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**Short communication**

# *Sinelobus stanfordi* (Richardson, 1901): A new crustacean invader in Europe

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## Abstract

This short note reports on the first European records of *Sinelobus stanfordi* (Crustacea: Tanaidacea: Tanaidae). The species has been recorded from five different water bodies in the Dutch coastal area and in the docks of the Belgian harbour of Antwerp. *S. stanfordi* was until now not known to inhabit (North-) European coasts and estuaries. It is thus very likely that its origin is non-indigenous.

**Key words:** *Sinelobus stanfordi*, The Netherlands, Belgium, estuaries, littoral

From the Dutch and Belgian North Sea coast only a few species of Tanaidacea have been recorded. For *Apseudes talpa* (Montagu, 1808) (Apseudidae) and both *Heterotanais oerstedi* (Krøyer, 1842) and *Leptochelia dubia* (Krøyer, 1842) (Leptocheliidae) there are no known recent records since Holthuis (1956) recorded these species from our area. *Tanais dulongii* (Audouin, 1826) has recently been rediscovered from the Belgian Oostende harbour (pers. comm. F. Kerckhof) and *Tanaissus lilljeborgi* (Stebbing, 1891) is a common representative on sandy substrata in the Oosterschelde estuary (Wolff 1973; pers. comm. M. Faasse). Holdich and Jones (1983) give records of many more species occurring along the British coast.

The new species, *Sinelobus stanfordi* (Richardson, 1901), was found for the first time on September 14th, 2006 in the river 'Oude Maas', The Netherlands and was quite abundant on stones (see Annexes 1 and 2 for more details). Only a few days later, the species was discovered in two other rivers in the Rhine Delta (Nieuwe Waterweg and Hollandse IJssel) and the Noordzeekanaal. In 2007 the species was still present in the Noordzeekanaal and the Nieuwe Waterweg. Besides this, it was newly found in the Canal of Gent-Terneuzen. The first Belgian record was done the same year in an artificial substrate in the Antwerp harbour, situated in the mesohaline part of the Schelde-estuary. All of these observations were in estuarine conditions with more or less marine influence.

Many factors make it highly likely that this small tanaid is a very recent newcomer in European waters. It was not recorded before 2006, and from that year on, it has been frequently found in a few sites which are in many cases well monitored. This paper gives a comprehensive account of *S. stanfordi*.

Identification. Tanaidaceans are a group of small malacostracan crustaceans, belonging to the superorder Peracarida (Table 1). Currently more than 900 species are known within the Tanaidacea (Jaume and Boxshall 2008) but the order is estimated to contain over a thousand species (Anderson 2009). Tanaidaceans range from 1 mm to several centimetres, but the majority (including *Sinelobus stanfordi*) are around a few mm in length (Larsen 2007).

*Sinelobus stanfordi* is built as many other species of Tanaidae, a cephalothorax with a pair of chelipeds, one pair of eyes and two pairs of antenna, six abdominal segments (or peraeon) with small legs (pereopods) and a pleon. In *S. stanfordi* the cephalothorax shows a remarkable sexual dimorphism which is rare within Tanaidae. The cephalothorax of the male speci-

**Table 1.** Systematic position of *Sinelobus stanfordi*

Phylum: Arthropoda
Subphylum: Crustacea
Class: Malacostraca
Superorder: Peracarida
Order: Tanaidacea Dana, 1849
Suborder: Tanaidomorpha Sig, 1980
Superfamily: Tanaoidea Dana, 1849
Family: TANAIDAE Dana, 1849
Subfamily: Sinelobinae Sieg, 1980
Genus: *Sinelobus* Sieg,1980
*Sinelobus stanfordi* (Richardson, 1901)
Syn: *Tanais stanfordi*; *T. philetaerus* Stebbing, 1904; *T. fluviatilis* Giambiagi, 1923; *Tanais sylviae* Mello-Leitao, 1941; *Tanais herminiae* Mane-Garzon, 1943; *Tanais estuarius* Pillai, 1954

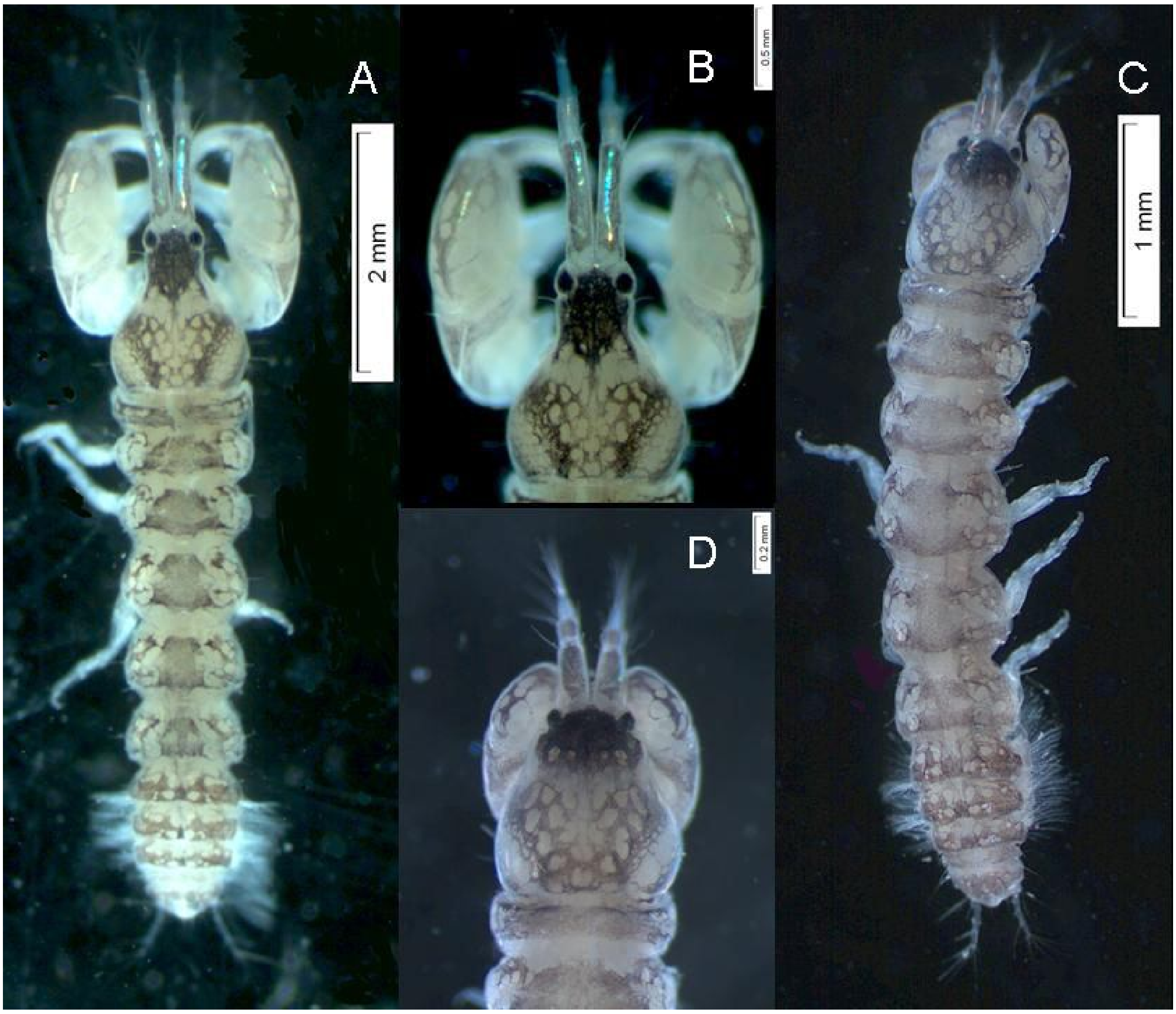


**Figure 1.** *Sinelobus stanfordi* in dorsal view, male (A, B) and female (C, D). Photographs by Ton van Haaren

mens is distinctly narrowed anteriorly, while in females the cephalothorax is less narrowed (Figure 1). In most other genera, including the resembling genera *Tanais* Latreille, 1831 and *Parasinelobus* Sieg, 1980, the sexual dimorphism is slight or absent i.e. the cephalothorax is less narrowed. The cheliped of the male *S. stanfordi* is larger than in females. Besides this, the inner side of carpus in males has a distinct lobe at the distal medial and ventral margin, while the merus has a short lobe at the distal ventral margin. Two other known species of *Sinelobus* i.e. *S. pinkenba* Bamber, 2008 from Queensland and *S. barretti* Edgar, 2008 from Tasmania show a reduced sexual dimorphism of the cheliped and lack the ventral lobe on the carpus in males (Edgar 2008; Bamber 2008). The six pairs of legs on each abdominal segment have the ischium lacking, so that these legs have four segments only and a single terminal claw. The claws on the first three pairs of legs are slightly curved and smooth while in the other they are strongly curved with two lateral rows of numerous hair like teeth. The pleon has four tergites (or pleonites 1-4) and one pleotelson (Figure 2). The first three pleonites are wider then the fourth and contain the (ventral) pleopods.

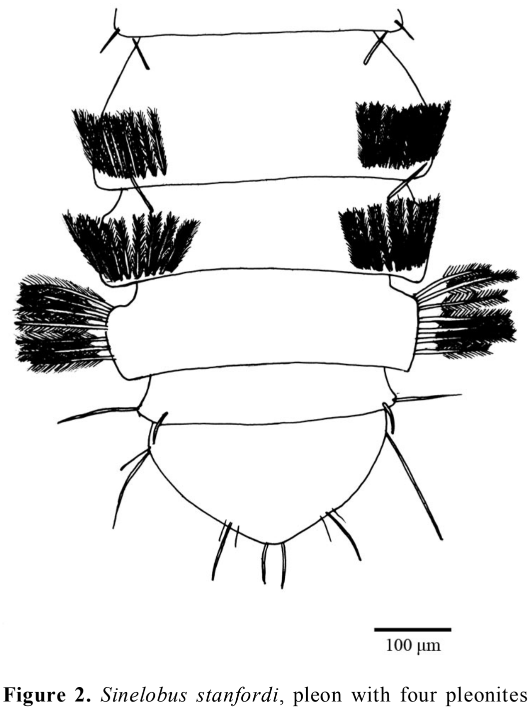


**Figure 2.** *Sinelobus stanfordi*, pleon with four pleonites and one pleotelson. Drawing by Ton van Haaren

The endopodite of the pleopods have only one hair on the inner side (Figure 3), while in similar genera there is a row of hairs. The dorsal side of pleonites 1-2 has a transversely arranged row of plumose hairs, widely interrupted in the middle. Pleonite 3 only has some lateral plumose hairs. As the hairs on the pleopods are long and visible from above, the pleon appears hairy. At the end of the pleotelson there is one pair of an uniramous four-segmented uropod (Figure 4) with relatively long terminal hairs at the distal end of segments one, three and four. The last uropod segment is not reduced as may be the case in other species.

*Sinelobus* can be separated from other genera by the relatively short uniramous uropod segments (4-segmented with the last segment not reduced), a pleon with four tergites (or pleonites) and one pleotelson, rows of plumose seta on the first two pleonites and the endopodite of the

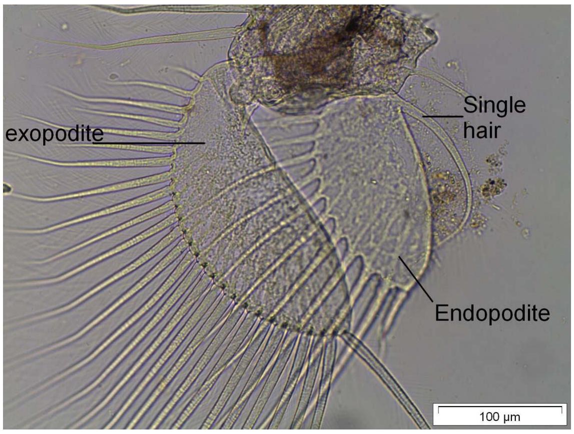


**Figure 3.** Pleopod of *Sinelobus stanfordi* with a single hair at the inner edge of the endopodite. Photograph by Ton van Haaren

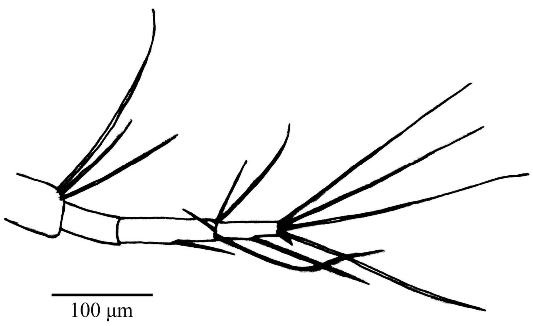


**Figure 4.** S*inelobus stanfordi*, uropod in dorsal view. Drawing by Ton van Haaren

pleopods have only one hair on the inner side. A less easy to spot feature is the absence of a distolateral or terminal lobe on the outer lobe of the labium, which is present in *Tanais* (Sieg 1980; Sieg and Winn 1981). The more pronounced sexual dimorphism of the cephalothorax and the cheliped in *S. stanfordi* can be used in separating them from most other Tanaidae and both other *Sinelobus* species (Edgar 2008).

Distribution. *Sinelobus stanfordi* is one of the few Tanaidacea having a wide distribution, occurring circumtropically and also penetrating the northern and southern temperate waters (Sieg 1986). It occurs along the Pacific and Atlantic coast of central and southern America, south-Africa, Indian Ocean, Polynesia, Kuril islands, and New-Zealand (freshwater) (Sieg 1980). The record from Australia (Queensland) by Sieg (1980) refer to *S. pinkenba* Bamber (Bamber 2008). It has also been collected in the South China Sea (Bird and Bamber 2000), the Caribbean Sea (Gutu and Ramos 1995; Garcia-Madrigal et al. 2005), Japan (Kikuchi and Matsumasa 1993; Miyadi 1938; Saito and Higashi 2000) and even into the Mediterranean (pers. comm R. Bamber). Heard et al. (2003) state that is has been reported nearly world wide from sub Antarctic (Southern Ocean) to the tropical and temperate waters of the western Atlantic and eastern and western Pacific Oceans, and Indian Ocean. Its type locality is Clipperton Island (Sieg 1980).

In The Netherlands, the species has been found in the Noordzeekanaal and in some tributaries in the northern part of the Rhine Delta. It is present in the Canal Gent-Terneuzen but not yet found in the neighbouring Westerschelde (Figure 5). In the Belgian part of the same Schelde estuary the species was discovered in some harbour docks. These records are close to the major ports of Amsterdam, Rotterdam and Antwerp respectively. Introduction via ballast water or as a part of the fouling community on the hulls seems very likely.

In North America the species is considered to be an invader in a few East- and West coast states: Fraser, Squamish and Kitimat River Estuary British Colombia (Levings and Rafi 1978); San Fransisco Bay and delta (Cohen and Carlton 1995); Lower Colombia River and Coos Bay, Oregon (Sytsma et al. 2004; Ruiz et al. 2000), South Carolina (South Carolina Department of Natural Resources 2008) and Washington (Joyce 2005).


**Figure 5.** Distribution of *Sinelobus stanfordi* in The Netherlands and Belgium (CGT=Canal Gent-Terneuzen; HY=Hollandse IJssel; NW=Nieuwe Waterweg; NZK=Noordzee-kanaal; OM=Oude Maas; OS=Oosterschelde; S=Schelde; WS=Westerschelde). See Annex 1 and 2 for more details on collected material

*Sinelobus stanfordi* is very likely to have been transported around the world since 1500 in association with solid ballast, in fouling communities on the hulls of sailing ships and then again with ballast water and aquaculture transplants (Sytsma et al. 2004). One wonders why this almost cosmopolitan species, took such a long time to reach the North Sea estuaries.

Ecology. While the vast majority of tanaidaceans are marine, a small number of species is found in brackish water (Sieg 1980; Holdich and Jones 1983; Larsen 2007) occurring over a wide range of depths (Holdich and Jones 1983). These species may occur in high densities. In shallow water, they often exceed 10,000 ind./m$^2$ and population densities over 140,000 ind./m$^2$ have been reported. However, tanaidaceans have their greatest ecological importance on the abyssal plain, where they are often the most abundant crustaceans and, on the level of order, the dominant and most diverse faunal component, rivalling that of polychaetes. Estimates of their abundance range from 13% to 22% of the total fauna. The continental shelf and slope also contain numerous tanaidaceans (Larsen 2007). They are usually benthic in habit (Holdich and Jones 1983; Levings and Rafi 1978) and may be tube-dwelling, burrowing or free-living (Gardiner 1975; Johnson and Attramadal 1982a, b).

Within the mainly marine order of Tanaidacea, *Sinelobus stanfordi* is one of the few species which also occur in fresh water. It has been reported from geographically scattered fresh waters as well as hypohaline and even hypersaline lakes (Jaume and Boxshall 2008; Gardiner 1975). This extremely euryhaline species can even tolerate a salinity of up to 52 PSU (Gardiner 1975). In Japan it was found in a freshwater lake (Kikuchi and Matsumasa 1993; Miyadi 1938) and in a dolphin-pool (Saito and Higashi 2000). In Florida, the species was discovered in Lake Okeechobee and from tidal fresh water habitats in North West Florida (Heard et al. 2003). In the Leiden Museum a specimen is deposited from Guadeloupe (river Salee near Sainte Rose) having a remark on its label, reading "freshwater". The species however is mainly recorded from brackish and estuarine habitats (Levings and Rafi 1978; Sieg 1980; Bird and Bamber 2000; this paper).

The species has been recorded from bivalves, balanids, plants (algae, rushes, mangrove stems and roots), among stones, on rocks, submerged piling and within the canals of sponges (Gardiner 1975). In the Caribbean Sea, *S. stanfordi* was found on algae, plankton and coral rocks (Garcia-Madrigal et al. 2005). In Japan (Gamo Lagoon) they were found associated with the filamentous algae *Polysiphonia* sp. growing on the concrete embankment of a channel, but also with the thin sediment on the embankment and bottom sediment (Matsumasa and Kurihara, 1988). The Bonde et al. (2004) report of "*Sinelobus stanfordi*" parasitic on the West-Indian Manatee (*Trichechus manatus* Linnaeus, 1758) is wrong, as that species would in fact have been *Hexapleomera robusta* (Moore, 1894), a known obligate parasite of turtles and manatees (pers. comm. R. Bamber).

In The Netherlands and Belgium, *Sinelobus stanfordi* has mainly been found on hard surfaces in the shallow littoral. Often more than over a 1,000 individuals in a sample have been recorded (Annex 2). On silt, clay or sandy bottoms their numbers are lower. It is striking that the species is absent in the soft intertidal and subtidal sediments of the Belgian Schelde estuary, which have been intensively monitored since more than a decade. But as Levings and Rafi (1978) stated, silt is required for the species to build their tubes. The locations where the species were found show a salinity range of 3.1-13.2 PSU (Table 2), although there was a single specimen found in the freshwater part of the Schelde-estuary (1.5 PSU) near the junction with the Albertkanaal. All locations are estuarine with fluctuations in salinity. Table 2 will not show the actual response of the species, for the maximum may even be higher at another time. For instance, the species was found in the brackish water river 'Nieuwe Waterweg' at Hoek van Holland in September 2006 as well as October 2007. At this location in the river, daily fluctuations in chlorine levels ranging from 2000 to 18000 mg $Cl.l^{-1}$ (3.6-32.5 PSU) are normal (pers. comm M. Kuitert). This confirms that *S. stanfordi* can withstand huge fluctuations in salinity. The species is able to survive these fluctuations presumably by active control of the osmotic concentration of the body fluids (Kikuchi and Matsumasa 1993).

In the Schelde-estuary in Verrebroekdok (Belgium), *S. stanfordi* was found in the fouling community attached to a 1.5 meter-deep artificial substrate (used for glass-eel monitoring). Cohen and Carlton (1995) mention this fouling-behaviour: "among masses of the introduced tubeworm *Ficopomatus* and lumbering along in intertwined mats of green algae *Ulva* and *Cladophora*, often in association with the introduced amphipods *Melita* and *Corophium*". In Verrebroekdok, the species was accompanied by a community dominated by the introduced amphipod *Gammarus tigrinus* Sexton, 1939. In smaller numbers, the non-indigenous crab *Rhithropanopeus harrisii* (Gould, 1841) and the snail *Potamopyrgus antipodarum* (Gray, 1843) were present. Native species like the polychaete *Nereis diversicolor* Müller, 1776, the isopod *Lekanesphaera rugicauda* (Leach, 1814) and the amphipod *Apocorophium lacustre* (Vanhöffen, 1911) were also present in this sample but only in very low numbers. It seems very likely that the species will also occur on buoys (and other overgrown artificial hard substrates) in the Schelde-estuary where *Melita palmata* (Montagu, 1804) and a variety of Corophiidae species occur (unpublished records INBO).

**Table 2.** Average values and standard deviation, minimal and maximal values and 10, 25, 50, 75 and 90-percentiles of temperature and selected chemical parameters of sampling locations with records of *Sinelobus stanfordi* (see Annex 2 for details)

| | Temperature (°C) | PH | $O_2$ (%-sat.) | $O_2$ mg.l$^{-1}$ | Conductivity µS.cm$^{-1}$ | Cl mg.l$^{-1}$ | Salinity PSU |
|---|---|---|---|---|---|---|---|
| average | 17.2 | 7.9 | 84 | 8.2 | 11844 | 4276 | 7.8 |
| St.dev | 2.1 | 0.3 | 20 | 2.3 | 5578 | 2195 | 3.2 |
| Min. | 13.1 | 7.6 | 61 | 5.8 | 439 | 38 | 1.5 |
| Max. | 20.8 | 8.4 | 133 | 13.5 | 20718 | 7841 | 13.2 |
| 10p | 14.5 | 7.7 | 65 | 6.0 | 4609 | 1433 | 3.1 |
| 25p | 15.7 | 7.8 | 68 | 6.4 | 8533 | 3036 | 5.8 |
| 50p | 17.2 | 7.8 | 81 | 7.3 | 12970 | 4562 | 8.2 |
| 75p | 18.8 | 8.2 | 91 | 9.3 | 16048 | 5684 | 10.3 |
| 90p | 19.8 | 8.3 | 110 | 10.9 | 18118 | 7451 | 11.6 |
| N (data) | 23 | 17 | 17 | 17 | 23 | 22 | 22 |

At all locations in The Netherlands and Belgium, except for Hollandse IJssel and Rijn-verbindings-kanaal, *S. stanfordi* was observed co-occurring with one or more corophiid species. This mainly concerned *Apocorophium lacustre*, but also *Corophium multisetosum* Stock, 1952 and occasionally *Chelicorophium curvispinum* (G.O. Sars, 1895), *C. robustum* (G.O. Sars, 1895) and *Monocorophium insidiosum* (Crawford, 1937). The co-occurrence with corophiid species is also known from the Fraser river estuary, British Colombia (*M. insidiosum* and *Corophium salmonis* Stimpson, 1857) (Levings and Rafi 1978) and Gamo lagoon, Japan (*C. uenoi* Stephenson, 1932) (Matsumasa and Kurihara 1988). In the latter case the tubes of *C. uenoi* were build on a different substrate (filamentous algae) than the tubes of *S. stanfordi* (concrete embankment). However, although in this latter case, *S. stanfordi* and a corophiid were observed using different microhabitats, competition of corophiid species and *S. stanfordi* should not be excluded, as they both build their silty tubes on hard substrates and probably feed on the same food. On the other hand, there is no evidence of any competition between *S. stanfordi* and (non-) native species. More non-indigenous species which have been found to co-occur with *S. stanfordi* include the tube-worm *Ficopomatus enigmaticus* (Fauvel, 1923), the molluscs *Dreissena polymorpha* (Pallas, 1771), *Mytilopsis leucophaeata* (Conrad, 1831), *Rangia cuneata* (Sowerby, 1831), *Mya arenaria* (Linnaeus, 1758) and *Potamopyrgus antipodarum* and the decapods *Hemigrapsus takanoi* Asakura & Watanabe, 2005 and *Palaemon macrodactylus* Rathbun, 1902. Like many other exotic species, *S. stanfordi* is taking 'advantage of the human introduction of hard substrates in estuaries where soft sediments naturally prevail' (Soors et al. in press).

It is astonishing, a little known species of a little known group of crustaceans seems to have colonised semi-natural habitats at this apparent speed. A further expansion of the distribution range of this curious macro-invertebrate species is well conceivable. The authors like to encourage the efforts undertaken by water board authorities to continue the monitoring of these non-native macro-invertebrates.

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**Annex 1.** Records of *Sinelobus stanfordi* in Europe. Country code NL=The Netherlands, BE=Belgium
Location 'km' (in the rivers) indicates the distance from the source

| nn | Country code | Water body | Location | Coordinates, WGS84 | | Record Date |
|---|---|---|---|---|---|---|
| | | | | Latitude, N | Longitude, E | |
| 1 | NL | Oude Maas | Heinenoordtunnel, km 990 | 51°50'09" | 4°30'21" | 14-Sep-06 |
| 2 | NL | Oude Maas | Hoogvliet, km 1001 | 51°50'56" | 4°21'03" | 14-Sep-06 |
| 3 | NL | Nieuwe Waterweg | Nieuwe Waterweg (km 1020/1021) | 51°55'05" | 4°13'42" | 19-Sep-06 |
| 4 | NL | Nieuwe Waterweg | Oeverbos west, km 1016 | 51°54'22" | 4°16'21" | 19-Sep-06 |
| 5 | NL | Nieuwe Waterweg | Oeverbos west, km 1016 | 51°54'22" | 4°16'21" | 19-Sep-06 |
| 6 | NL | Nieuwe Waterweg | Hoek van Holland, km 1031 | 51°58'51" | 4°06'36" | 21-Sep-06 |
| 7 | NL | Nieuwe Waterweg | Hoek van Holland, km 1029 | 51°58'03" | 4°07'51" | 21-Sep-06 |
| 8 | NL | Hollandse IJssel | Moordrecht | 51°58'43" | 4°39'47" | 25-Sep-06 |
| 9 | NL | Noordzeekanaal | Velsen Zuid (3.5 km from sealocks) | 52°27'46" | 4°38'30" | 05-Oct-06 |
| 10 | NL | Noordzeekanaal | Velsen Zuid (3.5 km from sealocks) | 52°27'45" | 4°38'30" | 05-Oct-06 |
| 11 | NL | Noordzeekanaal | Westzanerpolder (13.0 km from sealocks) | 52°25'44" | 4°45'58" | 05-Oct-06 |
| 12 | NL | Noordzeekanaal | Westzanerpolder (13.0 km from sealocks) | 52°25'44" | 4°45'57" | 05-Oct-06 |
| 13 | NL | Noordzeekanaal | Westzanerpolder (13.0 km from sealocks) | 52°25'43" | 4°45'56" | 05-Oct-06 |
| 14 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), pond | 52°26'12" | 4°43'02" | 09-May-07 |
| 15 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), littoral | 52°26'11" | 4°43'02" | 09-May-07 |
| 16 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), littoral | 52°26'10" | 4°43'04" | 09-May-07 |
| 17 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), ditches | 52°26'13" | 4°42'57" | 09-May-07 |
| 18 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), pond | 52°26'13" | 4°42'58" | 11-Sep-07 |
| 19 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), pond | 52°26'12" | 4°43'02" | 11-Sep-07 |
| 20 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), littoral | 52°26'11" | 4°43'02" | 11-Sep-07 |
| 21 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), littoral | 52°26'10" | 4°43'04" | 11-Sep-07 |
| 22 | NL | Noordzeekanaal | Zuiderpolder (9.5 km from sea locks), ditches | 52°26'13" | 4°42'57" | 11-Sep-07 |
| 23 | NL | Kanaal Gent-Terneuzen | Sluiskil | 51°17'09" | 3°50'14" | 20-Sep-07 |
| 24 | NL | Kanaal Gent-Terneuzen | Terneuzen | 51°18'55" | 3°49'32" | 20-Sep-07 |
| 25 | NL | Noordzeekanaal | Velsen Zuid (3.5 km from sealocks) | 52°27'45" | 4°38'18" | 04-Oct-07 |
| 26 | NL | Noordzeekanaal | Westzanerpolder (13.0 km from sealocks) | 52°25'57" | 4°44'19" | 04-Oct-07 |
| 27 | NL | Nieuwe Waterweg | Hoek van Holland, km 1028 | 51°57'45" | 4°8'30" | 10-Oct-07 |
| 28 | NL | Nieuwe Waterweg | Oeverbos west, km 1017 | 51°54'29" | 4°16'06" | 10-Oct-07 |
| 29 | BE | Schelde | Verrebroekdok, Verrebroek | 51°15'56" | 4°12'48" | 19-Jul-07 |
| 30 | BE | Schelde | Havendok, Kaai 51 near Albertkanaal, Antwerpen | 51°14'31" | 4°24'34" | 30-Jul-08 |
| 31 | BE | Schelde | kanaaldok, near Thijsmanstunnel, Lillo | 51°18'24" | 4°19'09" | 30-Jul-08 |
| 32 | BE | Schelde | Schelde Rijnverbindingskanaal, near Dutch Border, Zandvliet | 51°22'27" | 4°16'20" | 30-Jul-08 |

**Annex 2.** Details of sampling locations with records of *Sinelobus stanfordi*. Substrate, collecting method, number of individuals and sampling depth (when available) are provided as well as temperature and selected chemical parameters (when available)

| nn | Substratum | Collecting method | Indivi-duals collected | Sample depth (m) below sea level | TEMP, °C | pH | $O_2$ % | $O_2$ mg/l | Conductivity uS/cm | Cl mg/l | Sal PSU |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Stones | Hand | 1 | | | | | | | | |
| 2 | Stones | Hand | 1283 | | 20.8 | | | | 2422 | 710 | 1.5 |
| 3 | Stones | Hand | 3878 | | | | | | | | |
| 4 | Silt (littoral) | Pondnet | 9 | | | | | | | | |
| 5 | Stones | Hand | 6920 | | | | | | | | |
| 6 | Silt (littoral) | Hand | 5 | | 20.0 | | | | 20718 | 7841 | 13.2 |
| 7 | Stones | Hand | 905 | | 20.0 | | | | 20718 | 7841 | 13.2 |
| 8 | Silt/clay (littoral) | Ekman grab | 2 | | | | | | | | |
| 9 | Sand (profundal) | van Veen grab (0.22 $m^2$) | 2 | - 4.40 | 19.0 | 7.6 | 70 | 6.2 | 13502 | 4692 | 8.4 |
| 10 | Stones (0,58 $m^2$) | Hand | 2200 | - 0.70 | 18.0 | 7.7 | 71 | 6.4 | 11010 | 3878 | 7.0 |
| 11 | Sand (profundal) | van Veen grab (0.22 $m^2$) | 12 | - 4.80 | 19.2 | 7.7 | 67 | 5.9 | 12929 | 4478 | 8.1 |
| 12 | Stones | Hand | 13800 | | 18.6 | 7,8 | 81 | 7.3 | 10505 | 3673 | 6.6 |
| 13 | Sand (profundal) | van Veen grab (0.22 $m^2$) | 6 | | | | | | | | |
| 14 | Sand | Pondnet | 2 | -0.05 | 16.3 | 8.3 | 122 | 11.7 | 15800 | 5553 | 10.0 |
| 15 | Sand and clay | Pondnet | 16 | -0.25 | 16.2 | 8.4 | 89 | 8.9 | 16685 | 5864 | 10.6 |
| 16 | Sand and org. material | Pondnet | 3 | -0.25 | 14.5 | 8.3 | 95 | 9.6 | 16295 | 5727 | 10.3 |
| 17 | Clay | Pondnet | 26 | -0.65 | 15.4 | 8.4 | 133 | 13.5 | 16560 | 5821 | 10.5 |
| 18 | Clay | Pondnet | 4 | -0.2 | 17.2 | 7.8 | 61 | 5.8 | 12970 | 4559 | 8.2 |
| 19 | Sand | Pondnet | 7 | -0.2 | 17.2 | 7.8 | 68 | 6.5 | 12440 | 4372 | 7.9 |
| 20 | Sand | Pondnet | 7 | -0.3 | 18.5 | 7.8 | 64 | 6.0 | 13370 | 4699 | 8.5 |
| 21 | Sand and clay | Pondnet | 7 | -0.25 | 17.9 | 7.7 | 72 | 6.9 | 12990 | 4566 | 8.2 |
| 22 | Sand and clay | Pondnet | 75 | -0.6 | 17.5 | 7.8 | 66 | 6.4 | 13030 | 4580 | 8.3 |
| 23 | Artificial substrate | Onion-bag | 490 | | 19.1 | | | | 4523 | 1523 | 2.8 |
| 24 | Artificial substrate | Onion-bag | 4200 | | 16.9 | | | | 5001 | 1792 | 3.2 |
| 25 | Stones | Hand | 9600 | | | | | | | | |
| 26 | Stones | Hand | 19300 | | | | | | | | |
| 27 | Stones | Hand | 1120 | | 16.0 | | | | 18476 | 7627 | 11.7 |
| 28 | Stones | Hand | 1760 | | | | | | | | |
| 29 | Artificial substrate | Glass eel substrate | >10 | ca-1.5 | 13.1 | 8.0 | 91 | 9.3 | 8618 | | 5.47 |
| 30 | Artificial substrate | | 1 | | 15.3 | 7.8 | 91 | 9.3 | 439 | 38 | |
| 31 | Artificial substrate | | 8 | | 14.4 | 7.8 | 89 | 8.9 | 8448 | 2824 | 5.36 |
| 32 | Artificial substrate | | 6 | | 14.5 | 8.2 | 102 | 10.3 | 4953 | 1423 | 3.14 |