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RANGE EXTENSION OF THE ALIEN AMPHIPOD *GAMMARUS TIGRINUS* SEXTON, 1939, IN THE NETHERLANDS, IN 1971

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ABSTRACT

After the introduction of the *Gammarus tigrinus* in the Netherlands around 1964, the species developed explosively in the IJssellake and invaded large parts of the surrounding provinces. The dispersal was carefully recorded in previous papers. A survey in 1971 showed considerable range extension in the northern provinces, in the lake district of Loosdrecht (prov. of Utrecht), and in the isle of Voorne (prov. of South-Holland).

The range extension of *Gammarus tigrinus* Sexton, 1939, in the Netherlands was discussed previously by Nijssen & Stock (1966), Pinkster & Stock (1967), Dennert, Dennert & Stock (1968), and Gras (1971). In the summer of 1964 this amphipod appeared in high numbers in the IJssellake and the northern part of the province of North-Holland. Late 1966 the species reached the frontier of the province of South-Holland, the polder Oostelijk Flevoland, while in Friesland the limit of the distribution was reached at the line Harlingen - Bergum - Tjeukemeer. In 1967 the dispersal seemed to slow down, but accelerated again in 1968 to 1970; that period *Gammarus tigrinus* reached Overijssel, the Noordoostpolder, Groningen, and the Brielse Meer (prov. of South-Holland). It was supposed that the species had been introduced artificially into the latter locality.

In 1971 a new survey was carried out, especially at the borders of the 1970 range. Table I shows the number of samples taken in the different provinces, as a criterion concerning the reliability of the assertions.

Table I

Numbers and distribution of samples taken in 1971

| Province of | number of samples | | |
|-----------------|-------------------|----|----------|
| | positive | | negative |
| | containing | | |
| G. tigrinus | other species* | | |
| Friesland | 26 | 17 | 20 |
| Groningen | 17 | 14 | 38 |
| Drente | 3 | 10 | 20 |
| Overijssel | 2 | 1 | 17 |
| Utrecht | 8 | 4 | 14 |
| North - Holland | 5 | -- | -- |
| South - Holland | 71 | 51 | 125 |

*G. pulex L., G. zaddachi Sexton or G. duebeni Liljeborg.

Table II summarizes the exact localities, dates and chlorinities of the samples containing *Gammarus tigrinus*. The same information is shown in the map (fig. 1).

A considerable range extension of *Gammarus tigrinus* was found in the north of the provinces of Friesland and Groningen, west of the line Winsum - Groningen. Going to the east, *Gammarus tigrinus* appeared in high numbers in the Schildmeer and its drainage canal. Records in the Eemskanaal indicate that further spreading to the east takes place through this waterway. South of the IJssellake, *Gammarus tigrinus* penetrated into the Loosdrechtse Plassen and the area west of these lakes, in the province of Utrecht.

It was carefully investigated whether or not the isolated localities in the Brielse Meer established contact with the rest of the range, but there only was a slight southward extension of the main range towards Leidschendam. This fact supports once more the earlier supposed artificial introduction of *Gammarus tigrinus* in the Brielse Meer (Gras, 1971). In the surroundings of this lake an extension of some 10 km to the east and the south was observed. The range of *Gammarus tigrinus* is bounded now by the vast water system that is in connection with the Haringvliet, and is only blocked by the sluice-gates of Hellevoetsluis.

The new records show that *Gammarus tigrinus* continues gradually occupying the remaining parts of the Netherlands.

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Table II

Further records of *Gammarus tigrinus* in The Netherlands
(range extension in 1971)

| <u>Locality</u> | <u>Municipality</u> | <u>Date</u> | <u>Chlorinity</u> (mg/l) |
|---|-------------------------------------|-------------|-----------------------------|
| Province of Friesland | | | |
| Ditch 1 km W. of Sexbierum | Barradeel | Nov. 5 | 1640 |
| de Riet, 2 km N.W. of Franeker | Barradeel | Nov. 5 | 1250 |
| Ditch 1 km S. of Koehool | Barradeel | Nov. 5 | 780 |
| Canal through Tzummarum | Barradeel | Nov. 5 | 600 |
| Canal N. of Ried | Franekeradeel | Nov. 5 | 1380 |
| Canal from Menaldum to Berlikum 1 km W. of Menaldum | Menaldumadeel | Nov. 5 | 420 |
| Canal from Berlikum to Ried 1 km W. of Berlikum | Menaldumadeel | July 31 | ---- |
| Canal 200 m S. of village of St. Jacobiparochie | Het Bildt | July 31 | ---- |
| Canal along Oosthoek and Oude Bildtdijk, near Oosthoek | Het Bildt | July 31 | 700 |
| Canal 2 km S. of St. Annaparochie | Het Bildt | July 31 | ---- |
| Canal from Stiens to the east, 4 km E. of Stiens | Het Bildt | Aug. 1 | ---- |
| Dokkumer Ee, S. of Bartleheim | Leeuwarderadeel | Aug. 2 | ---- |
| Hallumertrekvaart near Bartleheim | Ferwerderadeel | Aug. 2 | ---- |
| Canal from Tergracht to Marrum 1 km W. of Wanswerd | Ferwerderadeel | Aug. 2 | ---- |
| Canal from Smidshuis to Blija E. of Lichtaard | Ferwerderadeel | Aug. 3 | ---- |
| Holwerdervaart, 500 m S. of Holwerd | Westdongeradeel | Aug. 3 | ---- |
| Affluent Dokkumer Ee, Bornwird | Westdongeradeel | Aug. 3 | ---- |
| Dokkumerdiep, Dokkum | Dokkum | Oct. 20 | 600 |
| Zuider Ee, Metslawier | Oostdongeradeel | Oct. 20 | 2180 |
| Zuider Ee, Ezumazijl | Oostdongeradeel | Oct. 20 | 1250 |
| Dokkumerdiep, Kollumerzijl | Dokkumerland | Oct. 14 | 490 |
| Lauwers, Pieterzijl | Dokkumerland | Oct. 14 | 380 |
| Kollumerkanaal, Kollum | Kollumerland & Nieuw - Kruisland | Oct. 14 | 12 |
| Opeinderkanaal, N.W. of Drachten | Smallingerland | Oct. 20 | 260 |
| Tjongerkanaal, Mildam | Heerenveen | Nov. 6 | 62 |
| Tjongerkanaal, Oldeberkoop | Heerenveen | Nov. 6 | 43 |
| Province of Groningen | | | |
| Reitdiep, Zoutkamp | Ulrum | Oct. 16 | 410 |
| Affluent of Zijldiep, Grijskerk | Grijskerk | Oct. 14 | 330 |
| Canal 1 km E. of Leens | Leens | Oct. 21 | 1300 |

Table II, continued

| | | | |
|---|---------------------|---------|------|
| Reitdiep, Rode Haan | Oldehove | Oct. 16 | 380 |
| Canal from Brillil to Enumatil W. of Zuidhorn | Zuidhorn | Oct. 13 | 251 |
| Canal from Winsum to Wehe Den Hoorn near Mensingerweer | Leens | Oct. 21 | 1010 |
| Winsumerdiep, Winsum | Winsum | Oct. 21 | 277 |
| Aduarderdiep, Feerwerd | Ezinge | Oct. 15 | 320 |
| Hunze, Garnwerd | Ezinge | Oct. 15 | 330 |
| Hoendiep, Vierverlaten | Groningen | Oct. 13 | 183 |
| Paterswolder Meer, southern side | Eelde | Aug. 25 | 66 |
| Eemskanaal, Woltersum | Ten Boer | Oct. 23 | 260 |
| Eemskanaal, Overschilt | Slochteren | Oct. 23 | 310 |
| Eemskanaal, Appingedam | Appingedam | Oct. 23 | 920 |
| Canal of Duurswold, Weiwerd | Delfzijl | Nov. 3 | 380 |
| Schildmeer, Steendam | Slochteren | Oct. 22 | 480 |
| Canal of Duurswold, Tjuchem | Slochteren | Nov. 3 | 340 |
| Province of Drente | | | |
| Leekster Meer, Matsloot | Roden | Oct. 13 | 160 |
| Paterswolder Meer, werstern side | Eelde | Oct. 12 | 106 |
| Zuidlaarder Meer, southern side | Zuid - Laren | Oct. 15 | 111 |
| Province of Overijssel | | | |
| Kalenbergergracht, Oldemarkt | Oldemarkt | Aug. 10 | 72 |
| Beulakerwijde, Wanpeerveen | Wanpeerveen | Aug. 11 | 52 |
| Province of Utrecht | | | |
| Ringvaart Groot Mijdrecht, Wilnis | Wilnis | Nov. 23 | 450 |
| De Geer, 1 km E. of the Geer village | Wilnis | Nov. 23 | 112 |
| De Geer, Portengen | Kockengen | Nov. 23 | 198 |
| De Geer, 2 km E. of Woerdense Verlaat | Kamerik | Nov. 23 | 215 |
| Loenderveense Plas, eastern side | Loosdrecht | Nov. 25 | 50 |
| Breukelveense Plas, Muijeveld | Loosdrecht | Nov. 25 | 42 |
| Breukelveense Plas, Tienhoven | Maarssen | Nov. 25 | 39 |
| Loosdrechtse Plassen, southern side | Maarssen | Nov. 26 | 76 |
| Province of North-Holland | | | |
| Westeinder Plas, Aalsmeer | Aalsmeer | Nov. 16 | 226 |
| Vecht, at Klomp | Weesp | Nov. 24 | 188 |
| Lake E. of Nigtevecht | Nederhorst Den Berg | Nov. 24 | 206 |
| Hilversums Kanaal, Kortenhoef | 's Graveland | Nov. 24 | 77 |
| Wijde Blik, near Hotel de Zuwe | 's Graveland | Nov. 24 | 186 |

Table II, continued

| Province of South-Holland | | | |
|---|----------------|---------|------|
| Vliet, Leidschendam | Leidschendam | Nov. 19 | 250 |
| Noord A, 2 km S. of Zoeterwoude | Zoeterwoude | Nov. 19 | 470 |
| Meerburger Wetering, Zoeterwoude | Zoeterwoude | Nov. 19 | 250 |
| Brielse Meer, Oostvoorne | Oostvoorne | Nov. 18 | 270 |
| Ditch along Pansersdijk, Tinte | Brielle | Nov. 18 | 1250 |
| Lange Vest, Brielle | Brielle | Nov. 18 | 880 |
| Voornse Kanaal, Heenvliet | Heenvliet | Nov. 18 | 450 |
| Brielse Meer, Heenvliet | Heenvliet | Nov. 18 | 380 |
| Voornse Kanaal, Hellevoetsluis | Hellevoetsluis | Nov. 18 | 410 |
| Connection canal Brielse Meer - Oude Maas, N. of Spijkenisse | Rotterdam | Nov. 18 | 390 |

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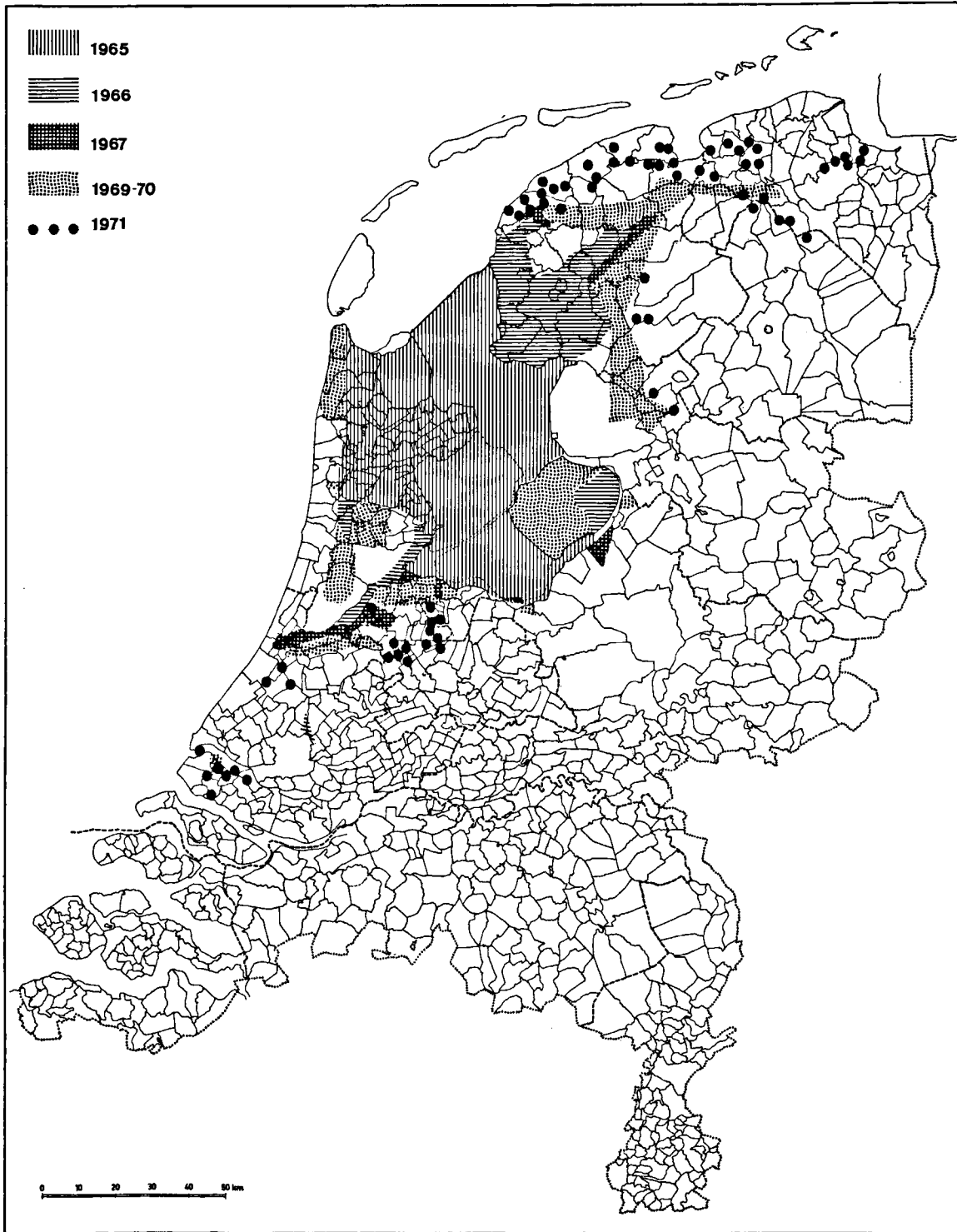


Fig. 1. Range extension in subsequent years of *Gammarus tigrinus* Sexton in the Netherlands.