

# BEAUFORTIA

SERIES OF MISCELLANEOUS PUBLICATIONS

ZOOLOGICAL MUSEUM OF THE UNIVERSITY OF AMSTERDAM

No. 169

Volume 14

March 31, 1967

## Range extension in 1966 of the alien amphipod, *Gammarus tigrinus* Sexton, 1939, in the Netherlands

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### ABSTRACT

The range extension of *Gammarus tigrinus* Sexton, 1939 (an amphipod recently introduced in the Netherlands), during the year of 1966, is recorded. New areas invaded are the southern part of the province of North-Holland, the greater part of the province of Friesland, and the polder Oostelijk Flevoland.

The euryhaline brackish water amphipod, *Gammarus tigrinus* Sexton, 1939, has recently been introduced in Germany (Schmitz, 1960) and in the Netherlands (Nijssen & Stock, 1966). Speaking in terms of biomass produced, the introduction was quite a success in both countries (Tesch & Fries, 1963; Schoenagel, 1965).

At the end of 1965 the distribution pattern of *Gammarus tigrinus* in the Netherlands was as follows (Nijssen & Stock, 1966): the entire IJsselmeer, southwestern part of the Veluwemeer, and, in inland waters, the northern half of the province of North-Holland (with the exception of the dune district bordering the North Sea). In North-Holland the species had pushed its way southward to the line Edam-Monnikendam-Alkmaar. The invaded area as it was in December 1965 is shown in fig. 1 (hatched); especially in the IJsselmeer and in North-Holland the position of the front-line of the invasion wave was firmly established by numerous observations. The area occupied by the species in the provinces of Friesland, Groningen and Drenthe was uncertain in this picture, since the fieldwork there was carried out as early as 1963.

In the last months of 1966, the authors have carefully checked the distribution of *G. tigrinus*. The fieldwork in the provinces of North-Holland and South-Holland has been carried out by J.H.S., that in the provinces of Utrecht, Gelderland, Overijssel, Drenthe, Groningen and Friesland by S.P. Except for some isolated records from the North Sea islands and from the

Received: January 20, 1967

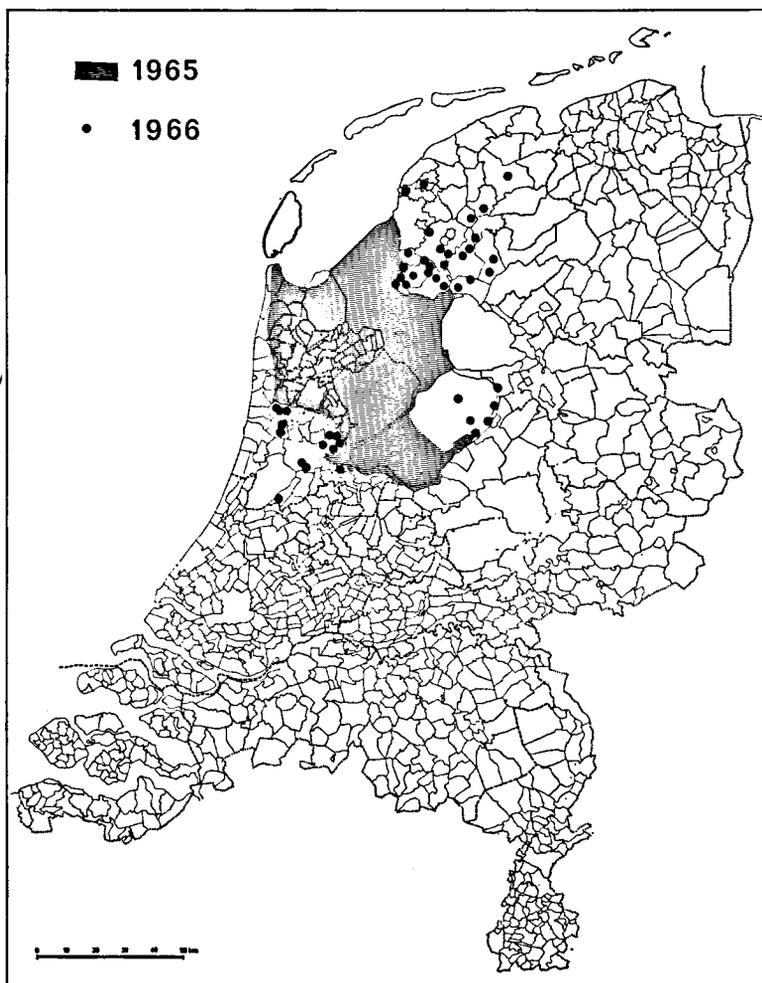


FIG. 1. New records in 1966 of *Gammarus tigrinus* Sexton in the Netherlands (each dot represents a new locality or a group of proximate localities). The minimal area occupied by the species at the end of 1965 is hatched.

province of Zeeland, no systematic survey has been undertaken in the rest of the country.

From the 1966 survey it becomes clear that *G. tigrinus* has firmly maintained itself in the area previously occupied. It has extended its range in 3 areas: (1) in the province of North-Holland, in the triangle roughly formed by Amsterdam-Westeynder Plassen-Alkmaar; (2) in the polder Oostelijk Flevoland and in the adjacent part of the Veluwemeer; (3) in the province of Friesland, in the area bounded by the IJsselmeer, the line Harlingen-Bergum and the line Bergum-Tjeukemeer. The localities in which *G. tigrinus*

was observed for the first time in 1966 are plotted in fig. 1. The "white areas" on this map are really indicative of the absence of *G. tigrinus*, and not of insufficient fieldwork. So, *G. tigrinus* is (still ?) absent in the Noord Oost Polder, in the extreme northern and eastern parts of Friesland, and in the inland waters of the provinces of Groningen, Drenthe, Overijssel, Gelderland and Utrecht. In North-Holland, it just reached the boundary of the province of South-Holland (near Kudelstaart) but is absent in the numerous lakes east of this locality.

These records imply that the invasion wave of *G. tigrinus* pushed its way forward in the Dutch inland waters over a distance of 30 to 40 kilometers in a year's time, and in spite of competition with local species.

#### ECOLOGICAL CONSIDERATIONS

In the area invaded in 1966 by *G. tigrinus* (Friesland, southern part of North-Holland), the invader penetrated in an area previously inhabited by 3 other species of *Gammarus*, *G. duebeni*, *G. zaddachi* and *G. pulex*. In 1965, *G. tigrinus* hardly entered in the *G. pulex* biotope; in 1966, however, it was found in many instances together with *G. pulex*. The supposition that *G. pulex* would, through competition, eliminate *G. tigrinus* (e.g., in Hynes, 1955) is not substantiated in stagnant waters in the Netherlands. In running waters, *G. pulex* seems indeed able to compete successfully with *G. tigrinus*. So, in the mouth of a stream called Hierdense Beek (municipality of Ermelo), the boundary of the distribution of *G. tigrinus* in 1966 lies still on exactly the same place as in 1965.

#### ACKNOWLEDGEMENTS

We are indebted to the following persons who have entrusted us material of *Gammarus*, collected mostly outside the census area, thus completing the picture already obtained: Drs. J. Dorgelo (material from Amsterdam), Professor Dr. C. van der Meer (material from South-Holland), Mr. P. Kant (material from Zeeland), Drs. P. Leentvaar (material from the Biesbosch), Mr. M. Mantje (material from Texel).

TABLE 1. Occurrence of *Gammarus tigrinus* Sexton, 1939, in the Netherlands; new localities occupied during 1966.

Locality	municipality	1966 date	mg Cl <sup>-1</sup>
Uitgeester Meer, east of Uitgeest	Uitgeest	Aug. 29	—
Knollendamervvaart, near Knollendam	Uitgeest	Aug. 29	350
De Krommenie, near Krommeniedijk	Krommenie	Aug. 29	340
Nauernasche Vaart	Assendelft	Aug. 18	294
Zijkanaal D, near Nauerna	Assendelft	Aug. 18	300
"Poel", south of Monnikendam	Monnikendam	Aug. 23	500
Kerk Ae, at Zuiderwoude	Broek in Waterland	Aug. 23	830
Oosterpoel, north of Uitdam	Broek in Waterland	Aug. 23	430
Uitdammer Die	Broek in Waterland	Aug. 23	500
Kinselmeer (2 ×)	Amsterdam	Aug. 23	380
Barnegat (2 ×)	Amsterdam	July 7	—
Amsterdam (North) (Buikslotermeerpolder)	Amsterdam	Aug. 23	—
Bosbaan	Amsterdam	July 18	—
Nieuwe Meer	Amsterdam	Oct. 15	—
Naardertrekvaart, near Muiden	Amsterdam	July 13	—
Westeinderplassen, near Kudelstaart	Amsterdam	July 13	—
	Muiden	Oct. 18	151
	Aalsmeer	Sept. 4	120
Wijde Ee (between Bergum and Suawoude)	Tietjerksteradeel	Nov. 21	132
Van Harinxmakanaal (1 km west of Franeker)	Franeker	Nov. 8	330
Van Harinxmakanaal (near bridge with E 10 highroad)	Franekeradeel	Nov. 8	1120
Kromme Grouw (300 m east of Irnsum)	Idaarderadeel	Nov. 9	134
Kromme Grouw (300 m east of Irnsum)	Rauwerderhem	Nov. 9	129
Wymerts (500 m north of Wolsum)	Wymbritseradeel	Nov. 8	254
Sneekerveer, Zoutepoel	Utingeradeel	Nov. 9	132
Geeuw, at IJlst	Wymbritseradeel	Nov. 1	181

Locality	municipality	1966 date	mg Cl <sup>-</sup> /l
Hengstepoel, at Jutrijp	Wymbritseradeel	Nov. 1	172
Workum, north of lock	Workum	Nov. 2	570
Oudegaaster brekken, near Oudega	Wymbritseradeel	Nov. 2	230
Anewiel, at Hommerts	Wymbritseradeel	Nov. 1	109
Zijlroede, near Broek	Doniawerstal	Nov. 10	109
Het Piel, at Gaastmeer	Wymbritseradeel	Nov. 1	241
Janeslout, near Langweerderwielen (1 km west of Langweer)	Doniawerstal	Nov. 10	134
Nannewijd, (2 km N.E. of St. Johannesga)	Haskerland	Nov. 9	45
Hindeloopen, landside of IJsselmeer locks	Hemelumer-Oldeferd	Nov. 2	158
Fluessen, (1 km north of Nyega)	Hemelumer-Oldeferd	Nov. 2	180
Hoger Dijkstervaart, near Vierhuisterbrug (Vierhuis)	Haskerland	Nov. 9	66
Slotermeer; Balk, near swimming-pool	Gaasterland	Nov. 2	185
Tjeukemeer, near Oosterzee	Lemsterland	Nov. 1	122
Vogelhoek, near Galamadammen	Hemelumer-Oldeferd	Nov. 2	211
Het Wijd, near Molkwerum	Hemelumer-Oldeferd	Nov. 2	158
Staveren, landside of lock to IJsselmeer	Hemelumer-Oldeferd	Nov. 2	310
Warnservaart, near milk-factory at Warns	Hemelumer-Oldeferd	Nov. 2	610
Sondelerleien	Gaasterland	Nov. 2	117
Tacozijsl, north of pumping-station	Lemsterland	Nov. 2	177
Veluwemeer, at Roggebotsluis	Oostelijk Flevoland	Dec. 27	41
Hoofdvaart II, near bridge in road from Biddinghuizen to Swiftenbant	Oostelijk Flevoland	Dec. 27	510
Veluwemeer, halfway Elburg and Roggebotsluis	Oostelijk Flevoland	Dec. 27	49
Hoofdvaart I, north of Biddinghuizen	Oostelijk Flevoland	Dec. 27	88
Veluwemeer, near Camping Riviera	Oostelijk Flevoland	Dec. 27	80
Veluwemeer, halfway Elburg and Harderwijk	Oostelijk Flevoland	Dec. 27	93

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