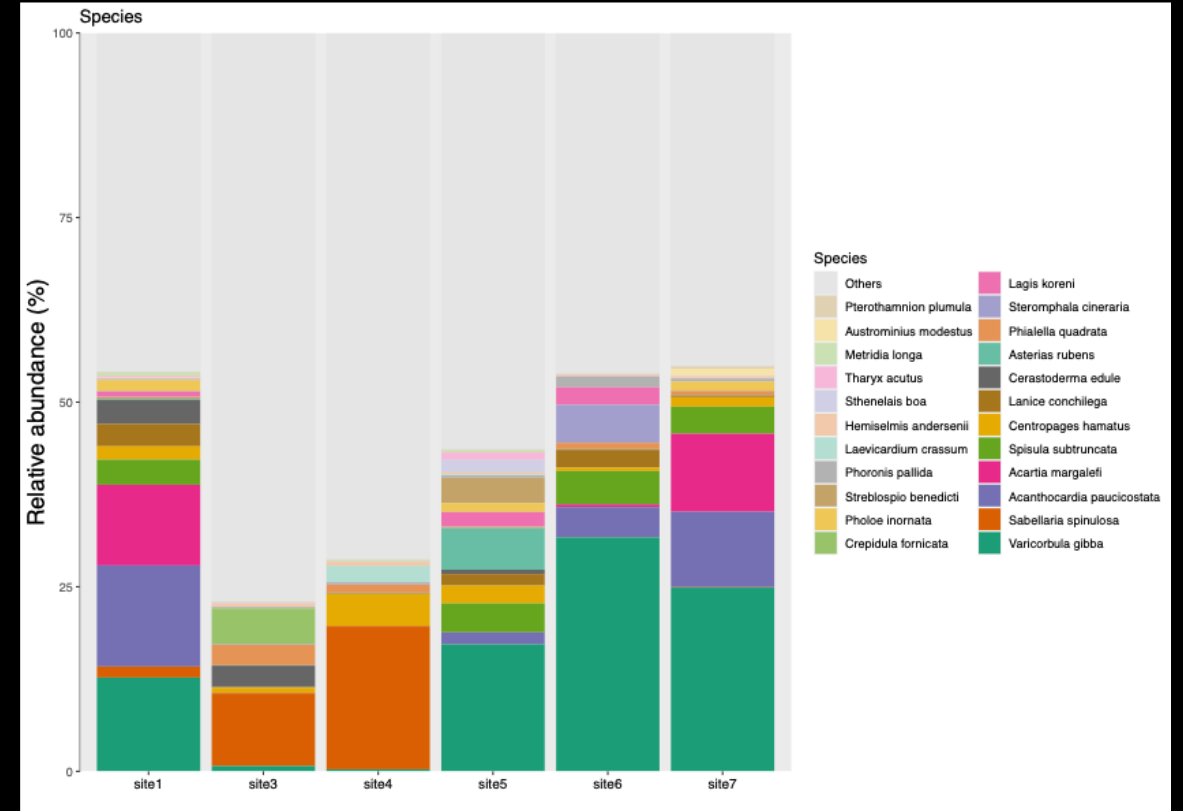
73 species, including NNS and *Yoldia limatula*, more widespread in the estuary

eDNA sampling and analysis



- Seawater collected in the upper estuary during the field course
- DNA extraction according to modified methods of Holman et al. (2019)
- Sequencing and bioinformatics at UoS Environmental Sequencing Facility
- Taxonomic assignment - DADA2 software with the Barcode of Life Systems Database

eDNA preliminary data from May 2026



Relative abundance (%) of major detected metazoan phyla and species across Southampton Water sampling sites, based on preliminary environmental DNA (eDNA) COI metabarcoding data produced via Oxford Nanopore sequencing

Next steps

- Cross-check 2026 taxonomic and molecular data
- Disseminate findings
- Plan to continue eDNA sampling in 2027 and beyond (BES Long-term grant submitted)

