EUROPEAN INVERTEBRATE SURVEY

PROVISIONAL ATLAS

OF THE

NEMATODES of the BRITISH ISLES

General editors: J. HEATH, D.J.F. BROWN and B. BOAG

Part 1 LONGIDORIDAE

edited by D.J.F. BROWN and C.E. TAYLOR

Part 2 TRICHODORIDAE

edited by B. BOAG and T.J.W. ALPHEY

Part 3 CRICONEMATIDAE

edited by B. BOAG and K.J. ORTON WILLIAMS

Scottish Horticultural Research Institute
Invergowrie
Dundee
Scotland

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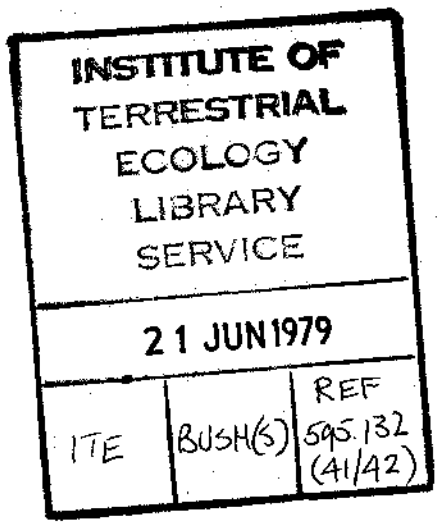

Preface

A survey of the distribution of the Longidoridae within the British Isles was started in 1970 and a year later a second survey was undertaken to investigate the nematodes associated with forest and woodland trees in Scotland and northern England. The combined results from the two surveys provide the first comprehensive account of the distribution of plant parasitic nematodes based on systematic sampling at a country level.

It is hoped that this booklet will stimulate interest in nematode surveys and encourage the formation of a European Nematode Survey Committee to organise the compilation of records on the distribution of selected plant parasitic nematode species throughout Europe.

Préface

Une enquête pour établir la distribution des Longidoridae dans les Iles Britanniques a commencé en 1970; l'année après une second enquête a été entreprise pour étudier les nématodes associés aux arbes des forêts et des bocages en Ecosse et dans le nord de l'Angleterre. Les résultats combinés de ces deux enquêtes fournissent le premier relevé synthétique de la répartition de nématodes parasites de végétaux, basé sur un énchantillonnage systématique au niveau d'un pays.

On espère que ce fascicule stimulera l'intérêt pour les enquêtes sur les nématodes et encouragera la formation d'un Comité de la Cartographie des Nématodes Européens, lequel organiserait la compilation des données de répartition a travers toute l'Europe, pour des espèces choisies de nématodes parasites de végétaux.

Vorwort

Im Jahre 1970 wurde eine Untersuchung der Verbreitung der Longidoridae auf den Britischen Inseln eingeleitet; eine zweite Untersuchung erfolgte ein Jahr später mit dem Ziel, die an Wald und Waldbäume gebundenen Nematoden

in Schottland und Nordengland zu erfassen. Die Ergebnisse beider Untersuchungen liefern zusammen die erste umfassende Kenntnis der Verbreitung von pflanzenparasitischen Nematoden auf der Grundlage einer systematischen Besammlung des ganzen Landes.

Wir hoffen, mit dieser Veröffentlichung das Interesse an Nematoden-Untersuchungen zu fördern und Anreiz für die Schaffung eines Europäischen Komitees zue Erfassung der Nematoden zu geben, um die Verbreitungsdaten ausgewählter pflanzenparasitischer Nematodenarten aus dem gesamten europäischen Raum sammeln und verarbeiten zu können.

Introduction

A survey of the Longidoridae of the British Isles was initiated in 1970 as part of a co-operative project between Professor F. Lamberti, Head of the Laboratorio di Nematologia Agraria, Bari, Italy and Dr C. E. Taylor, Director of the Scottish Horticultural Research Institute, Dundee, Scotland and financed by a NATO Scientific Research grant (Grant No. 424).

When the survey started in 1970 data were collected using three methods. The first involved the collection of soil samples from as many 10 kilometre squares as possible within the grid system of the British Ordnance survey maps. Samples were taken within each 10 kilometre square from each of five vegetation types :- arable, permanent pasture, deciduous woodland, coniferous woodland and scrub or moorland. At each site a number of cores to a depth of 30 centimetres were taken with an auger from an area of 100 square metres. The second method was a request to Agricultural Advisory Services for any records applicable to the survey. Finally, a literature search was made for any further relevant records. Over 2,000 soil samples and 2,500 records were collected during this survey. The data together with 800 samples from a NERC woodlands survey (see below) were used to produce the longidorid maps.

The NERC woodlands survey, started in 1971 by Dr B. Boag, SHRI, was part of a project investigating the association of nematodes with Scottish forests and woodlands. This project was financed by NERC grant No. F60/8/1. Samples collected from both surveys were used in the preparation of the criconematid distribution maps.

In 1973, in conjunction with Dr T. J. W. Alphey, SHRI, the soil samples were re-examined for trichodorid nematodes. This new information, together with additional soil samples - and records provided by the Agricultural Advisory Services, producing an overall total of approximately 4600 records, was used to compile the trichodorid maps.

This booklet is the culmination of three separate surveys from which the information was shared by each group of workers to enhance their own

individual results. Further information has already been presented and discussed elsewhere in descriptions of the biology of individual species and the factors affecting their distribution (Taylor & Brown, 1976; Alphey & Boag, 1976; Boag & Orton Williams, 1976). The maps which illustrate the distribution pattern for each of the species make a practical contribution to plant nematology, providing information on the relative incidence of economically important nematodes which cause damage to many crops either by direct feeding or because of the viruses they transmit.

Acknowledgements

We wish to express our gratitude to colleagues in the Agricultural Advisory Services, Research Institutes and Schools for their help in collecting soil samples, supplying records or verifying the identification of some of the more rare nematode species. We also wish to thank Miss Pauline B. Topham, statistician at the SHRI, for her help with the computer management and analysis of the survey data.

J. Heath
D.J.F. Brown
B. Boag

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Taylor, C.E. & Brown, D.J.F. 1976. The Geographical Distribution of *Xiphinema* and *Longidorus* Nematodes in the British Isles and Ireland. Ann. appl. Biol. 84

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PART 1

LONGIDORIDAE

edited by

D.J.F. BROWN* and C.E. TAYLOR*

* Scottish Horticultural Research Institute, Invergowrie, Dundee, Scotland.

Introduction

Longidorid nematodes are readily identified from most other dorylaims by their long (2-12 mm) rather narrow body and their feeding apparatus which is characterised by an elongated axial mouth spear (odontostyle) plus an extension (odontophore) of about half the length of the spear. Species of the three genera (*Longidorus, Paralongidorus, Xiphinema*) are plant parasites, usually feeding at the root tips and causing galling.

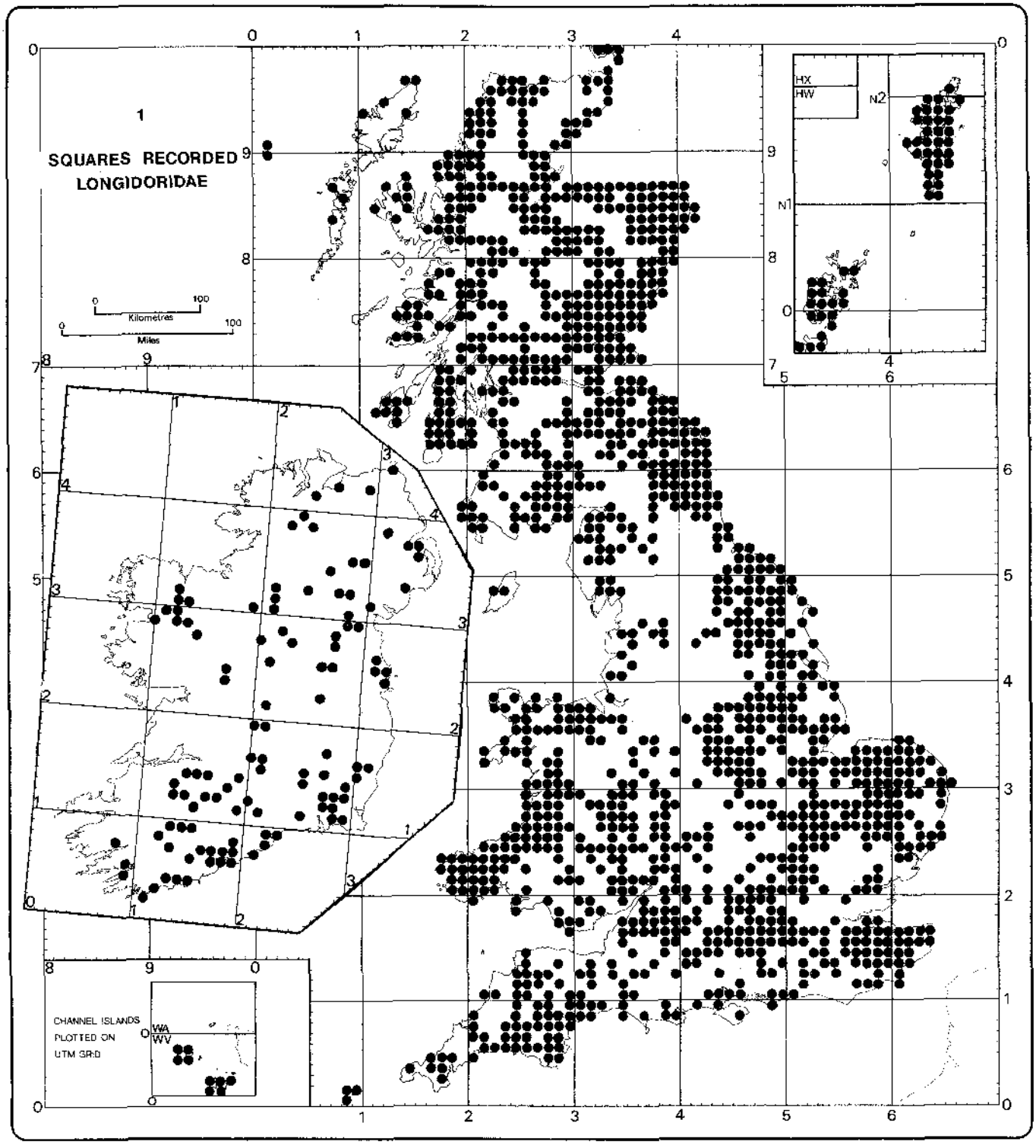
Interest in *Longidorus* and *Xiphinema* was stimulated by the discovery that some species are vectors of plant viruses. A group of American workers in 1958 showed *Xiphinema index* to be a vector of grapevine fanleaf virus and this discovery was quickly followed by others which implicated *X. diversicaudatum, X. americanum, L. elongatus, L. macrosoma* and *L. attenuatus* as vectors of several different viruses.

Table Viruses Transmitted by Longidorid Nematodes in Britain

Virus	Nematode	Some Crops Affected by the Virus
Arabis Mosaic	*Xiphinema diversicaudatum*	Hop, raspberry, rose, strawberry
Raspberry ringspot	*Longidorus elongatus*) *Longidorus macrosoma*)	Blackberry, raspberry, redcurrant, strawberry
Tomato black ring	*Longidorus elongatus*) *Longidorus attenuatus*)	Onion, potato, raspberry, strawberry, sugar beet
Strawberry latent ringspot	*Xiphinema diversicaudatum*	Cherry, plum, raspberry, rose, strawberry

The maps illustrate the natural distribution of species indigenous to the British Isles and also the species *Longidorus vineacola, Paralongidorus maximus, Xiphinema coxi, Xiphinema mediterraneum* and *Xiphinema vuittenezi* which occur sporadically in the British Isles but which have possibly been introduced in relatively recent times with planting material. *Longidorus elongatus* is widespread but has probably been introduced to the Scottish islands as it is found there only in private gardens.

Longidorus caespiticola and *L. macrosoma* have been successfully maintained in their natural soil outwith their area of natural distribution in out of door micro-plots at the SHRI, Dundee. *Xiphinema index* has been similarly maintained at the Plant Pathology Laboratory, Harpenden but although widespread in the vine growing areas of Europe has not yet been recorded from the British Isles. *Xiphinema americanum*, a species closely related to *X. mediterraneum*, transmits tobacco and tomato ringspot viruses and although not reported from Europe has been recorded from many countries in the world including Canada, U.S.A. and New Zealand. It has been identified from around the roots of "bonsai" plants imported from Japan.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LONGIDORIDAE
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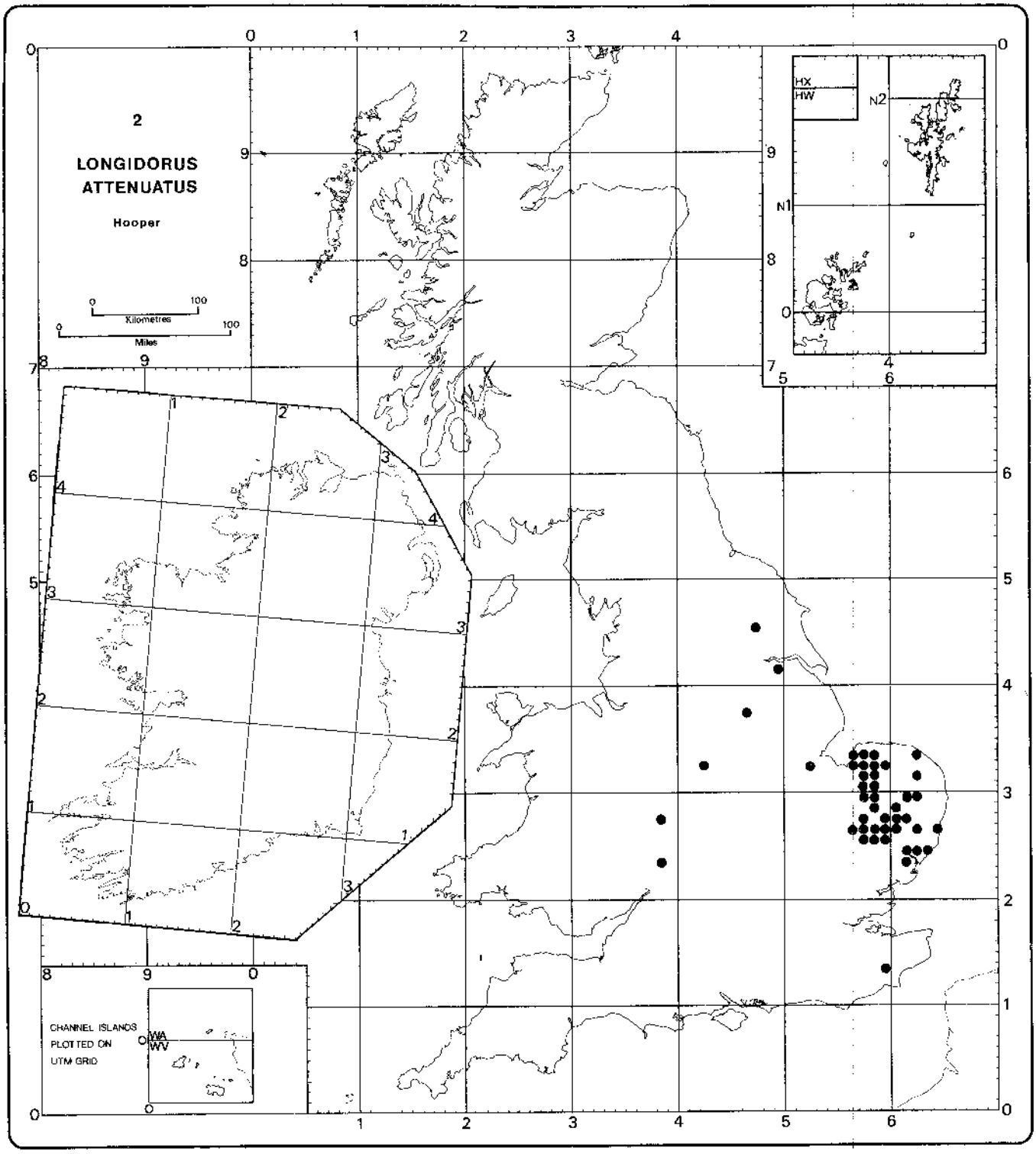
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV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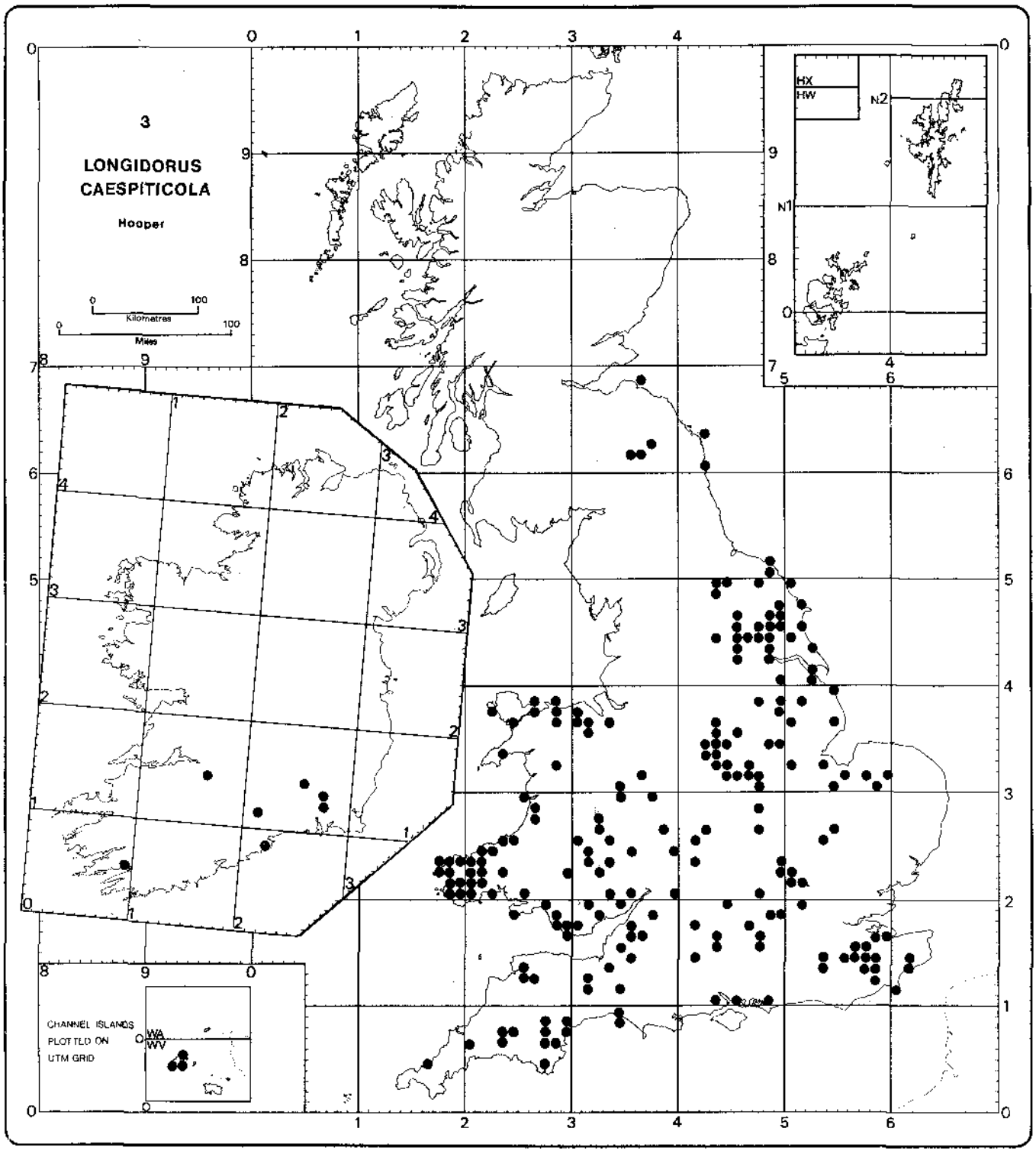
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N1
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PLOTTED ON
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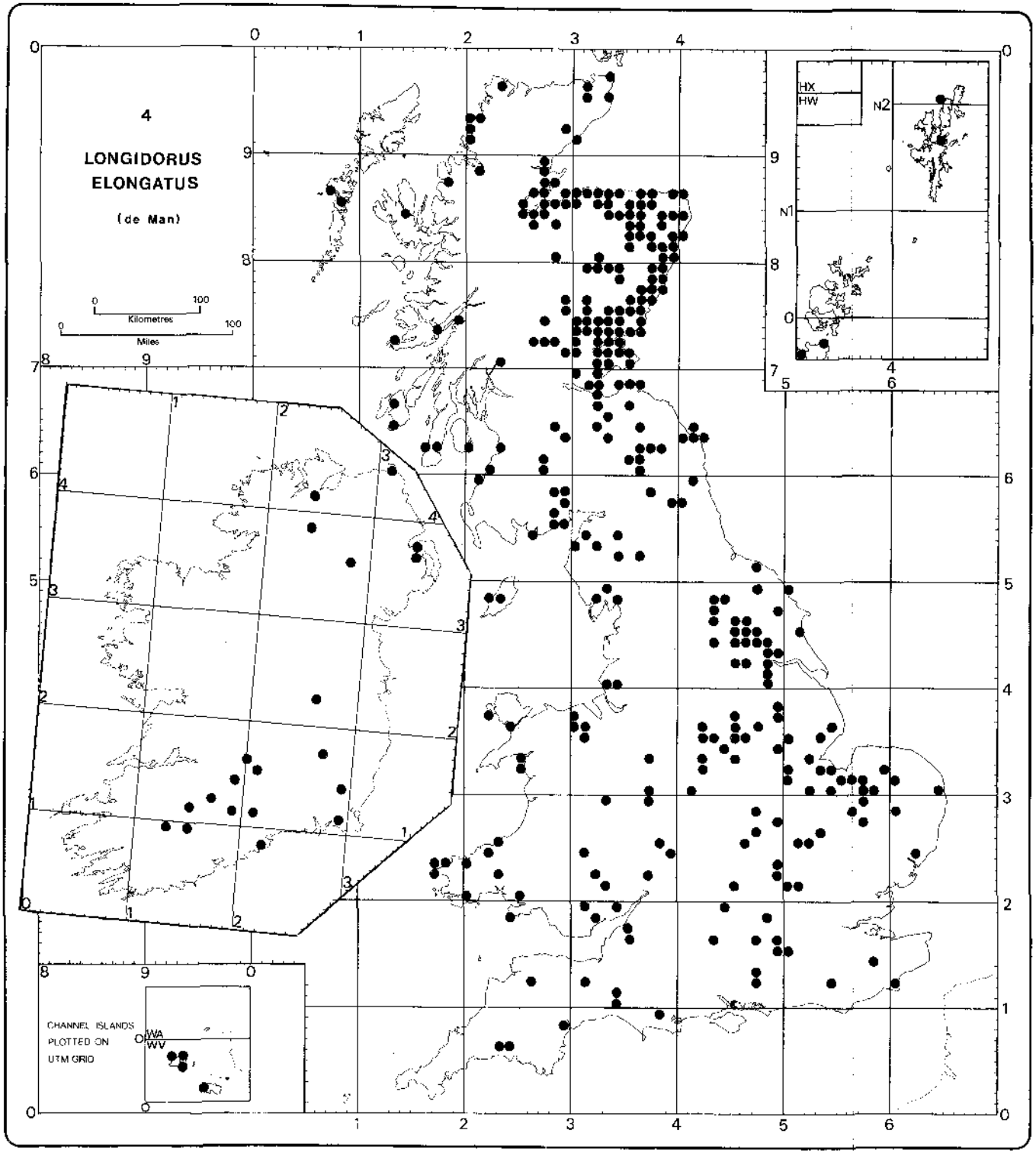
WV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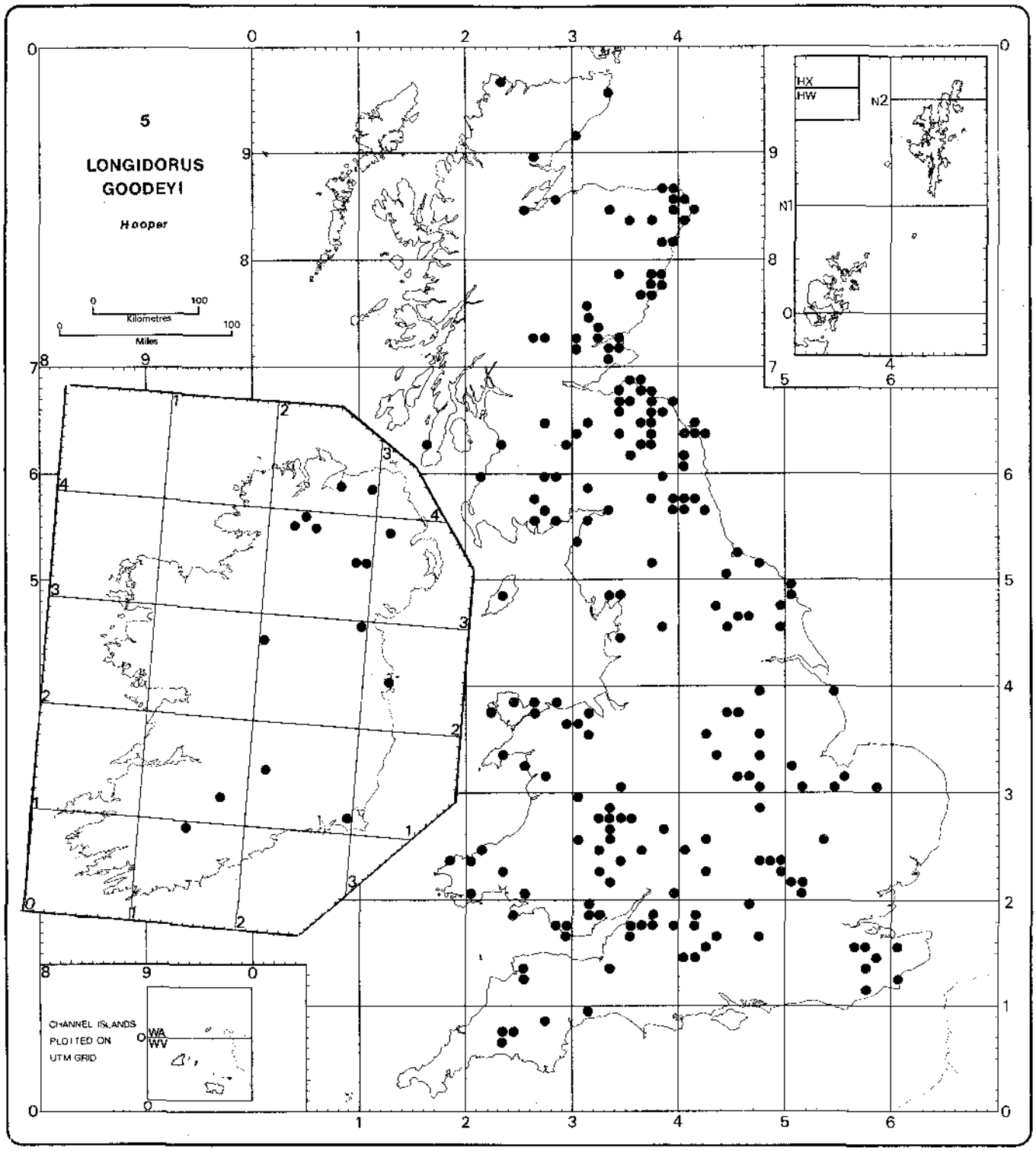
WV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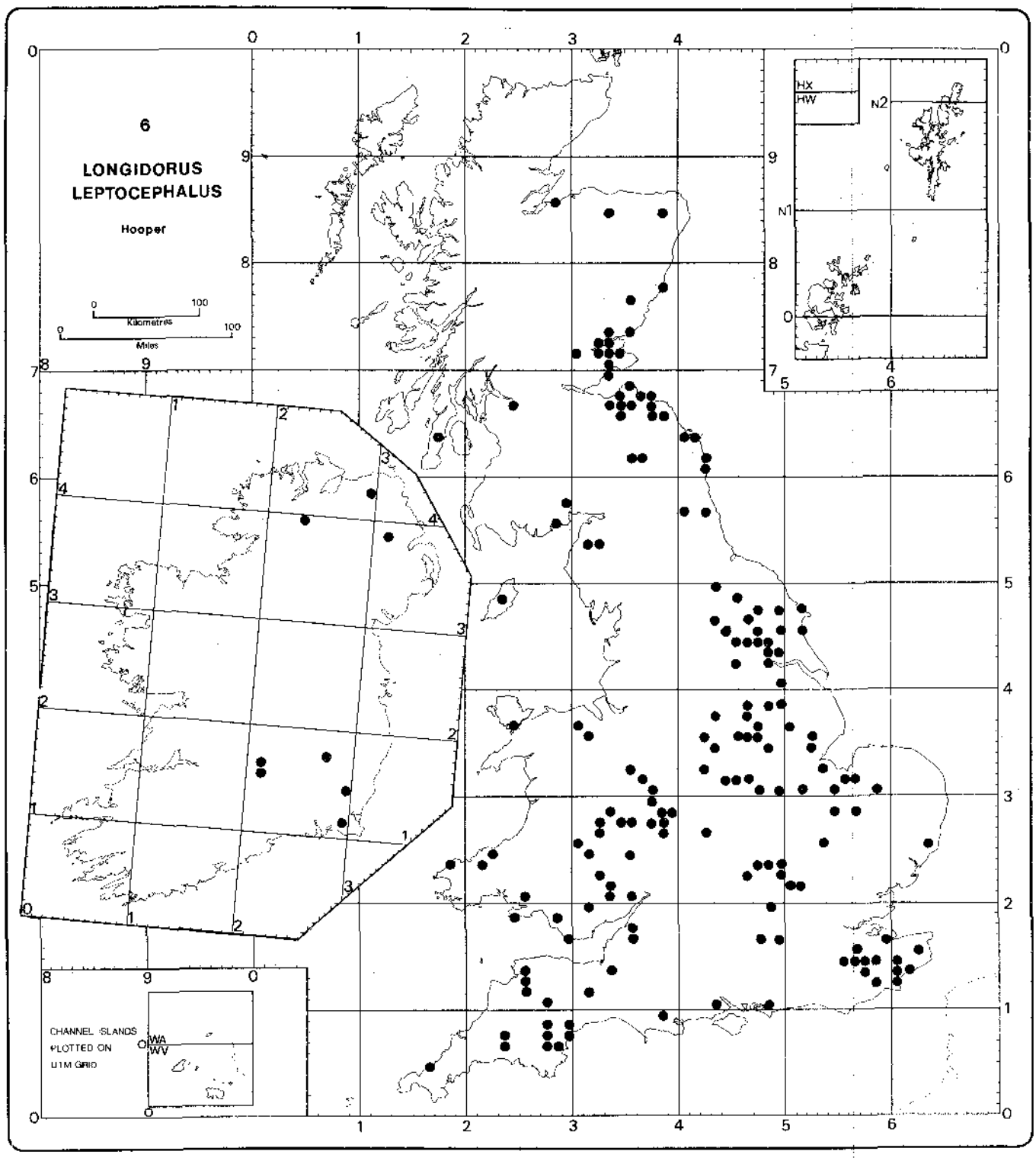
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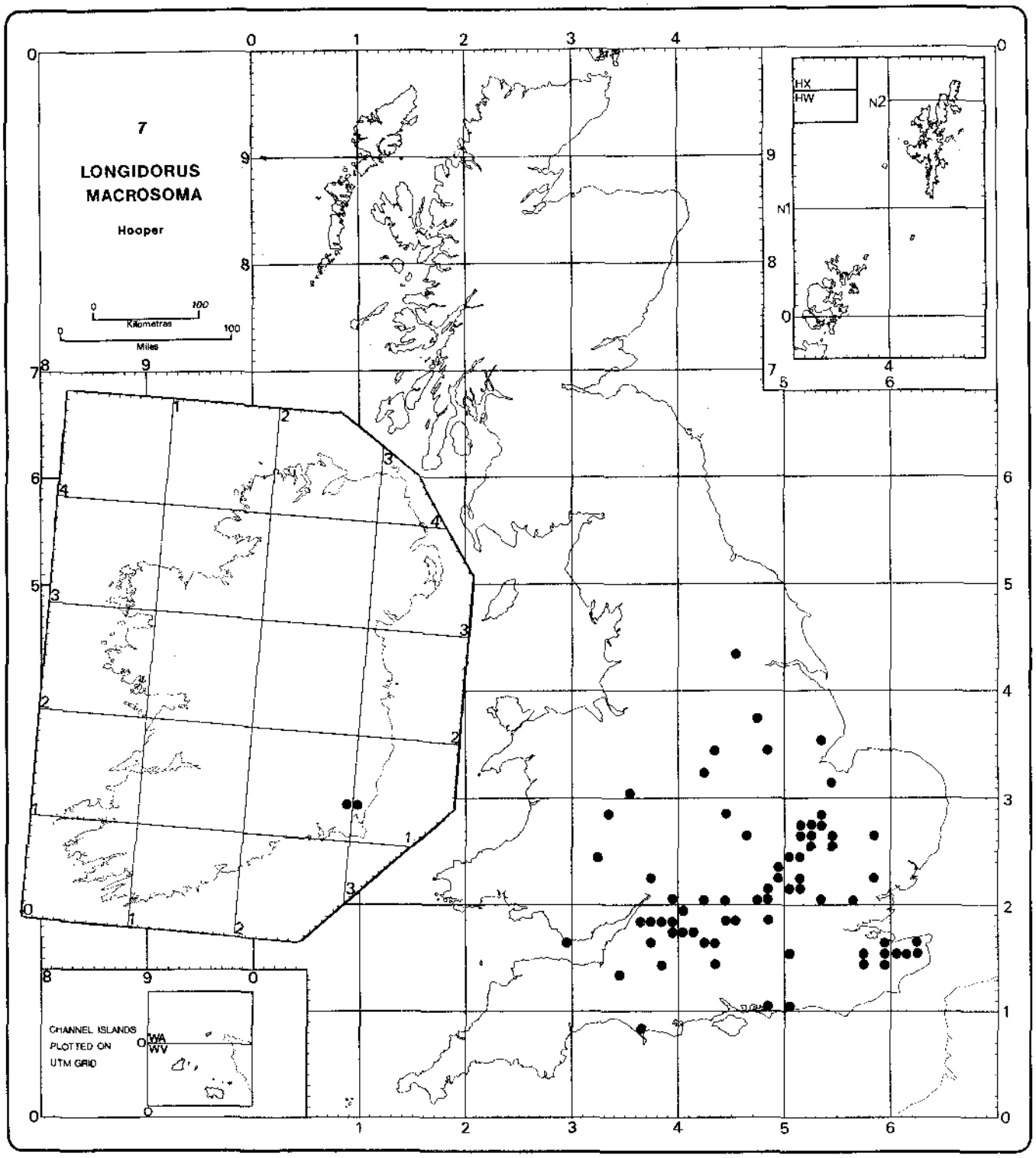
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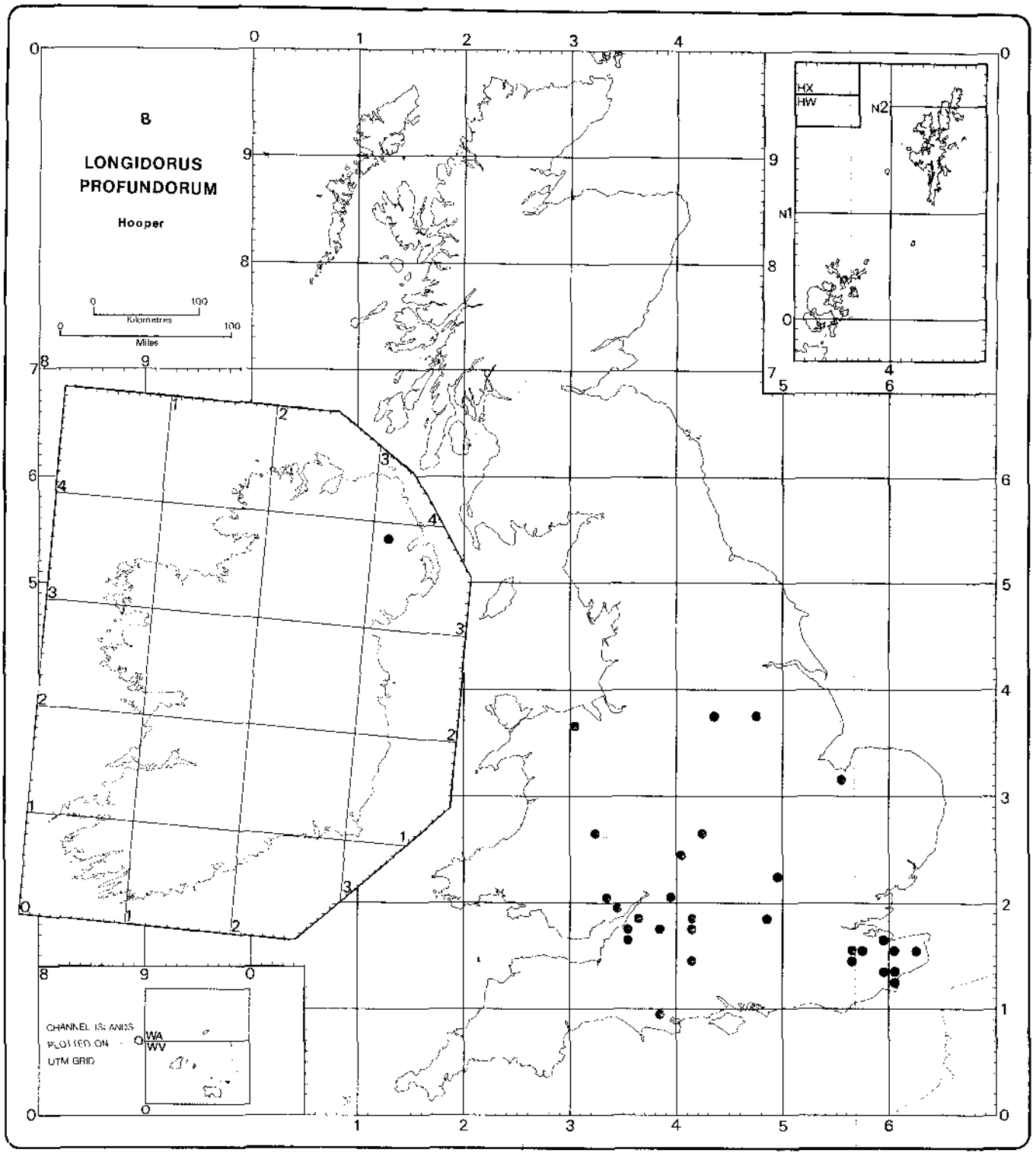
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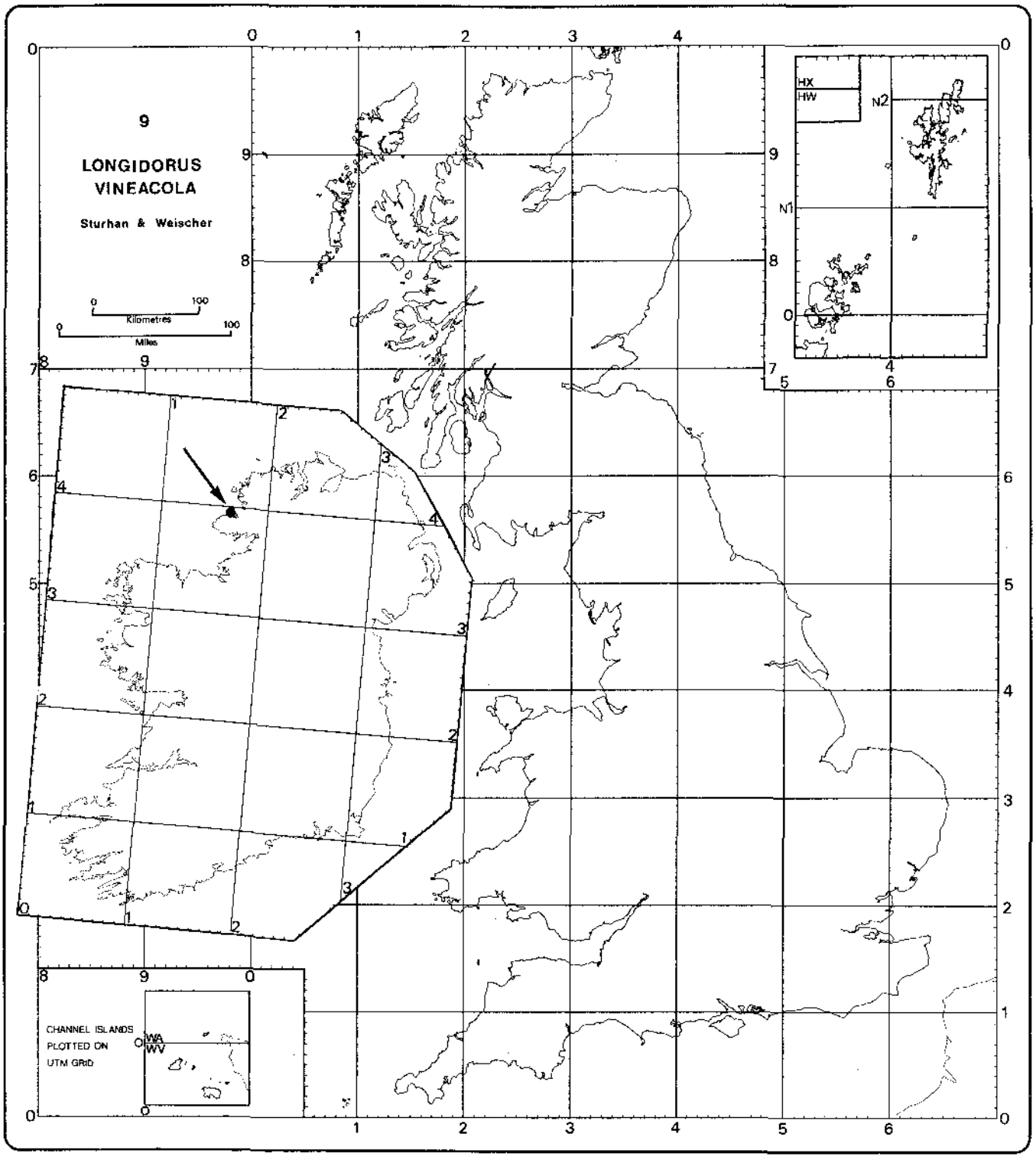
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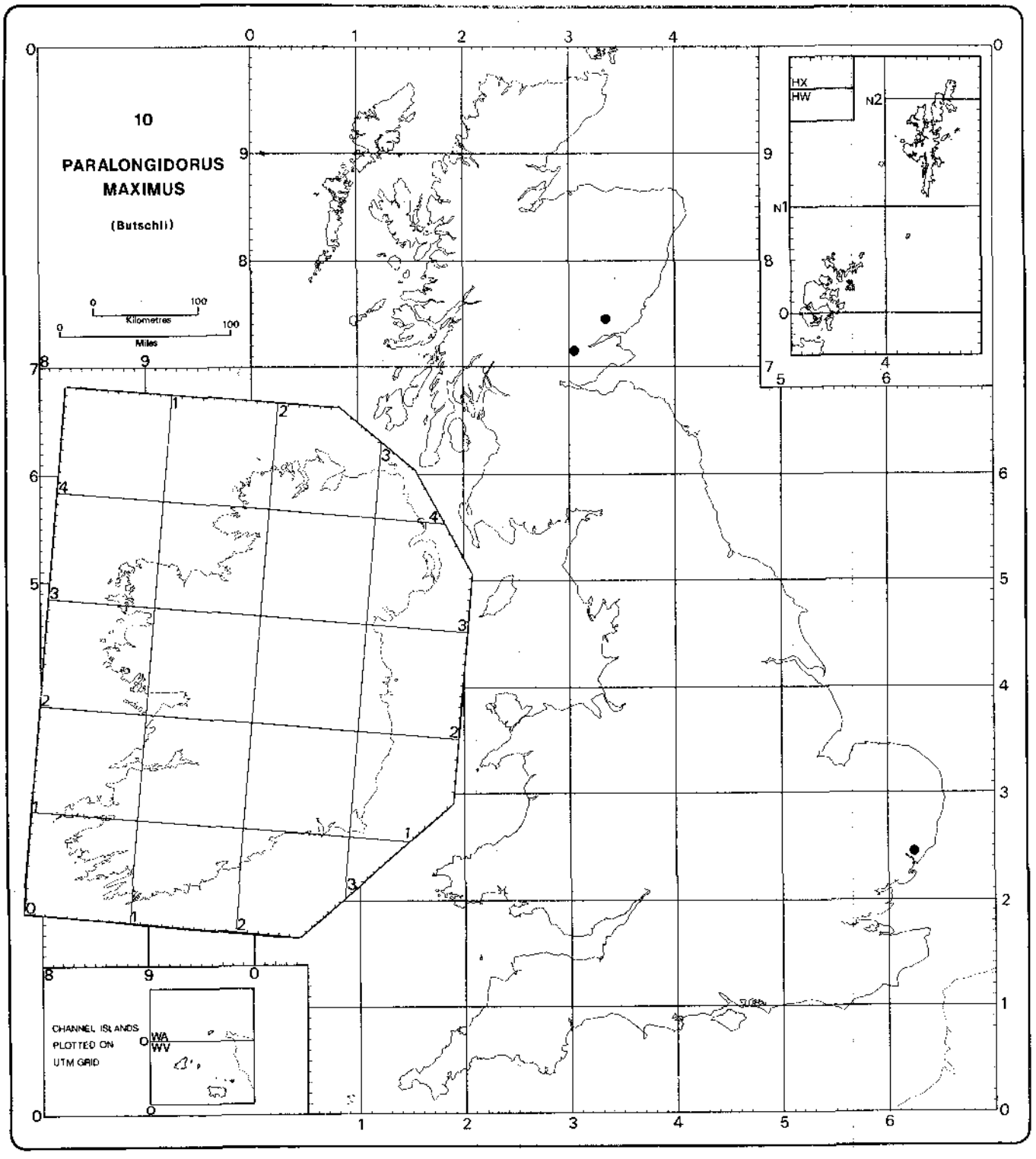
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PARALONGIDORUS MAXIMUS
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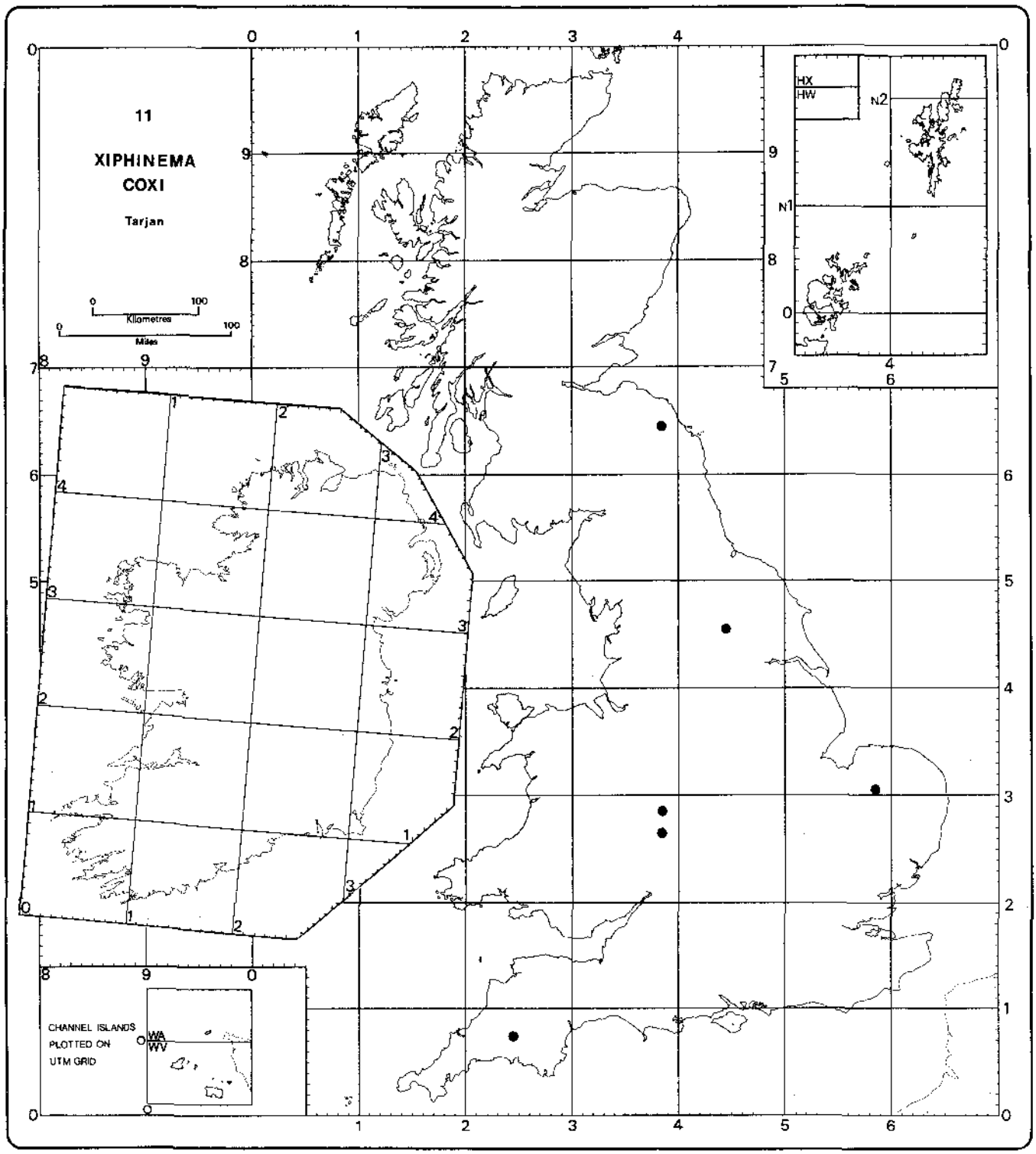
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COXI
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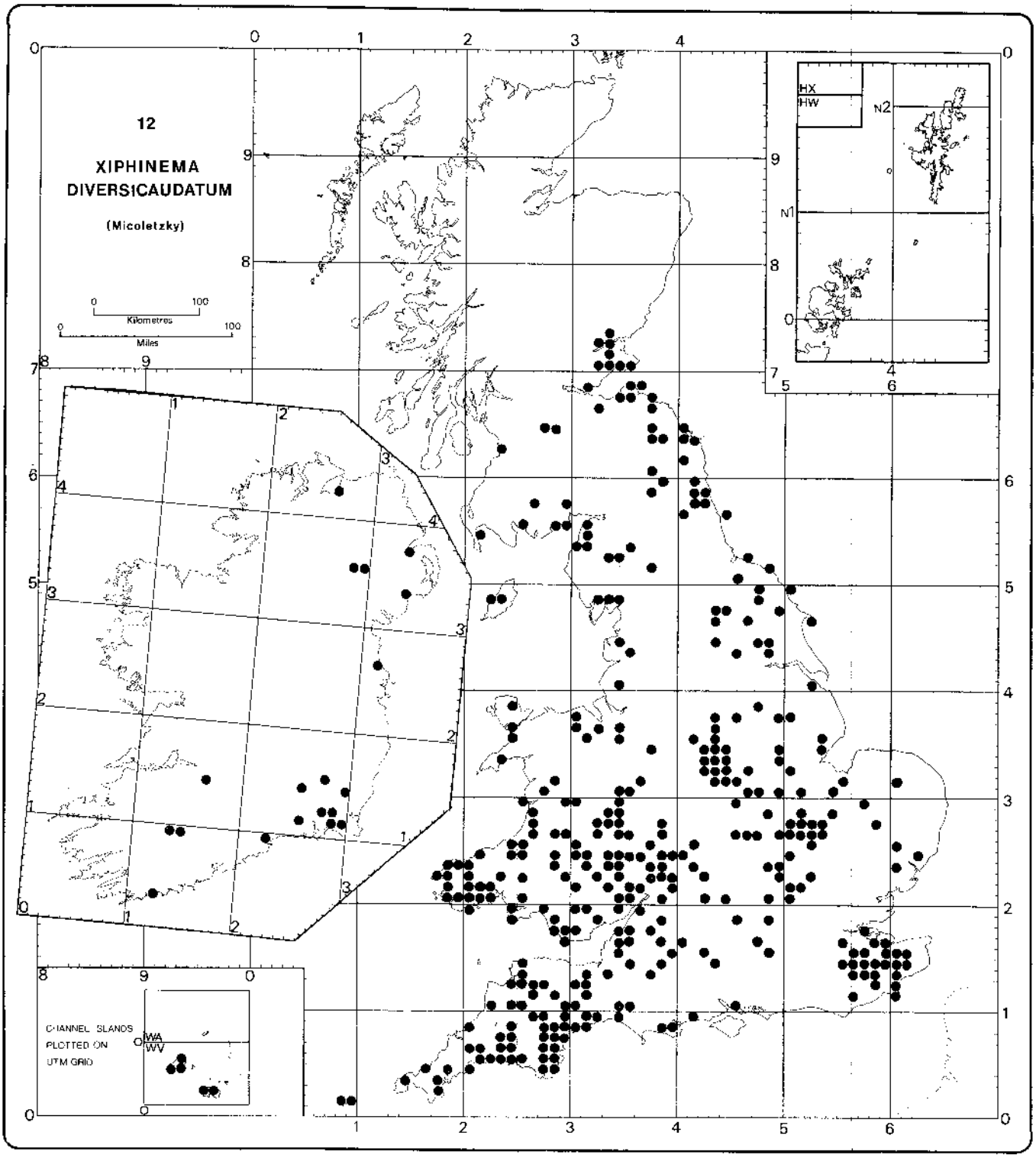
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DIVERSICAUDATUM
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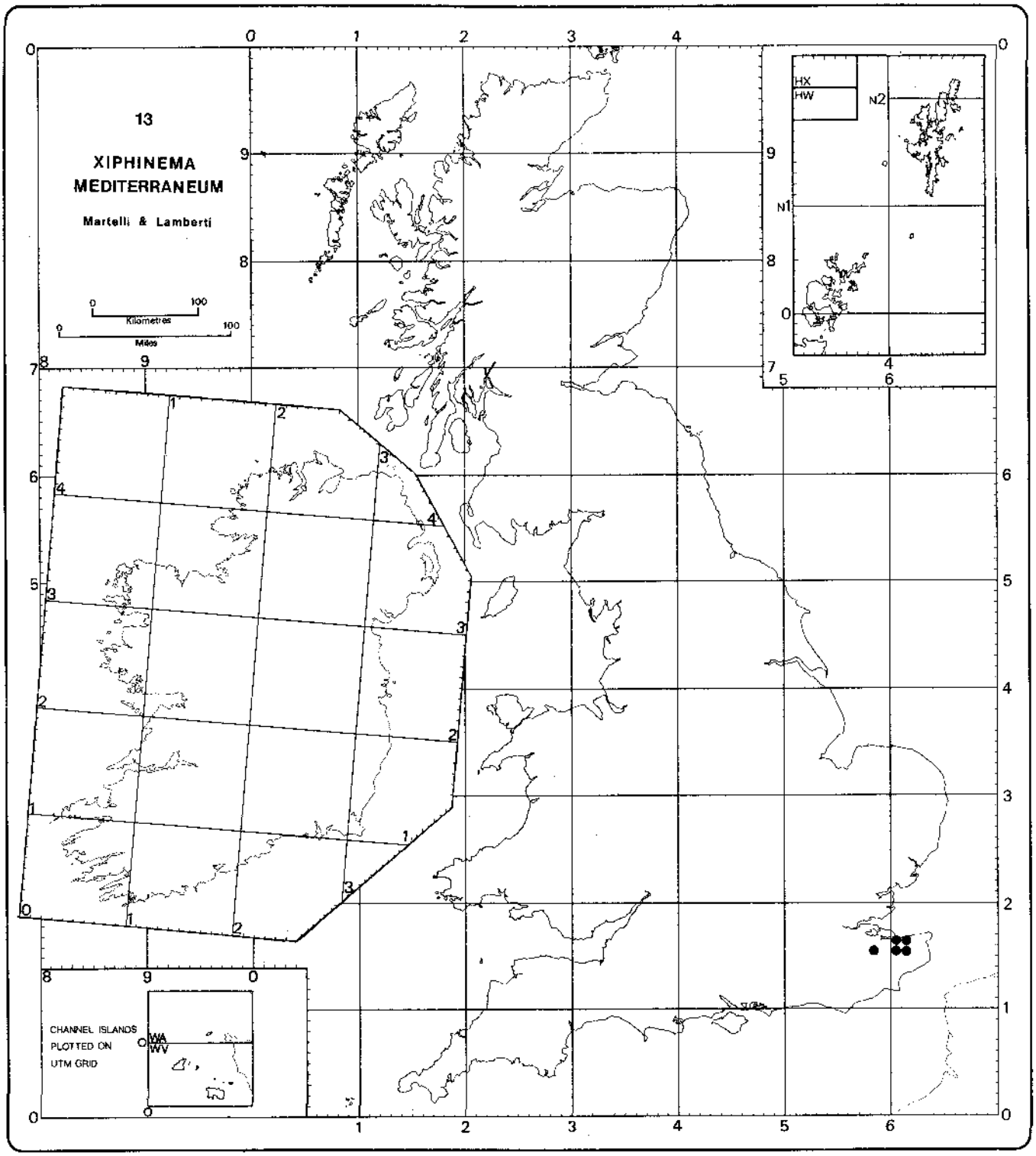
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Martelli & Lamberti
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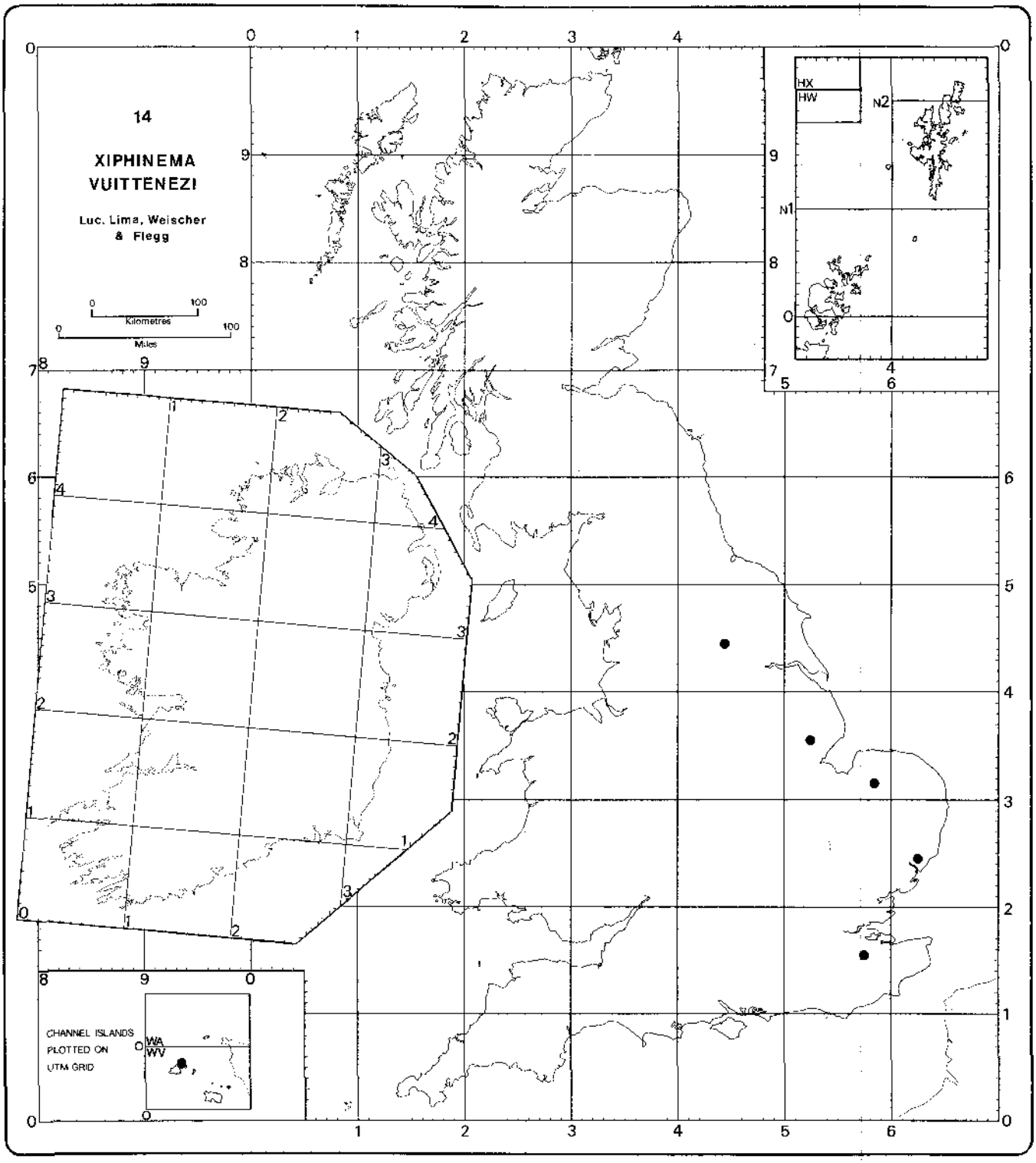
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VUITTENEZI
Luc, Lima, Weischer
& Flegg
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Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

PART 2

TRICHODORIDAE

edited by

B. BOAG* and T.J.W. ALPHEY*

* Scottish Horticultural Research Institute, Invergowrie, Dundee, Scotland.

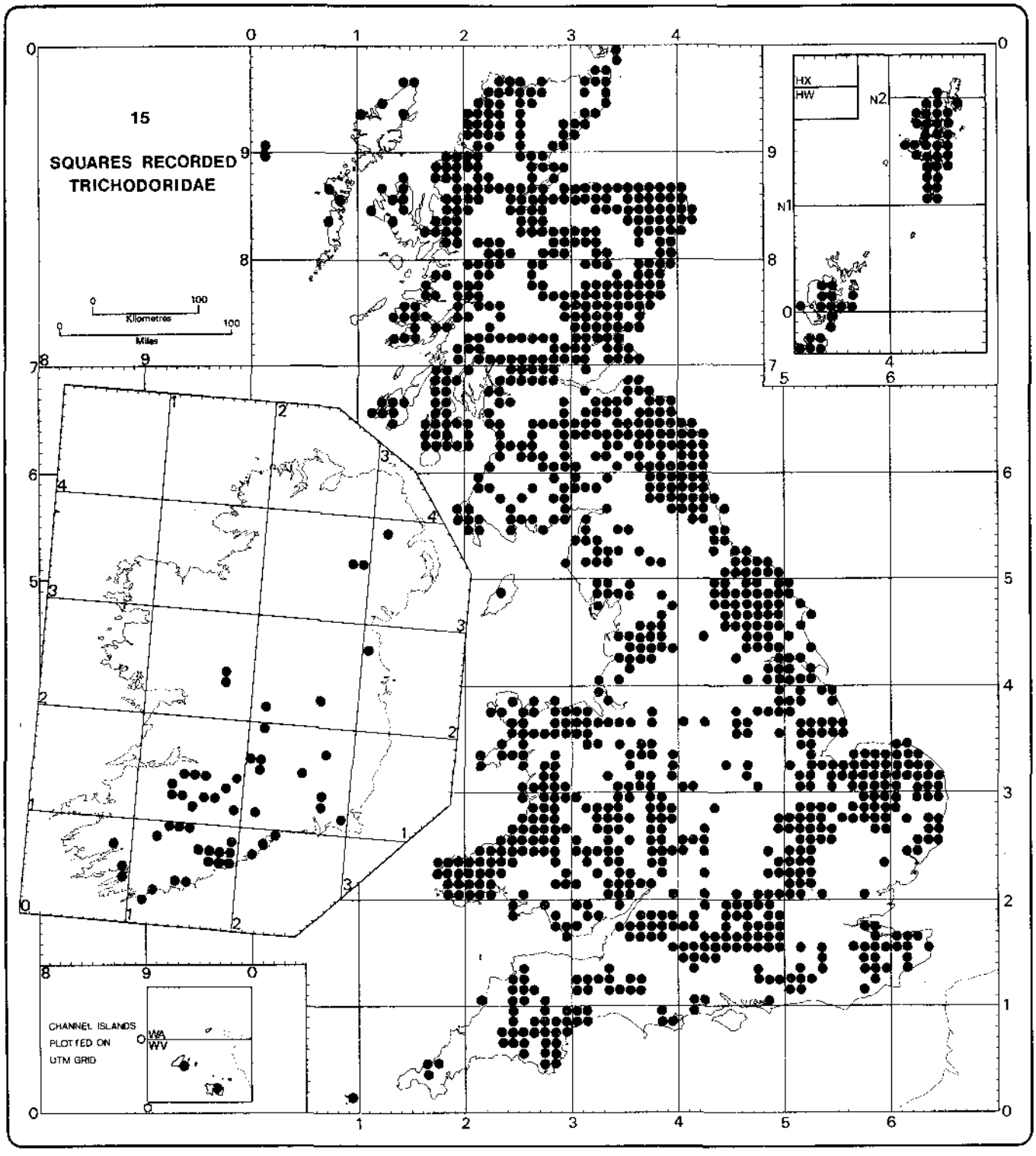
Introduction

Trichodorids are small (0.35-1.7 mm in length) root ectoparasitic nematodes. There are two genera *Trichodorus* and *Paratrichodorus* which belong to the order Dorylaimida (Nematoda). A good diagnostic character for the genera is the presence of a slender curved solid spear (onchiostyle). The nematodes have a wide host range. Species from both genera cause damage to economically important plants either by vectoring virus e.g. Spraing disease (tobacco rattle virus) in potato or by direct feeding e.g. Docking disorder in sugar beet caused by trichodorids and/or Longidorids.

Table Viruses transmitted by trichodorid nematodes in the British Isles.

Virus	Nematode
Pea early browning	*Trichodorus primitivus, T. viruliferus, Paratrichodorus anemones, P. pachydermus, P. teres.*
Tobacco rattle	*Trichodorus cylindricus, T. primitivus, T. similis, T. viruliferus, Paratrichodorus anemones, P. pachydermus, P. teres, P. nanus*

In the British Isles twelve species have been recorded and the geographical distribution of each species is presented in this atlas.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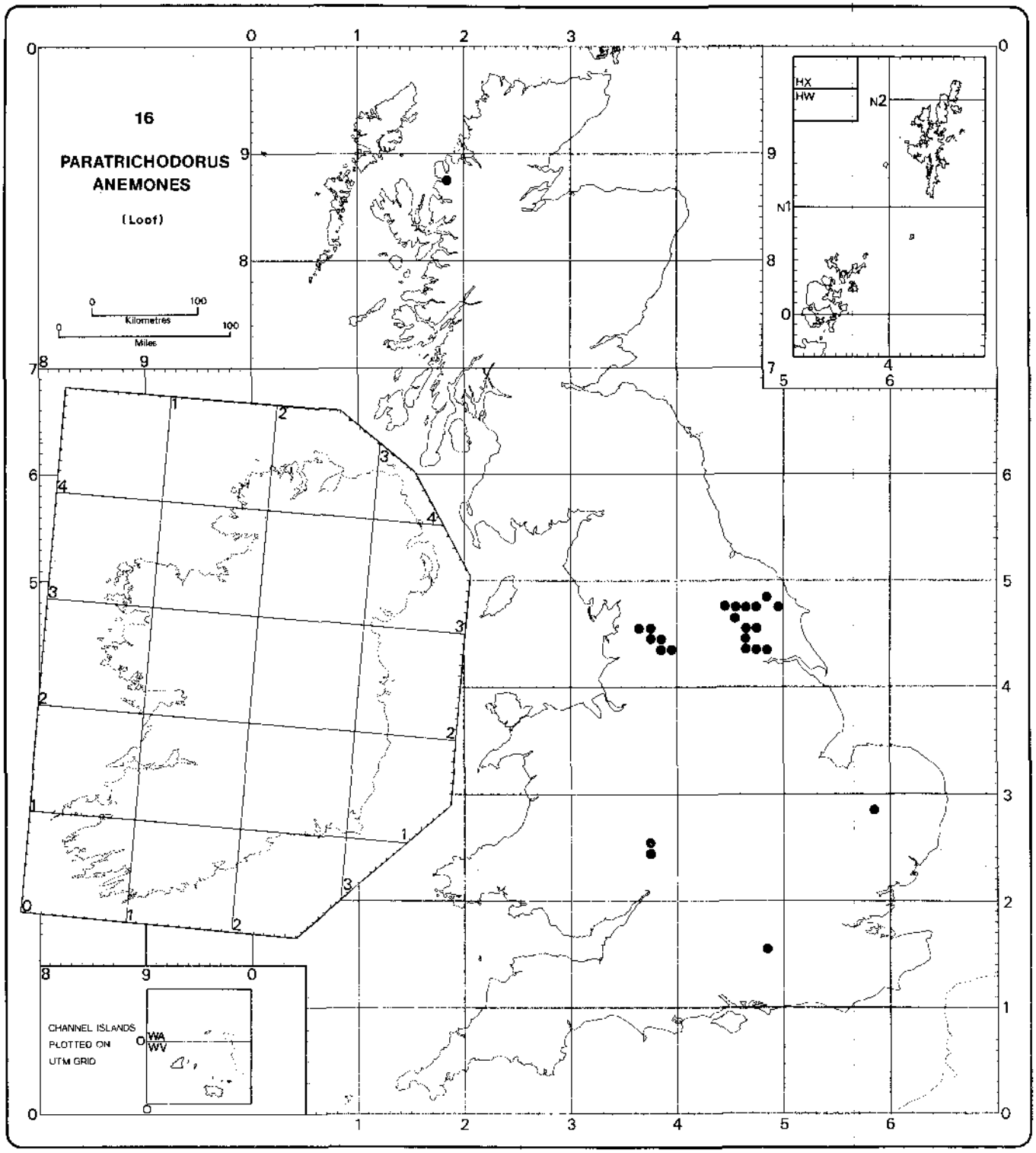
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PARATRICHODORUS ANEMONES
(Loof)
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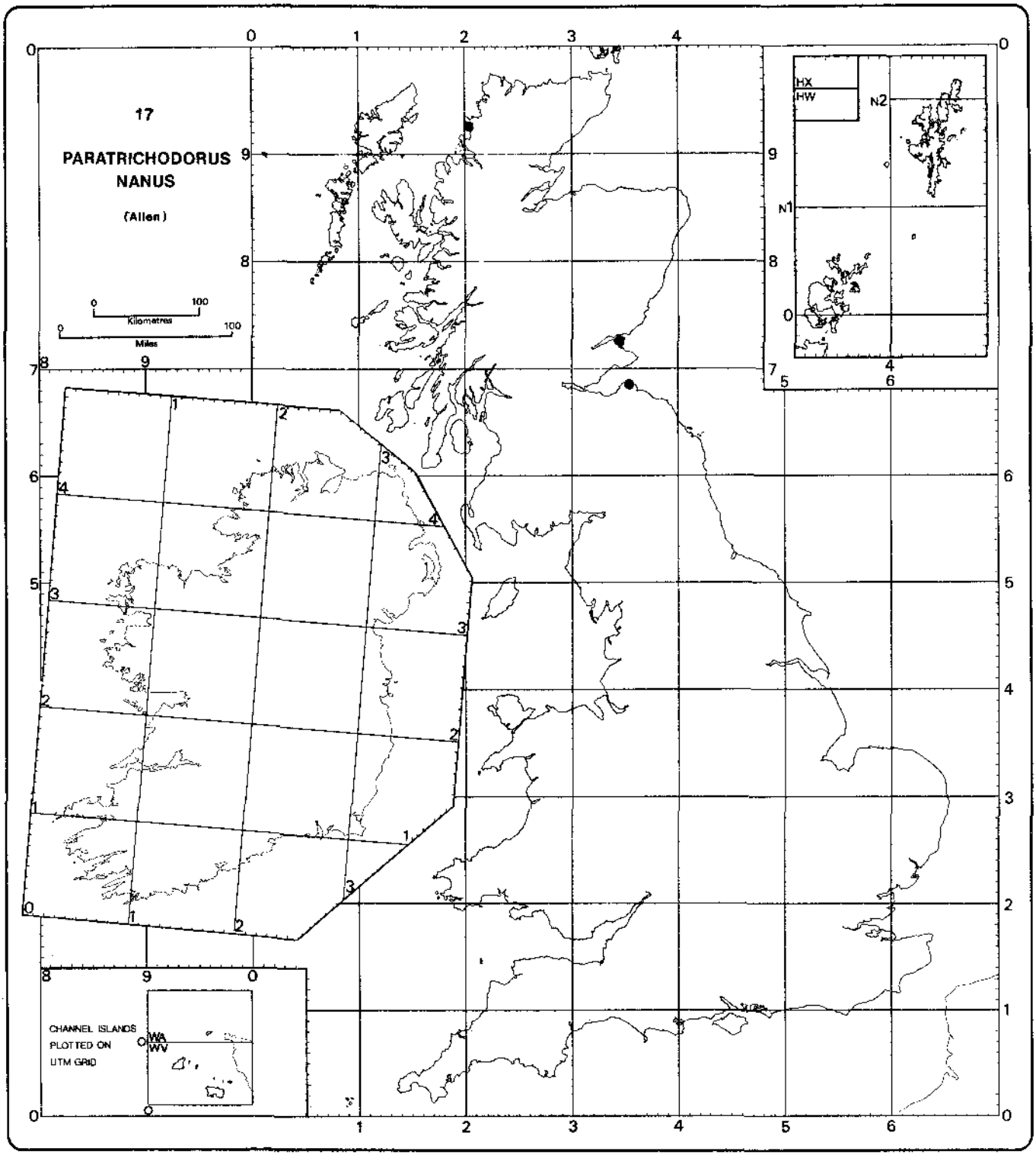
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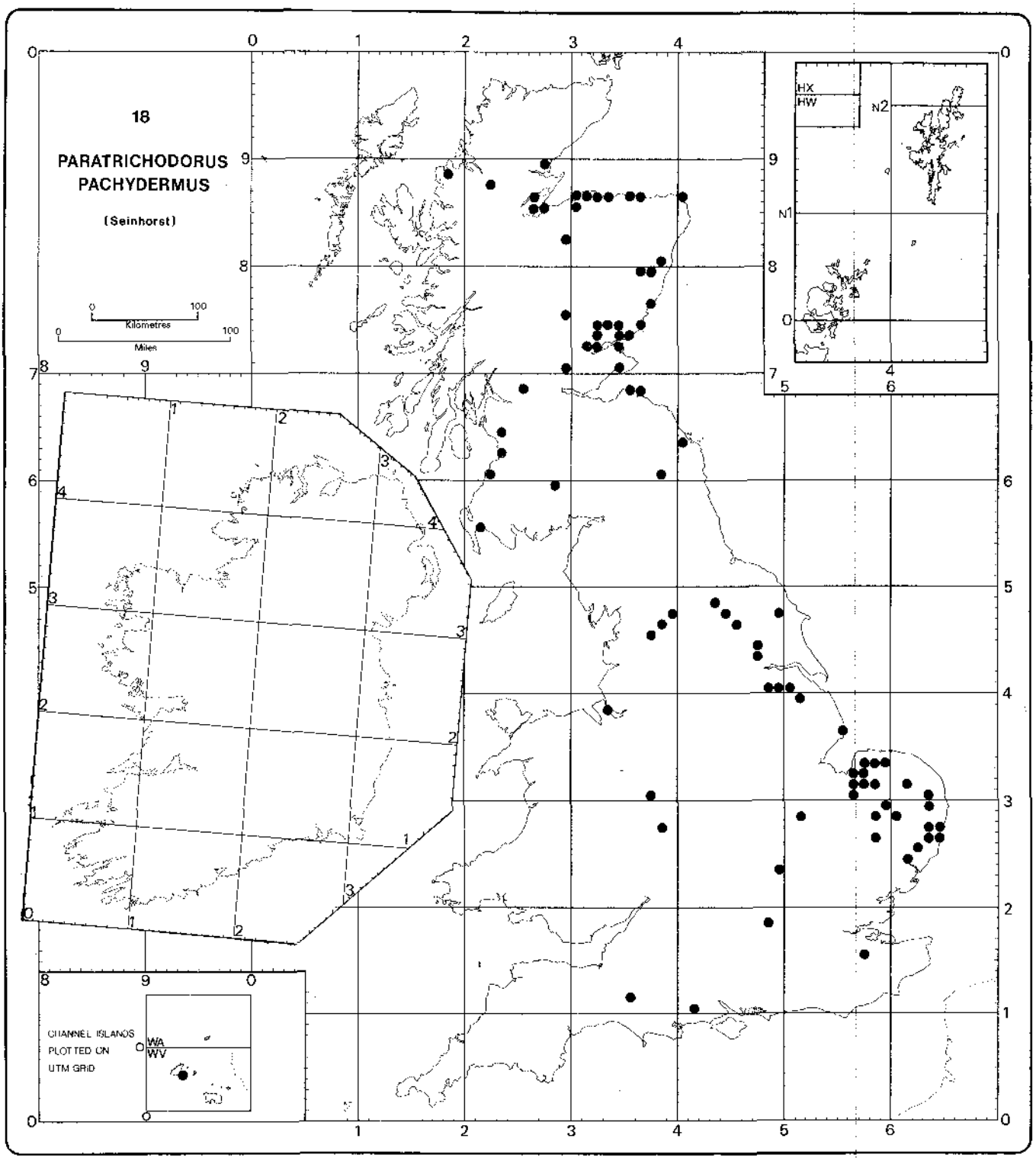
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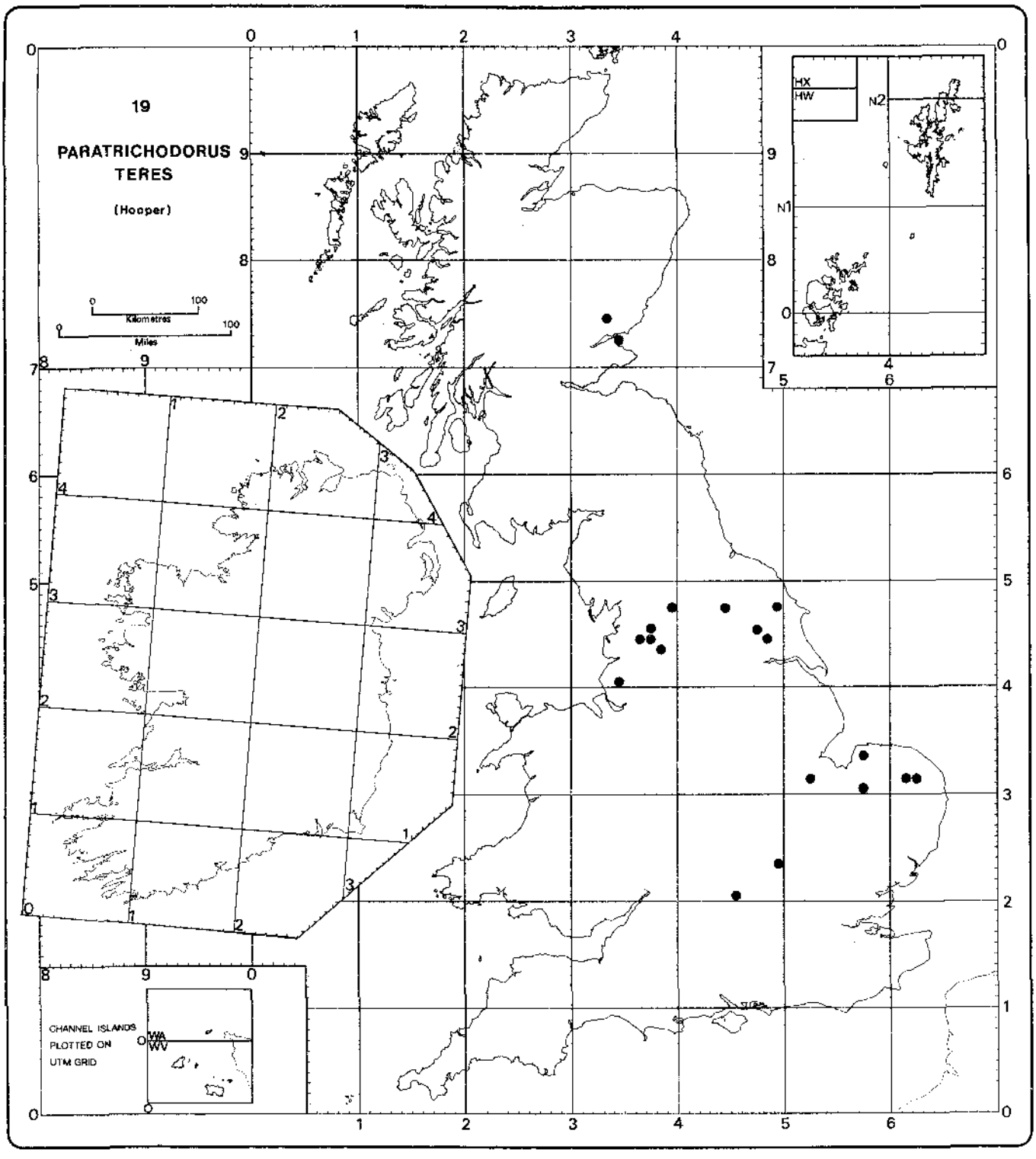
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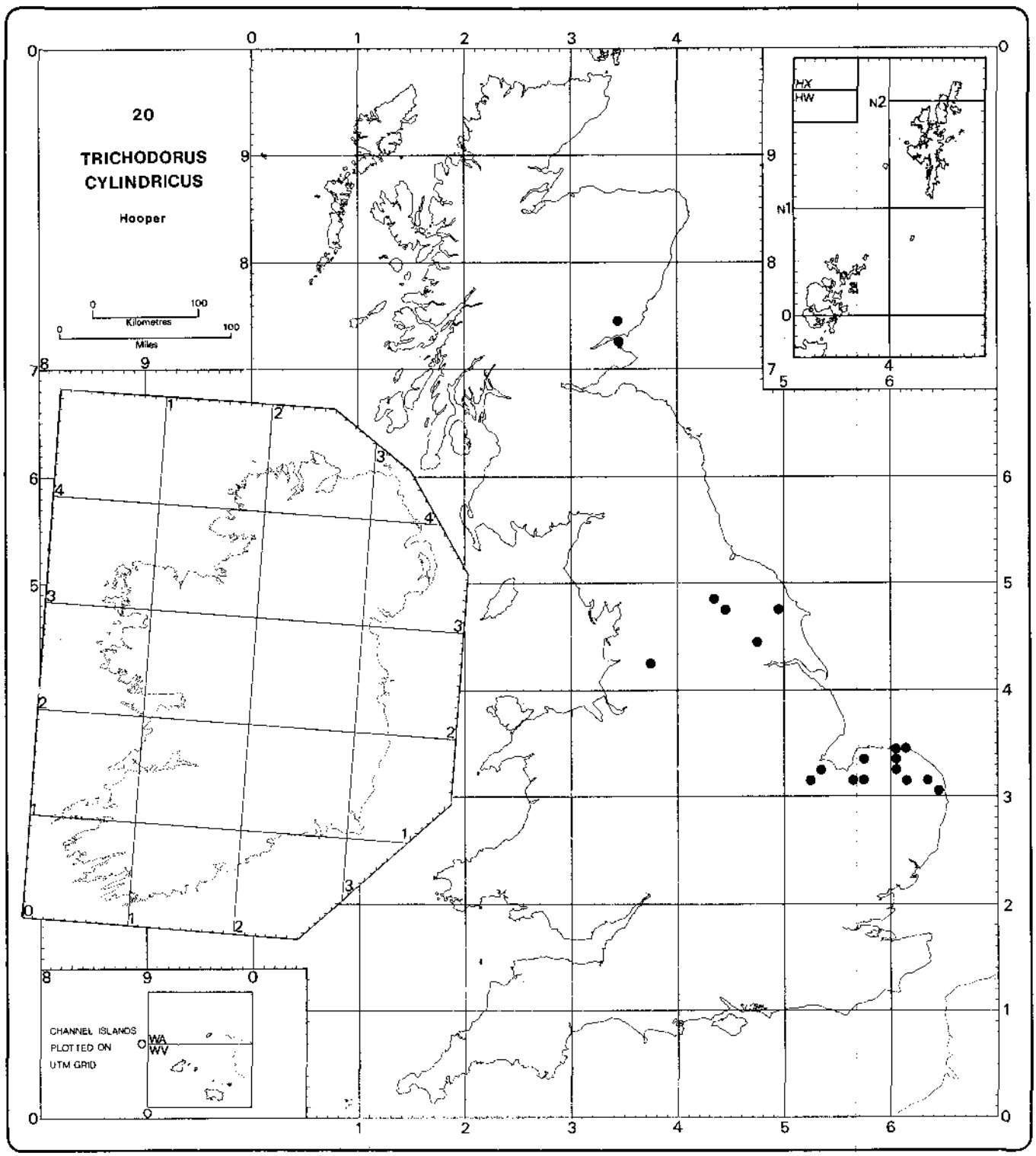
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Hooper
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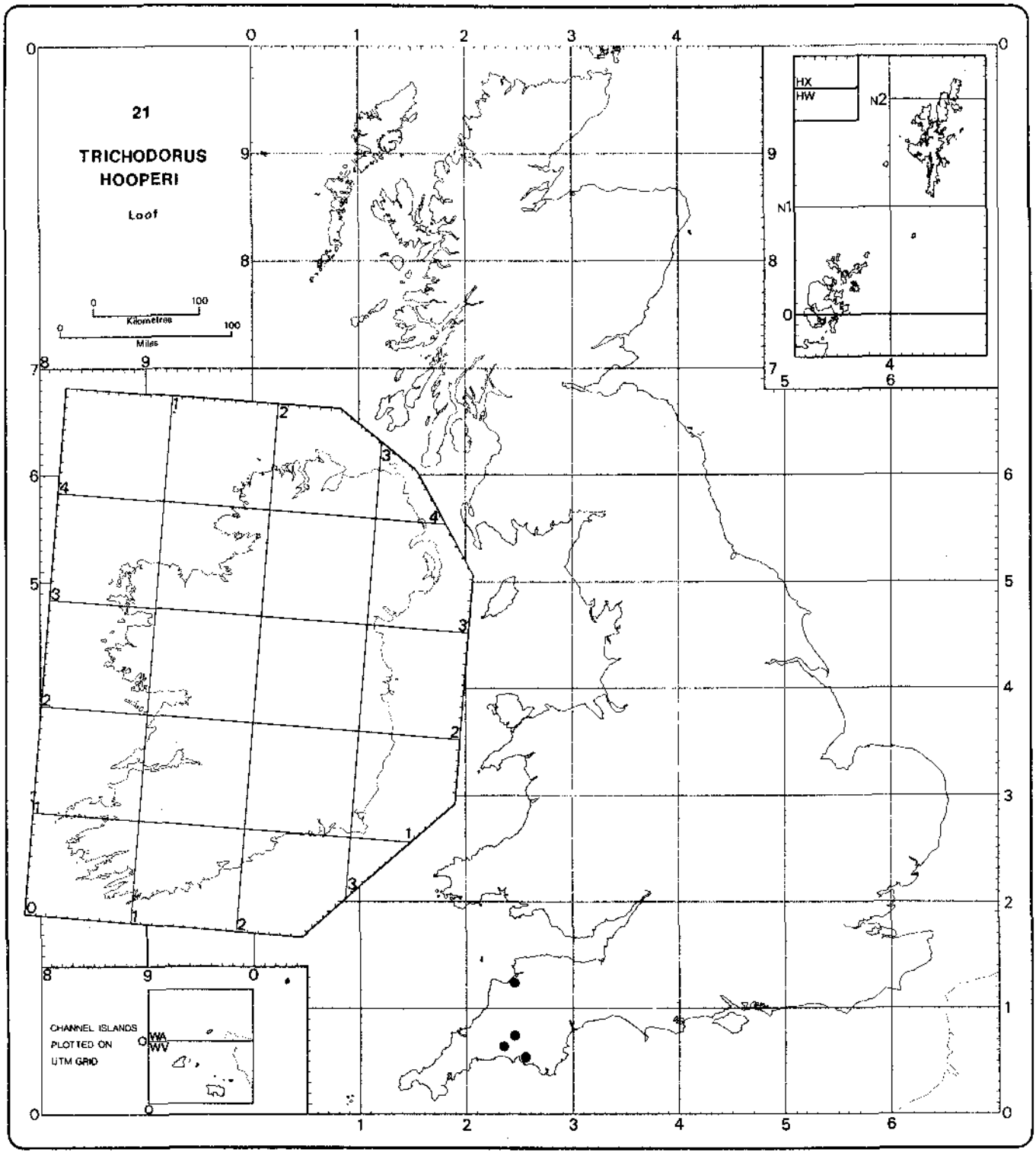
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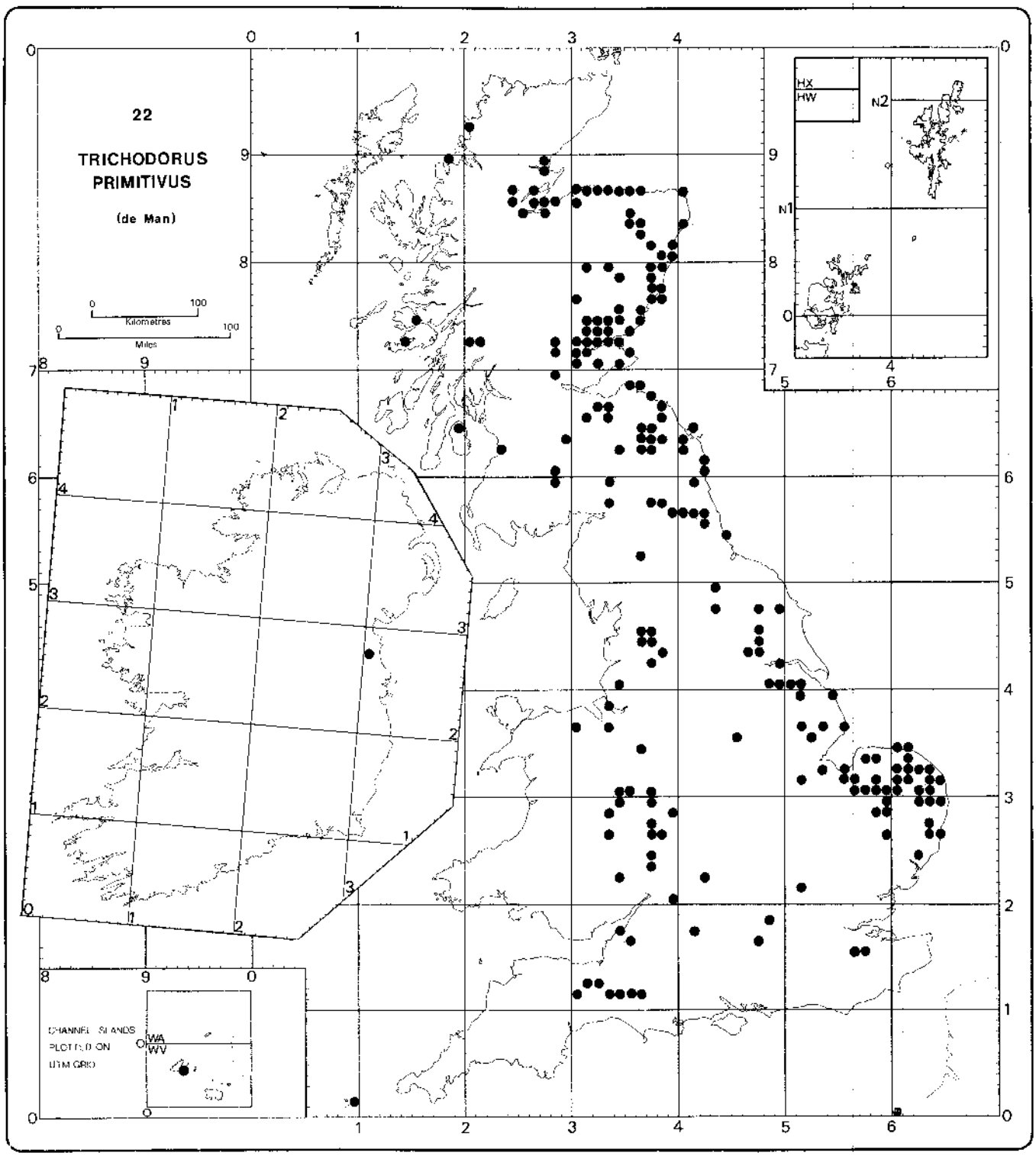
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PRIMITIVUS
(de Man)
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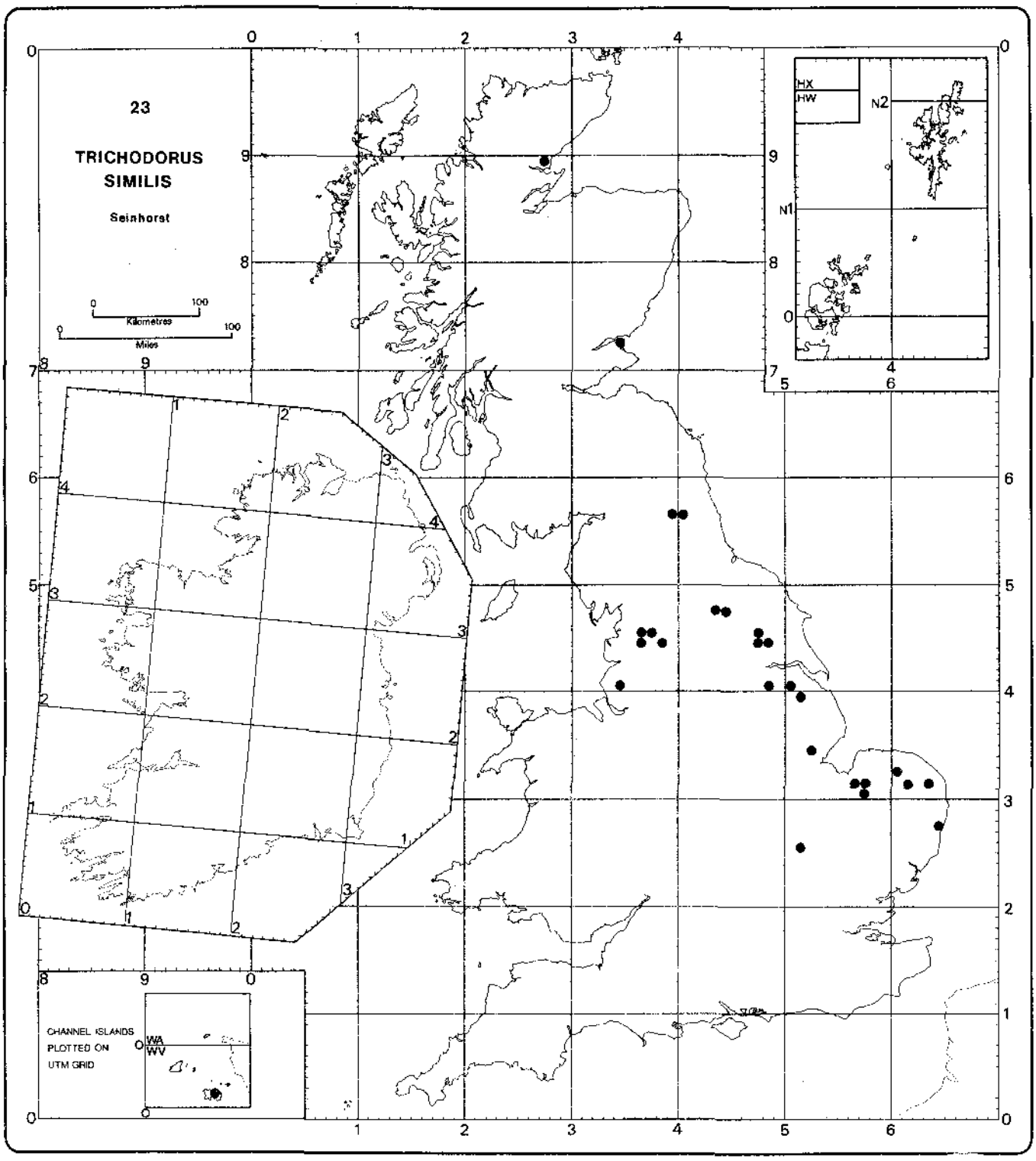
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SIMILIS
Seinhorst
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0 100
Miles
HX
HW
N2
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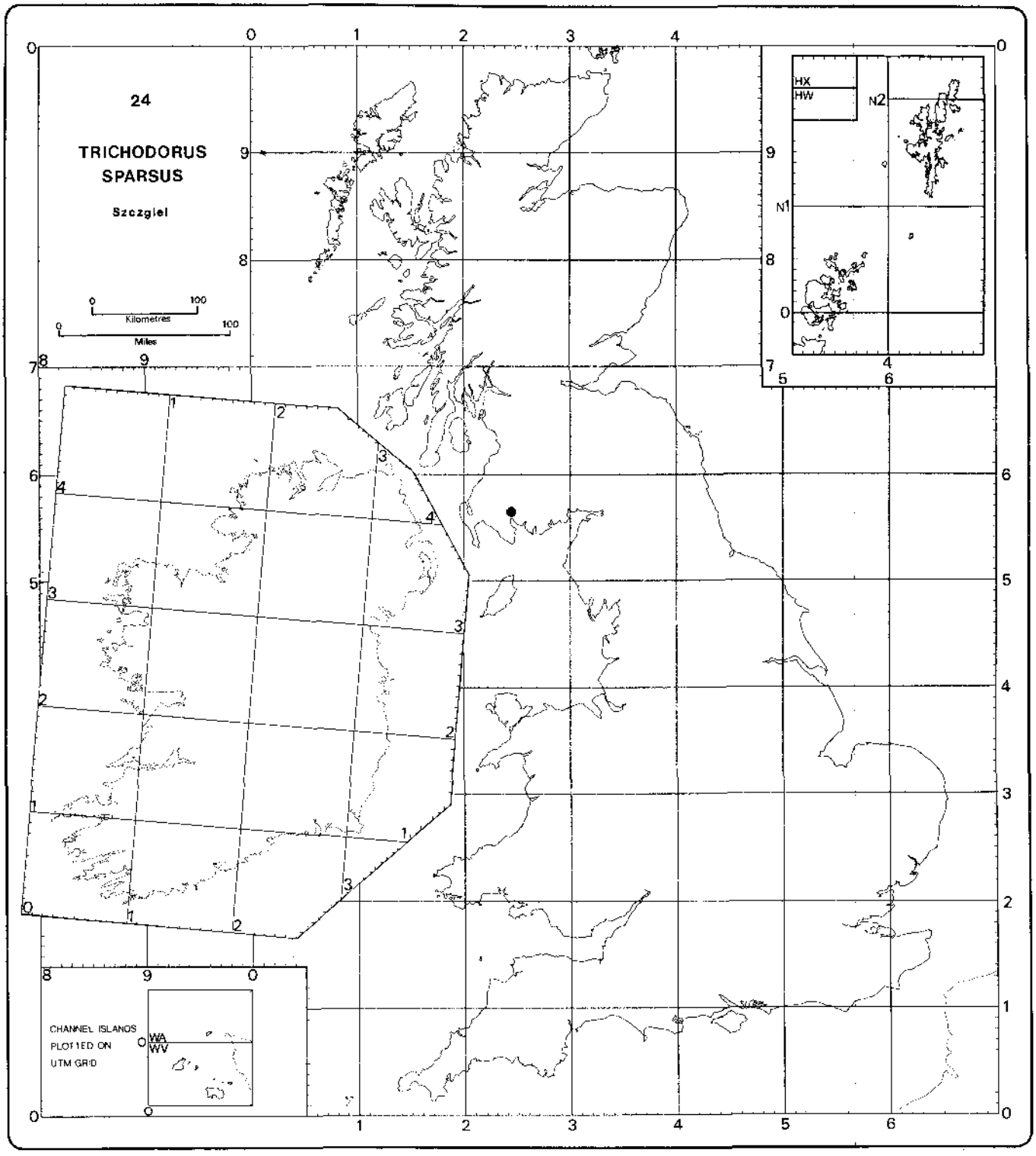
WV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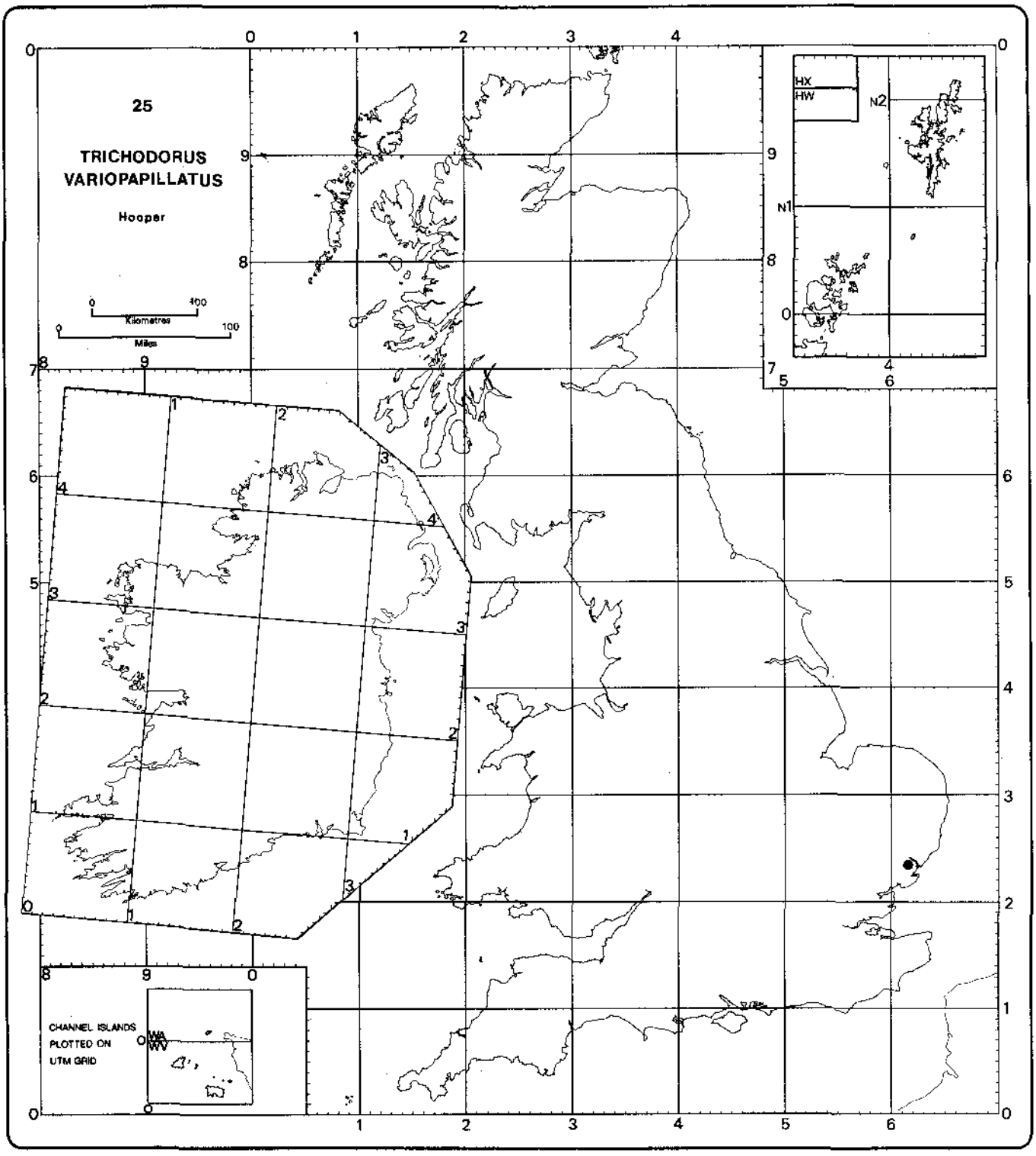
WV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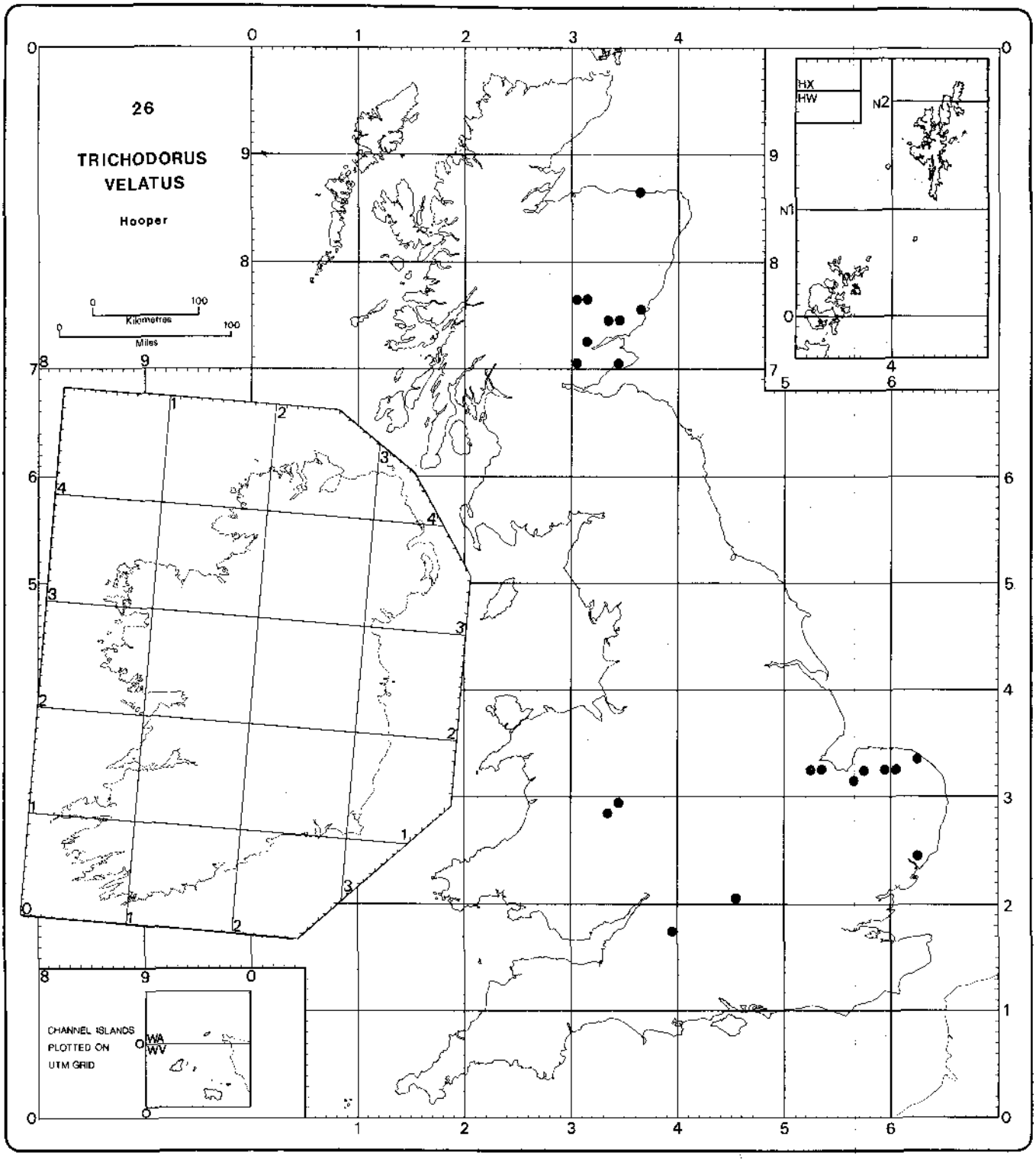
WA
WV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TRICHODORUS
VELATUS
Hooper
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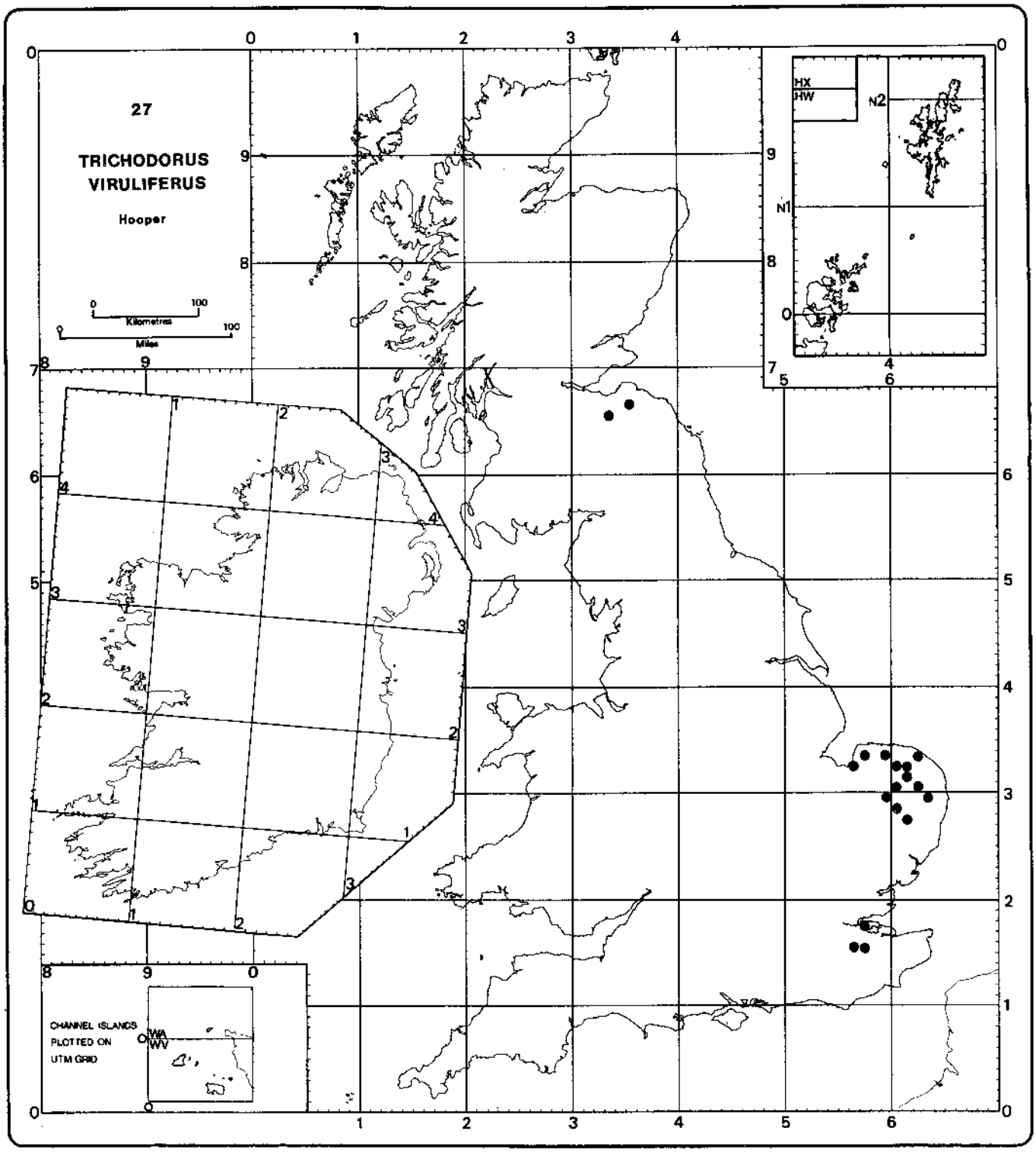
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV


27
TRICHODORUS
VIRULIFERUS
Hooper
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

PART 3

CRICONEMATIDAE

edited by

B. BOAG[1] and K.J. ORTON WILLIAMS[2]

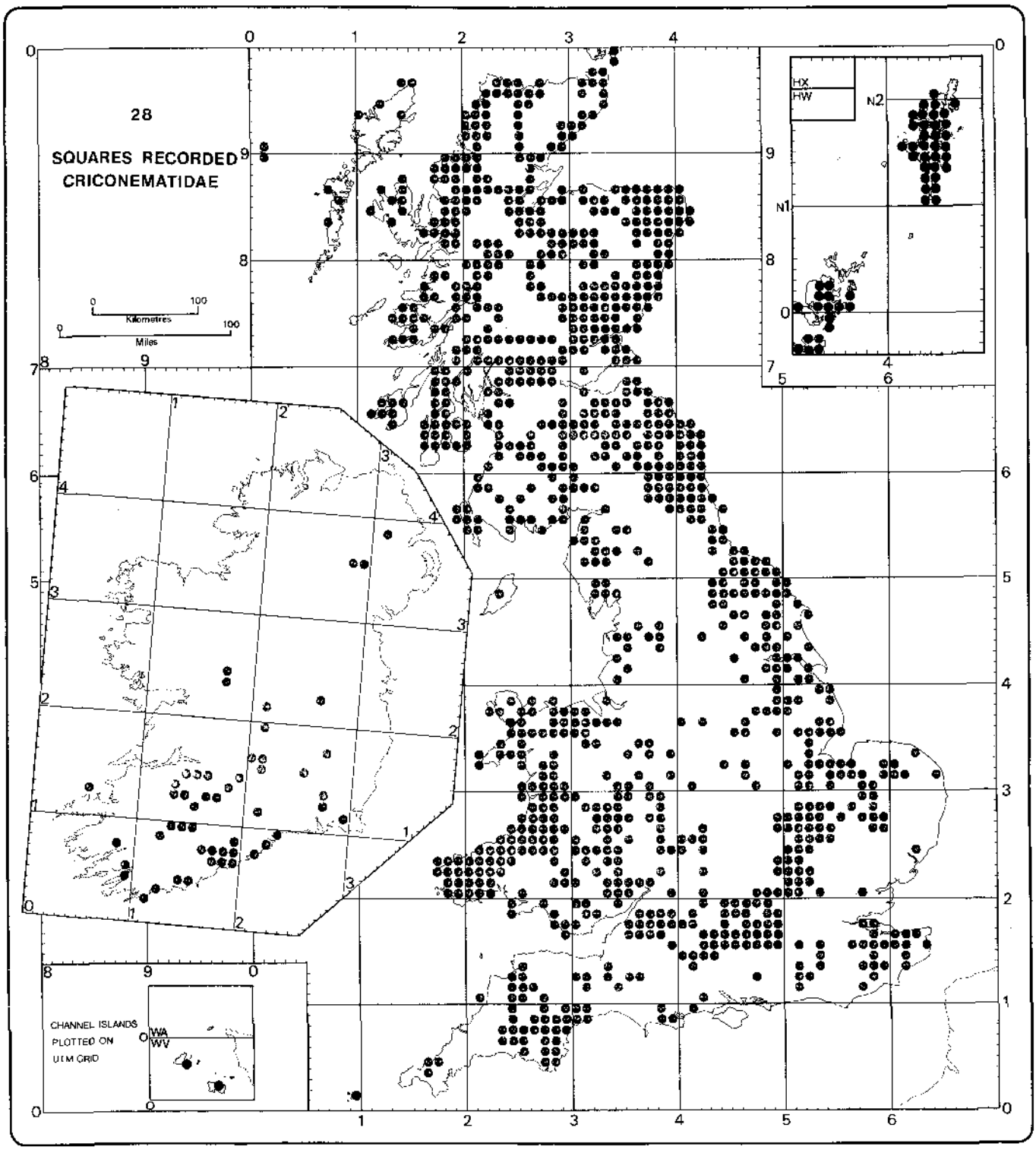
[1] Scottish Horticultural Research Institute, Invergowrie, Dundee, Scotland.

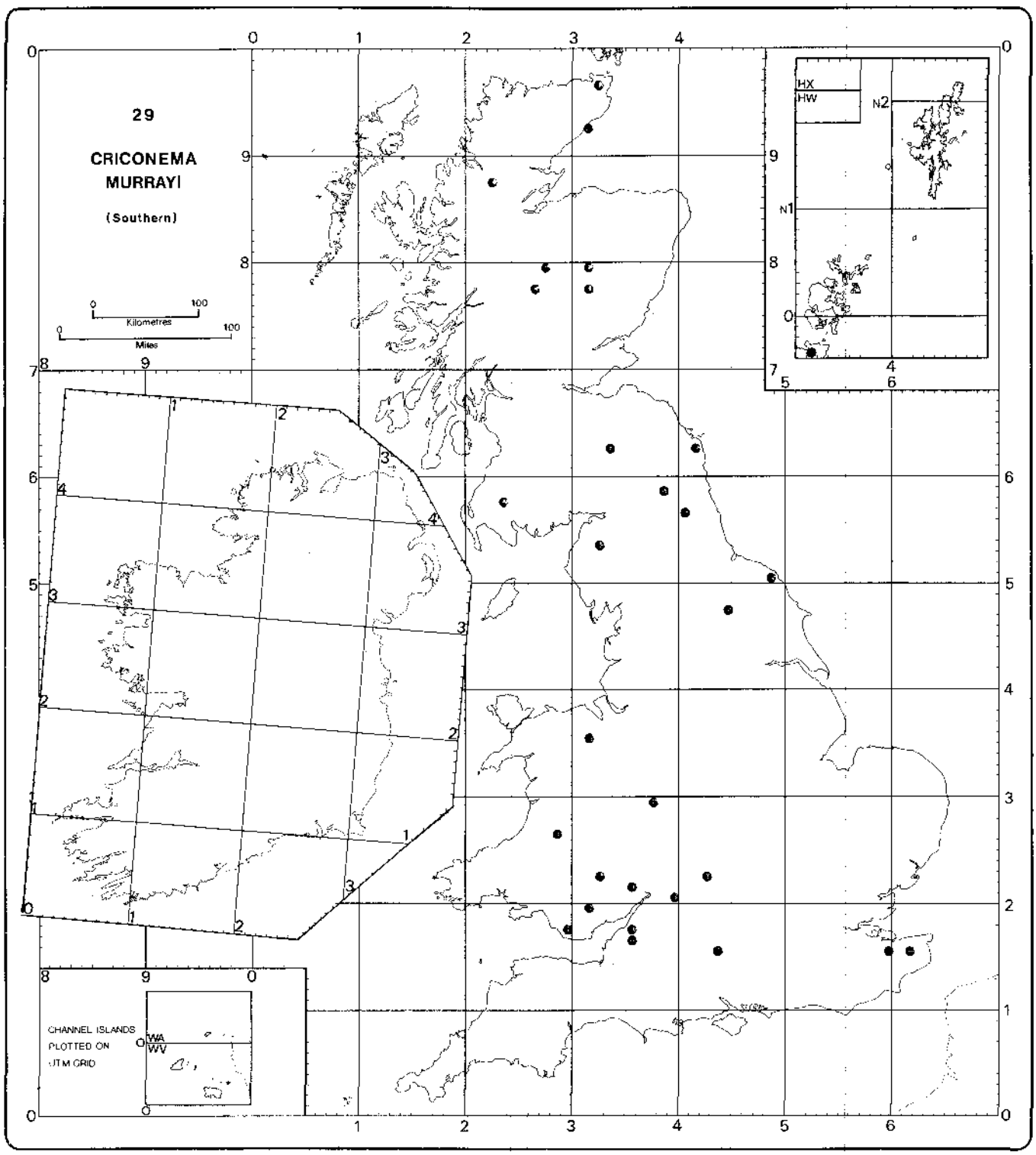
[2] Commonwealth Institute of Helminthology, St. Albans, Herts., England.

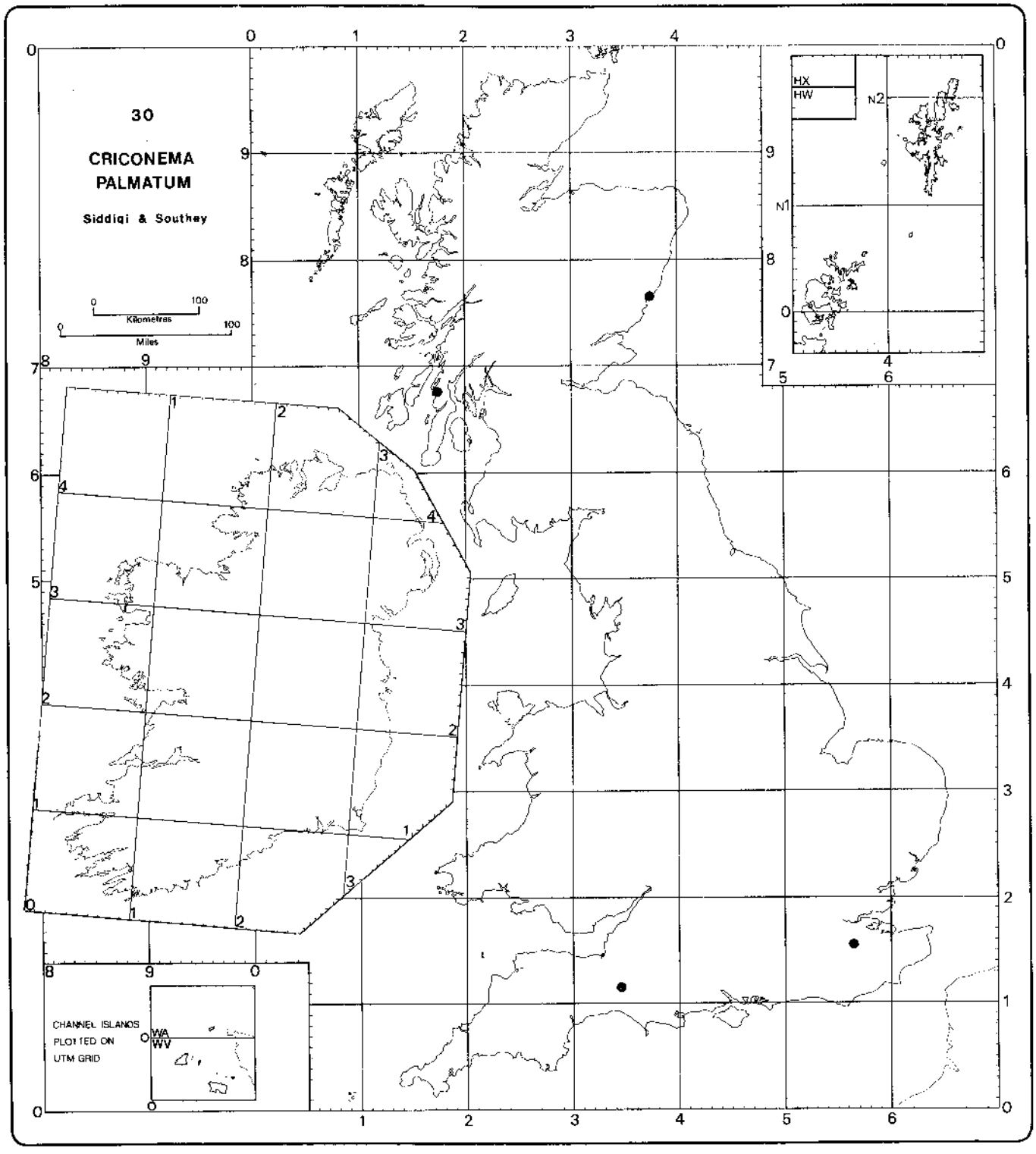
Introduction

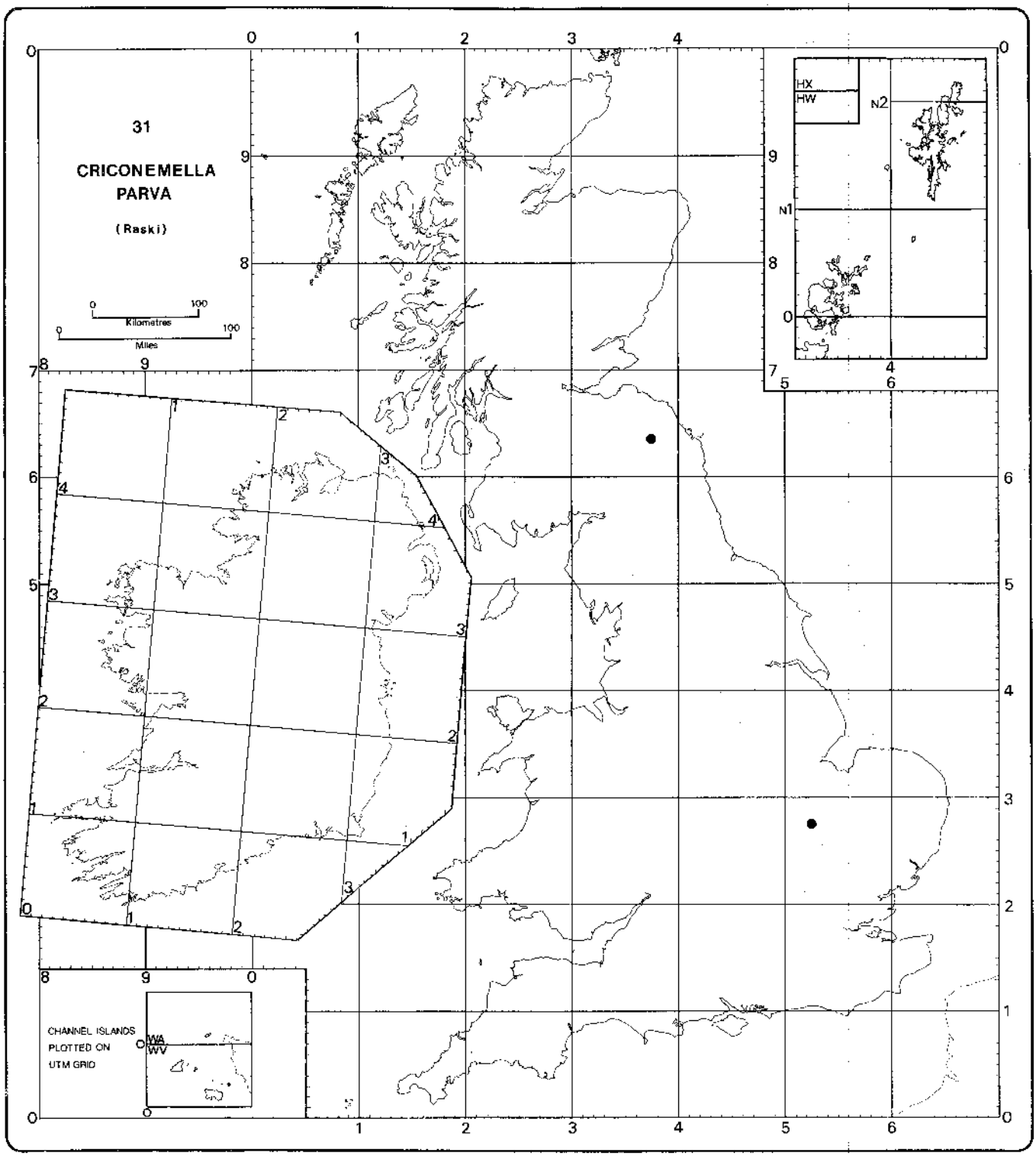
Criconematid nematodes are small (0.2-2.0 mm in length) and are characterised by pronounced annules which surround the body. They belong to the order Tylenchida (Nematoda) and have a protrusable hollow stylet which is used to puncture root cells upon which they feed. Some species have been implicated as causing economic damage, either by their direct feeding or by introducing other pathogens *mainly fungi*. The majority of species feed on woody hosts but some, e.g. *Macroposthonia rustica* and *Criconemoides informis* are associated more with graminaceous plants.

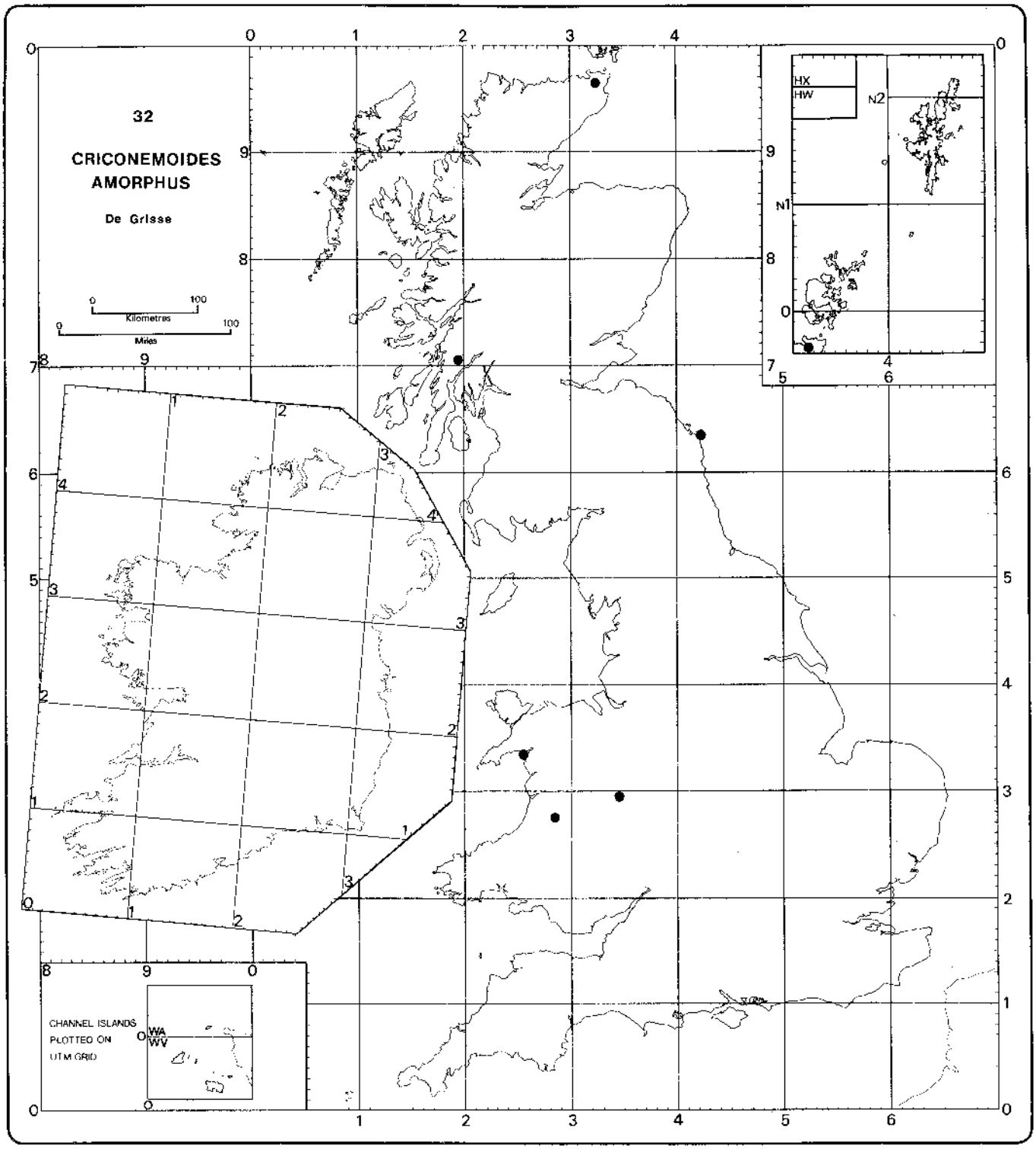
Twenty nine species have been recorded from the British Isles, twenty two of them being recorded for the first time.

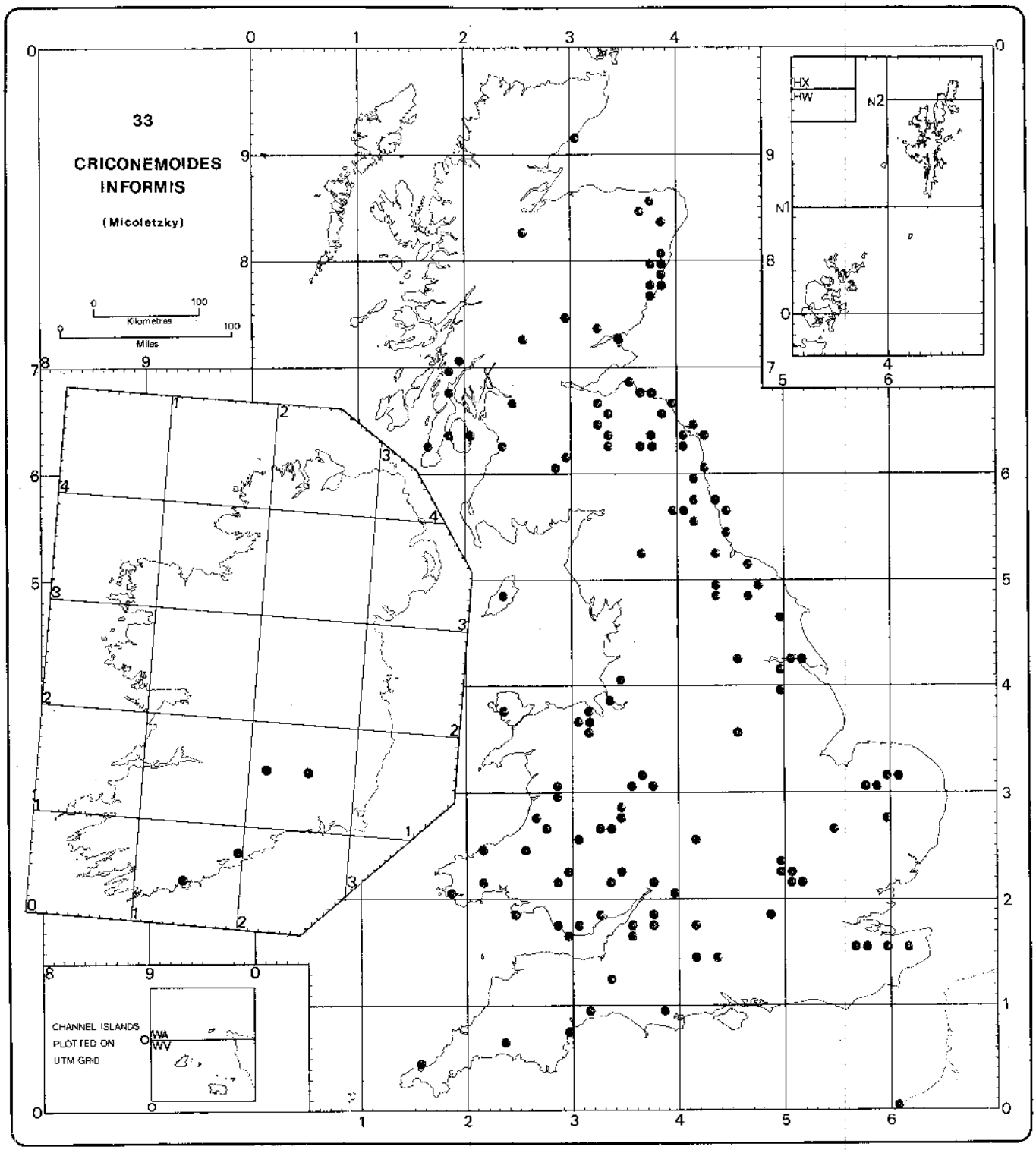

28
SQUARES RECORDED
CRICONEMATIDAE
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

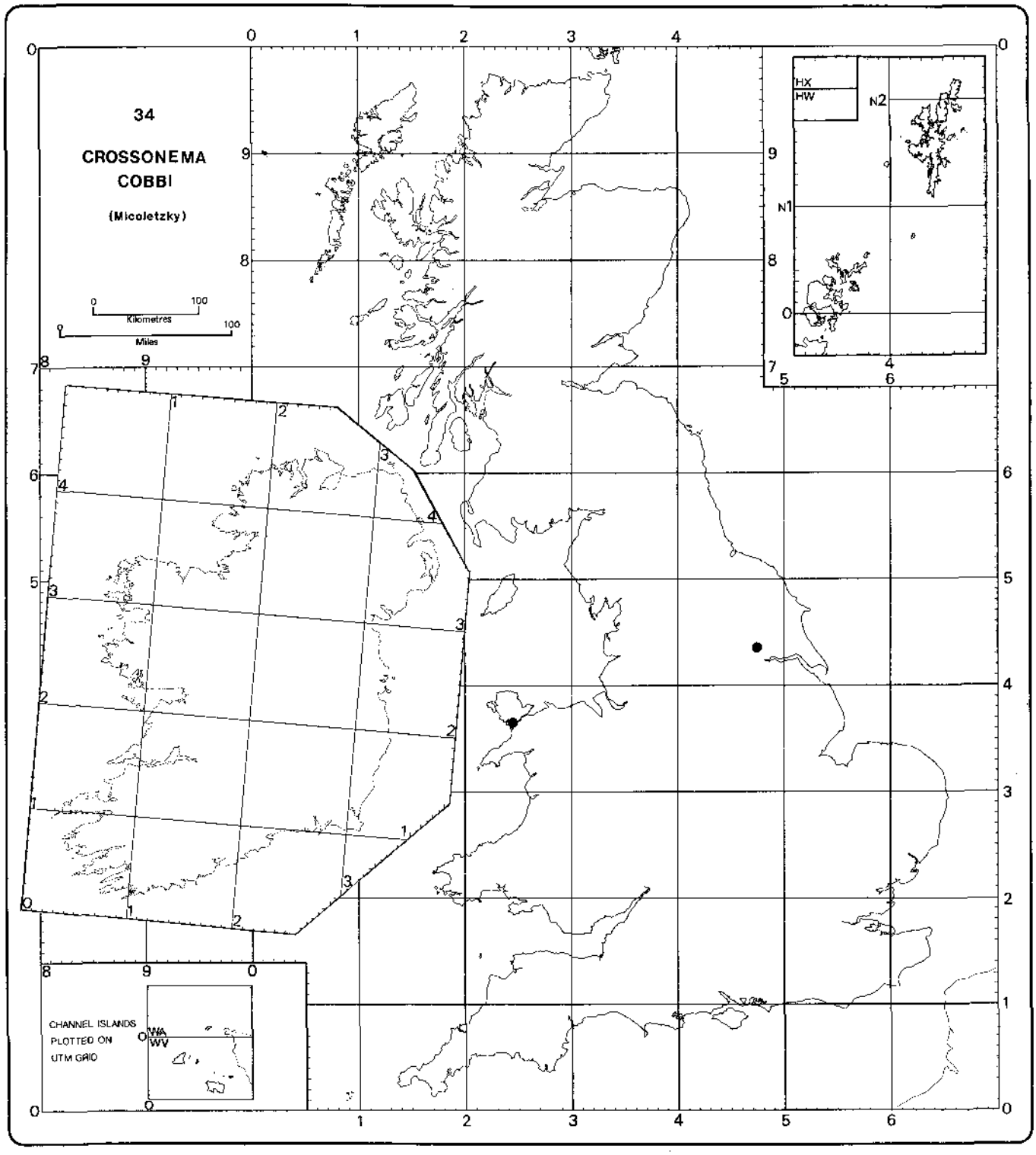

29
CRICONEMA
MURRAYI
(Southern)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

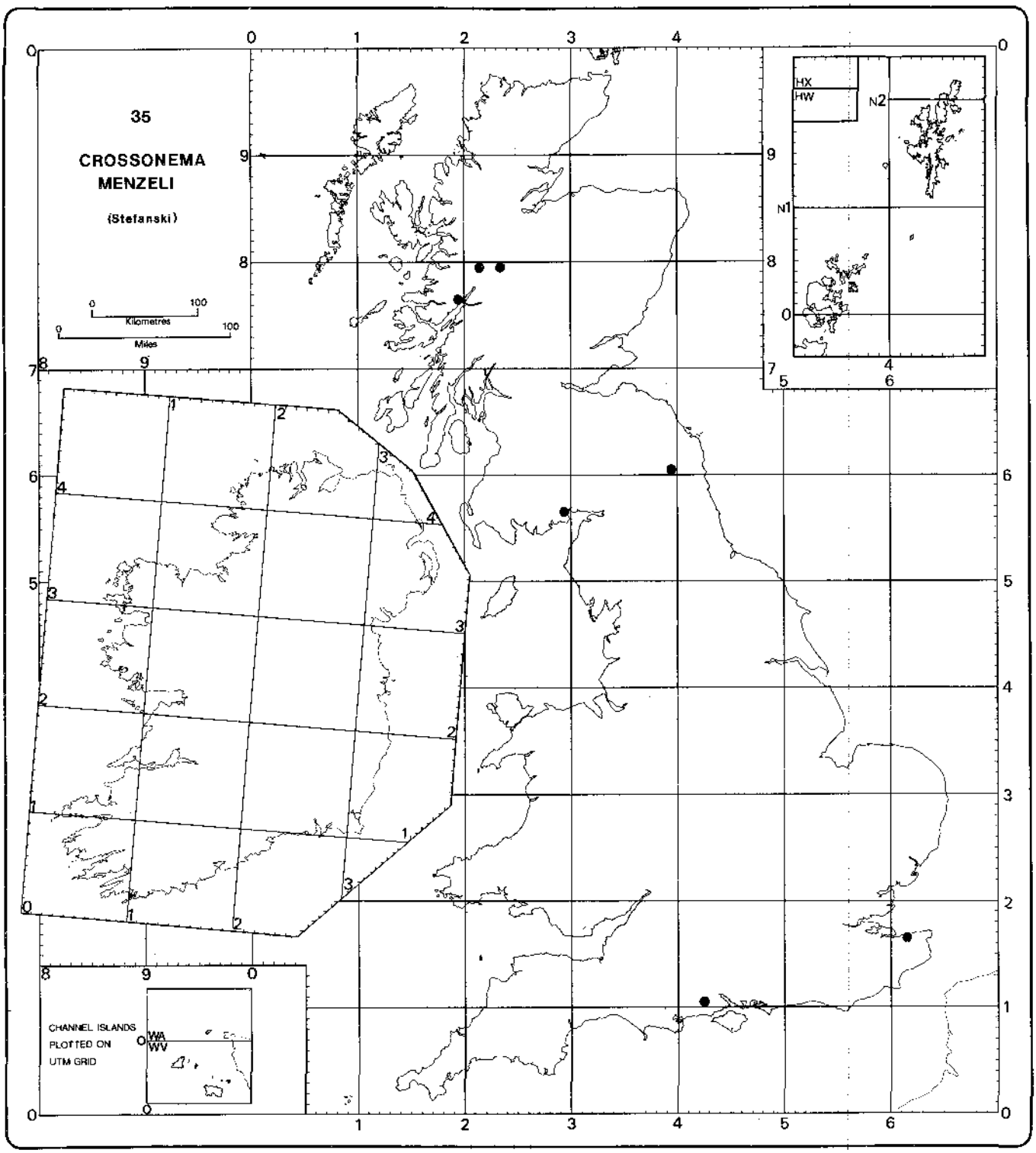

30
CRICONEMA
PALMATUM
Siddiqi & Southey
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

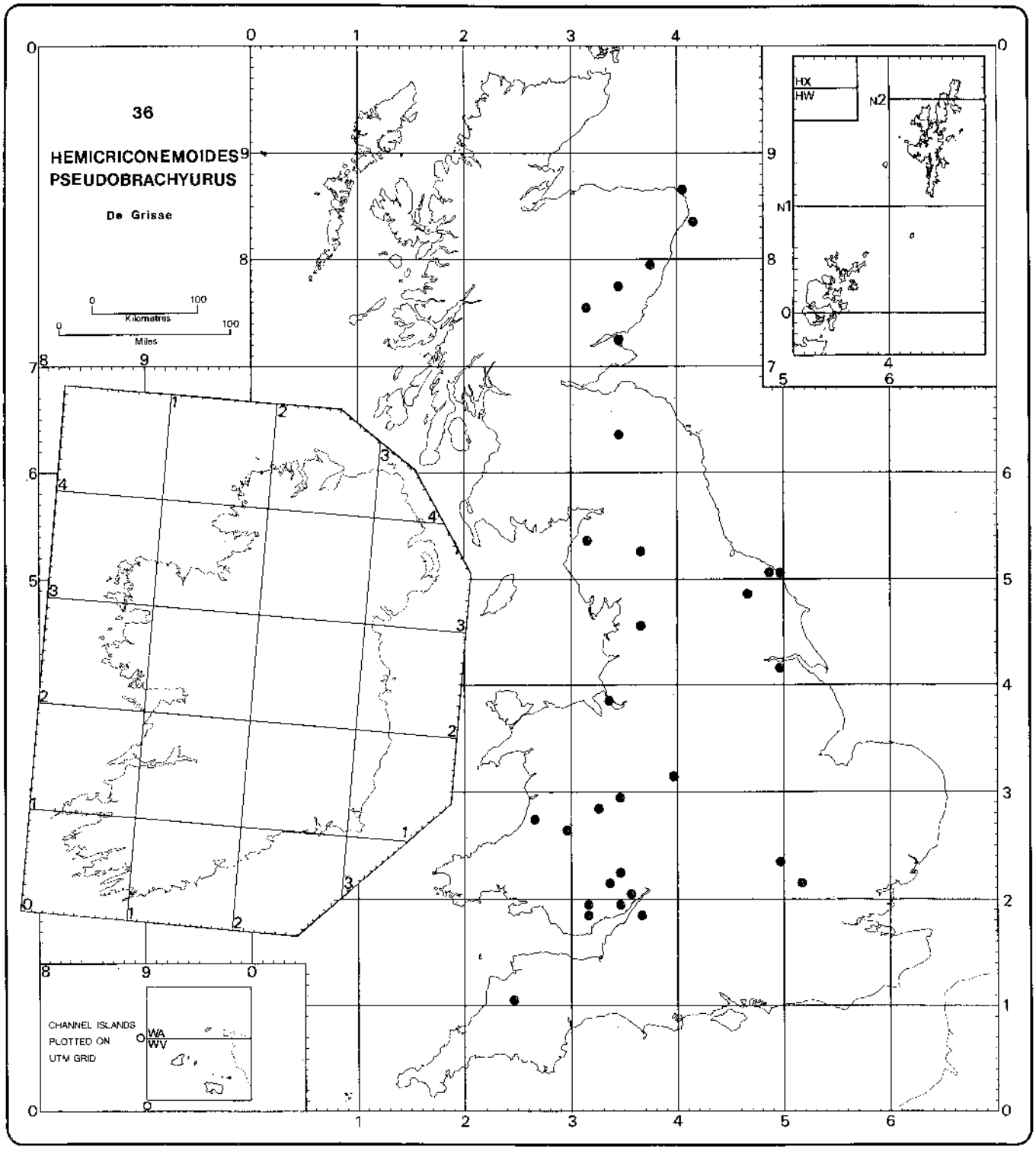

31
CRICONEMELLA PARVA
(Raski)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

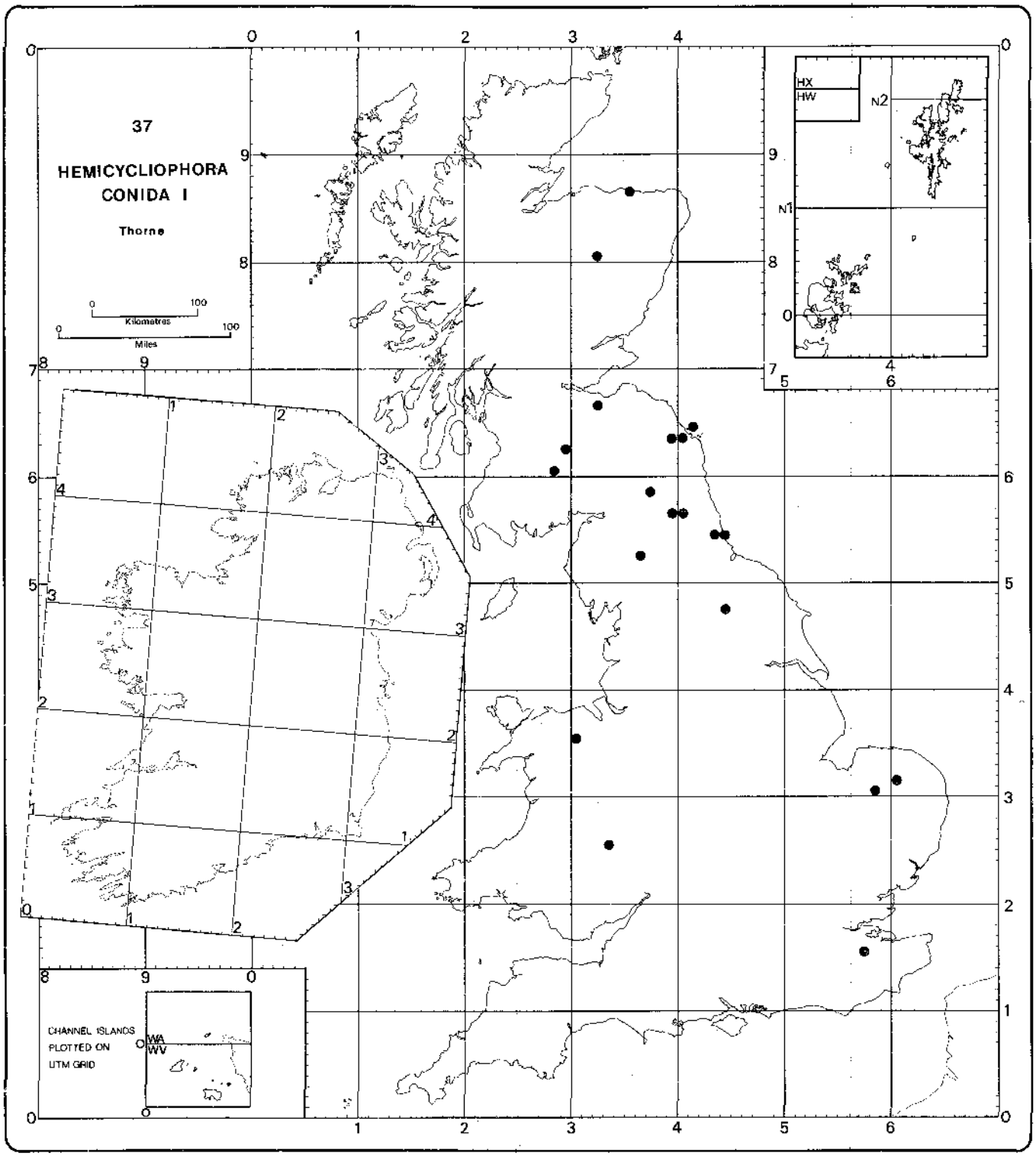

32
CRICONEMOIDES AMORPHUS
De Grisse
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

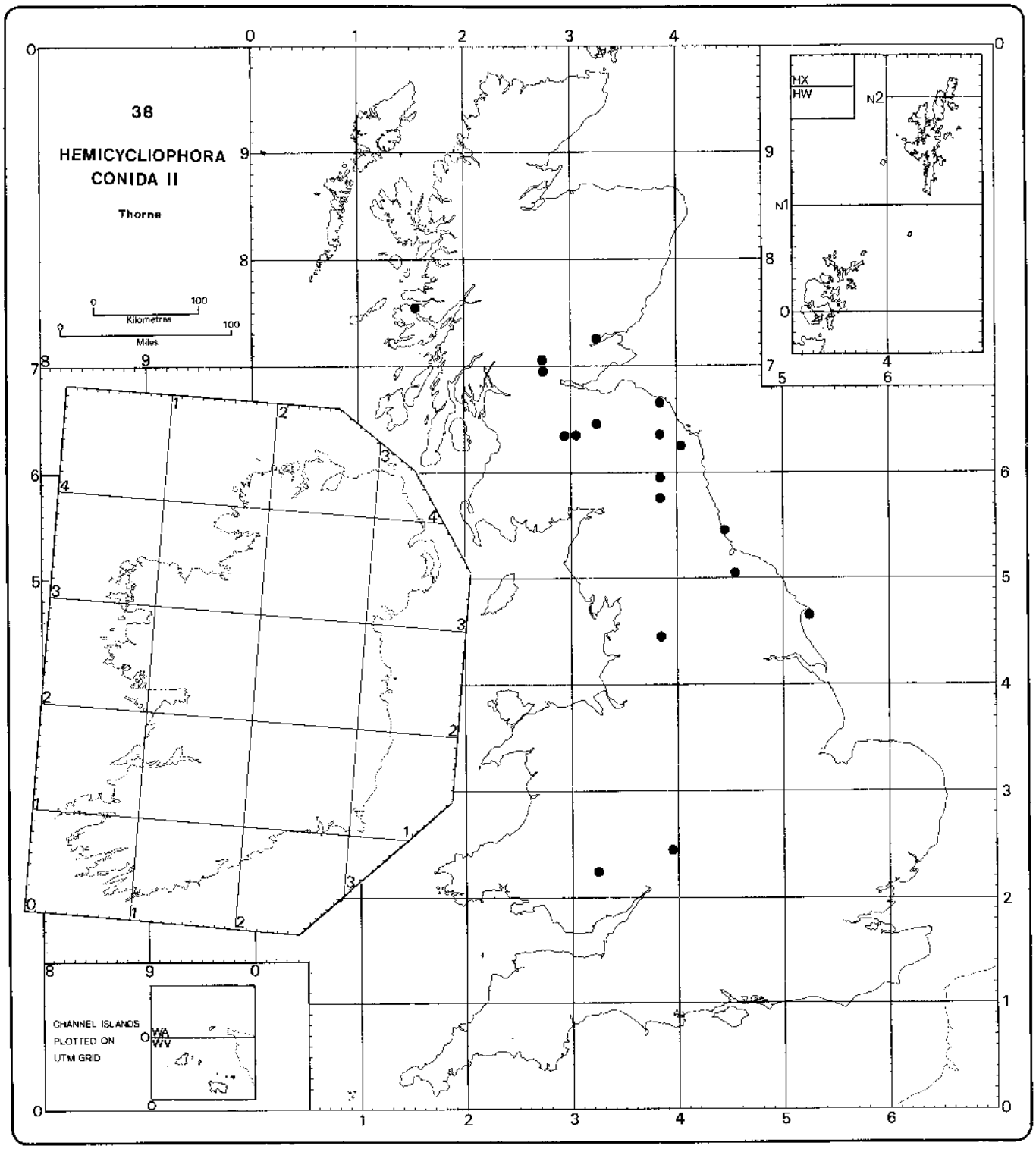

33
CRICONEMOIDES INFORMIS
(Micoletzky)
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

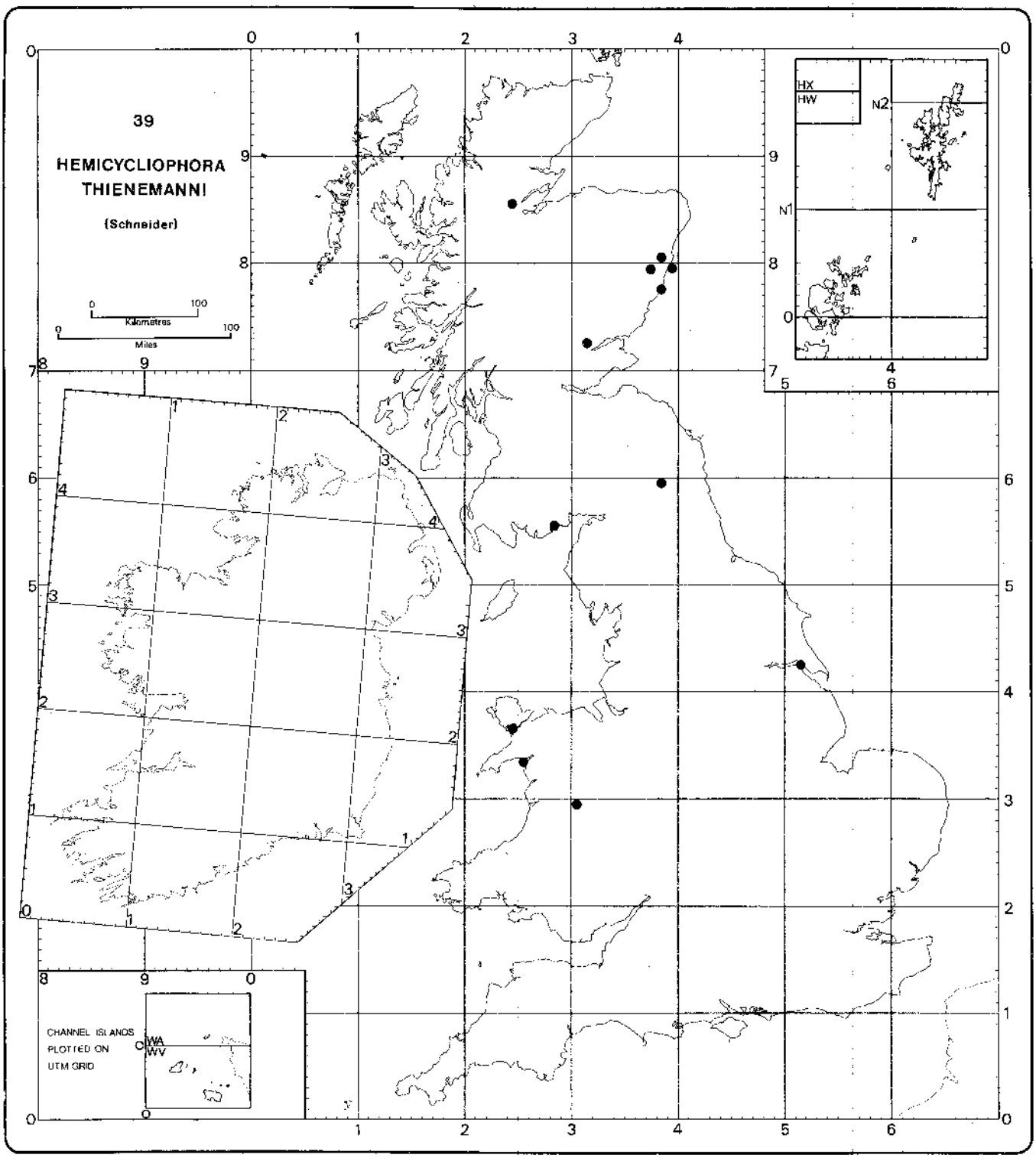

34
CROSSONEMA
COBBI
(Micoletzky)
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

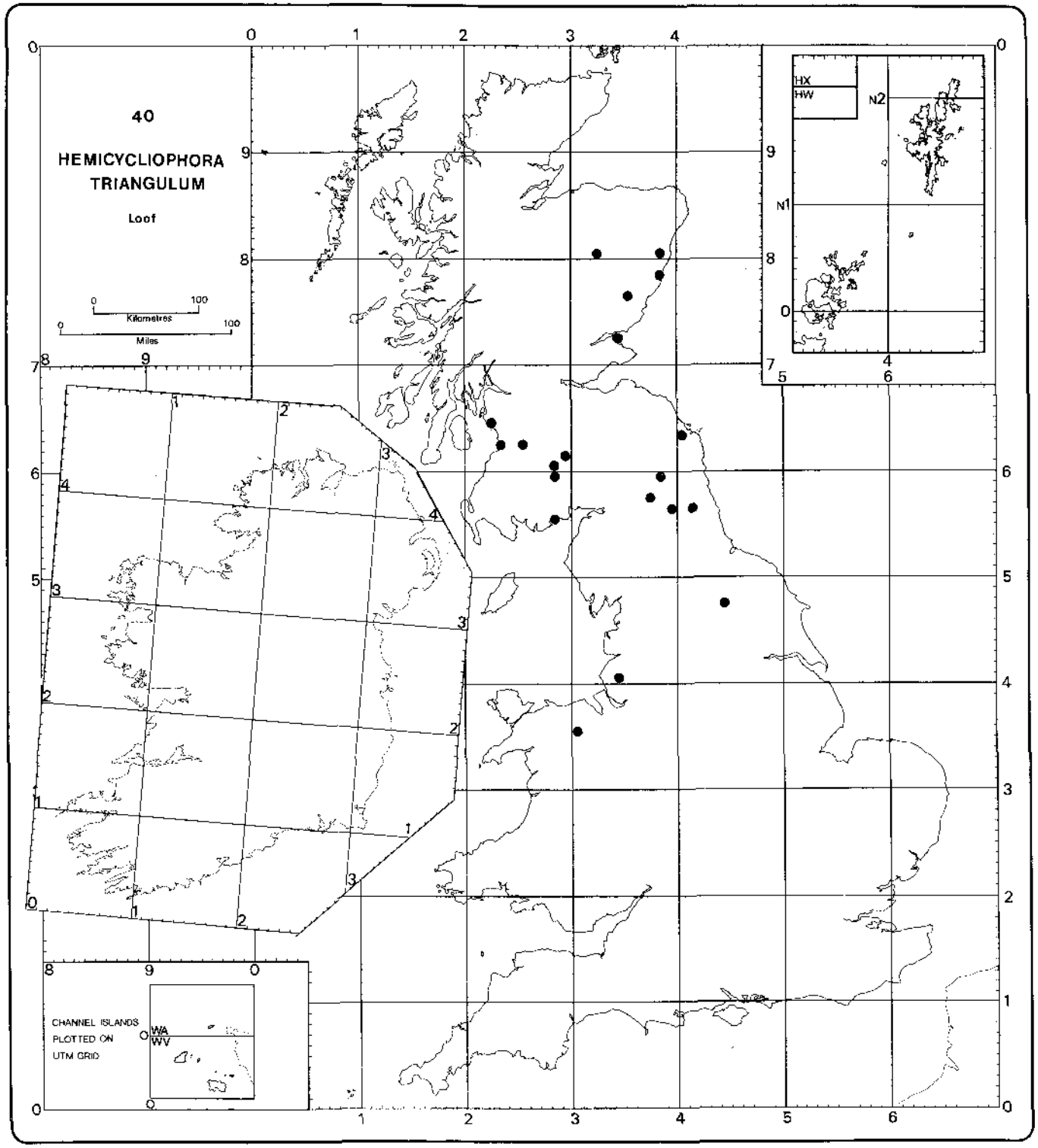

35
CROSSONEMA
MENZELI
(Stefanski)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

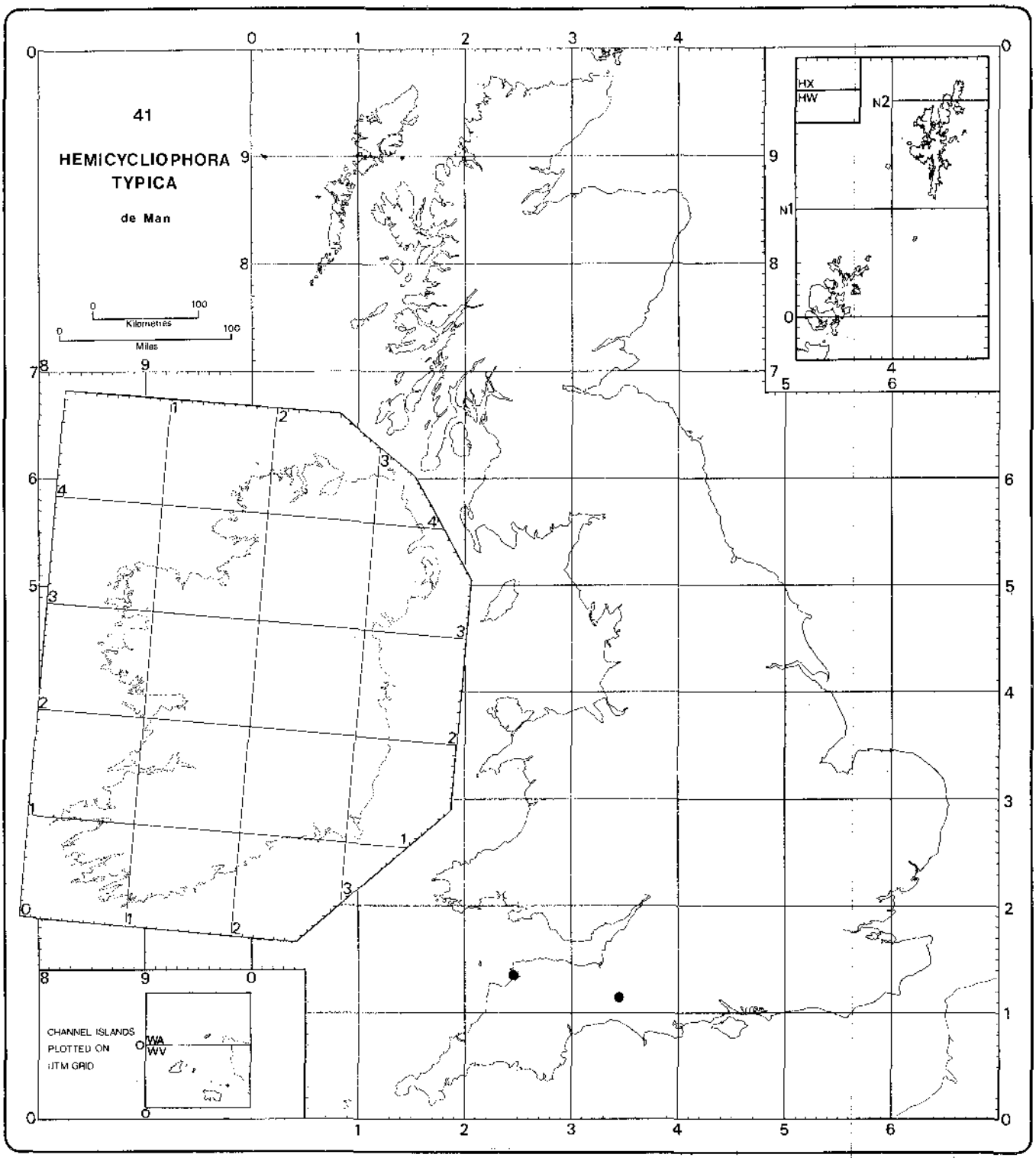

36
HEMICRICONEMOIDES PSEUDOBRACHYURUS
De Grisse
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

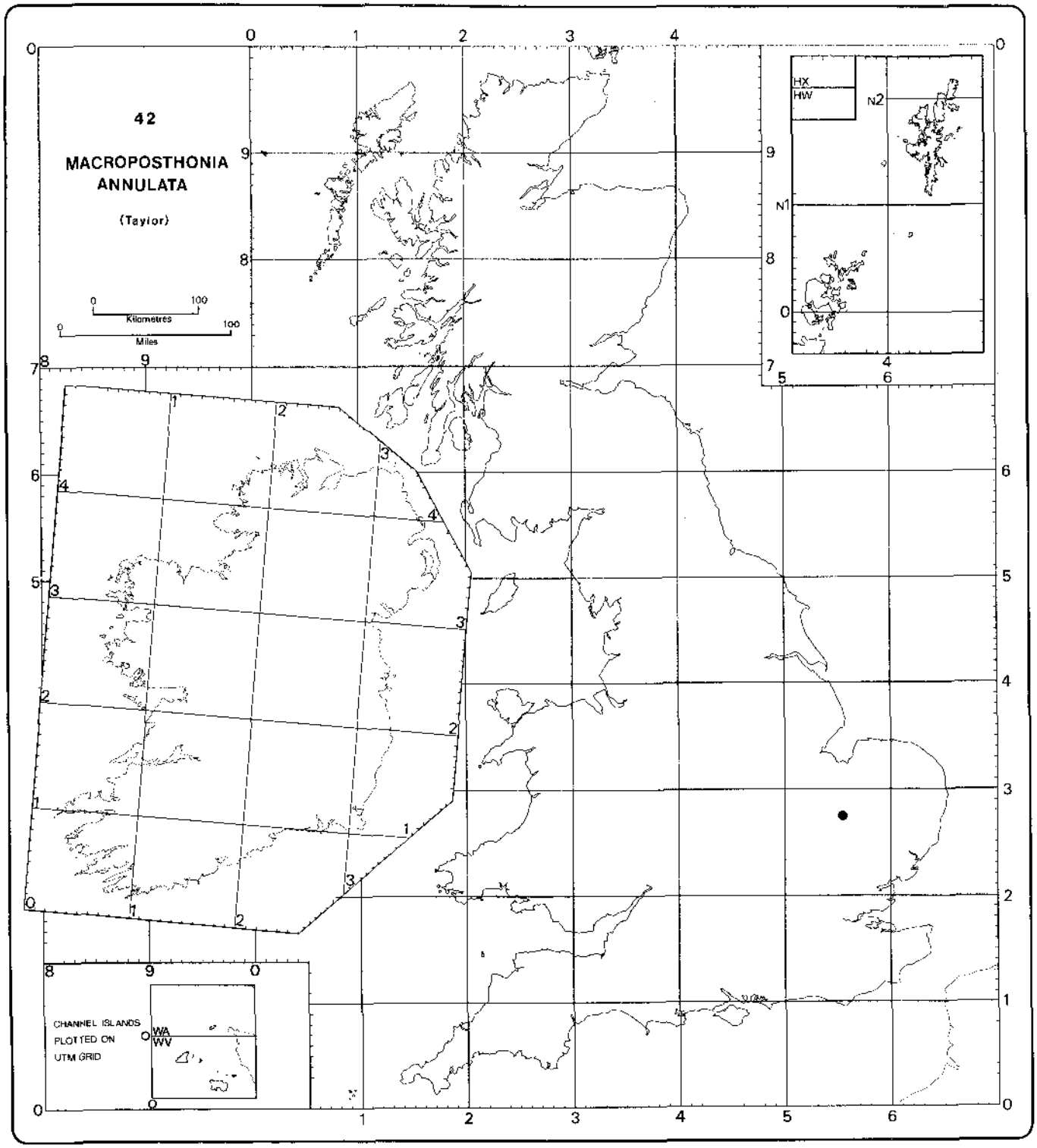

37
HEMICYCLIOPHORA
CONIDA I
Thorne
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

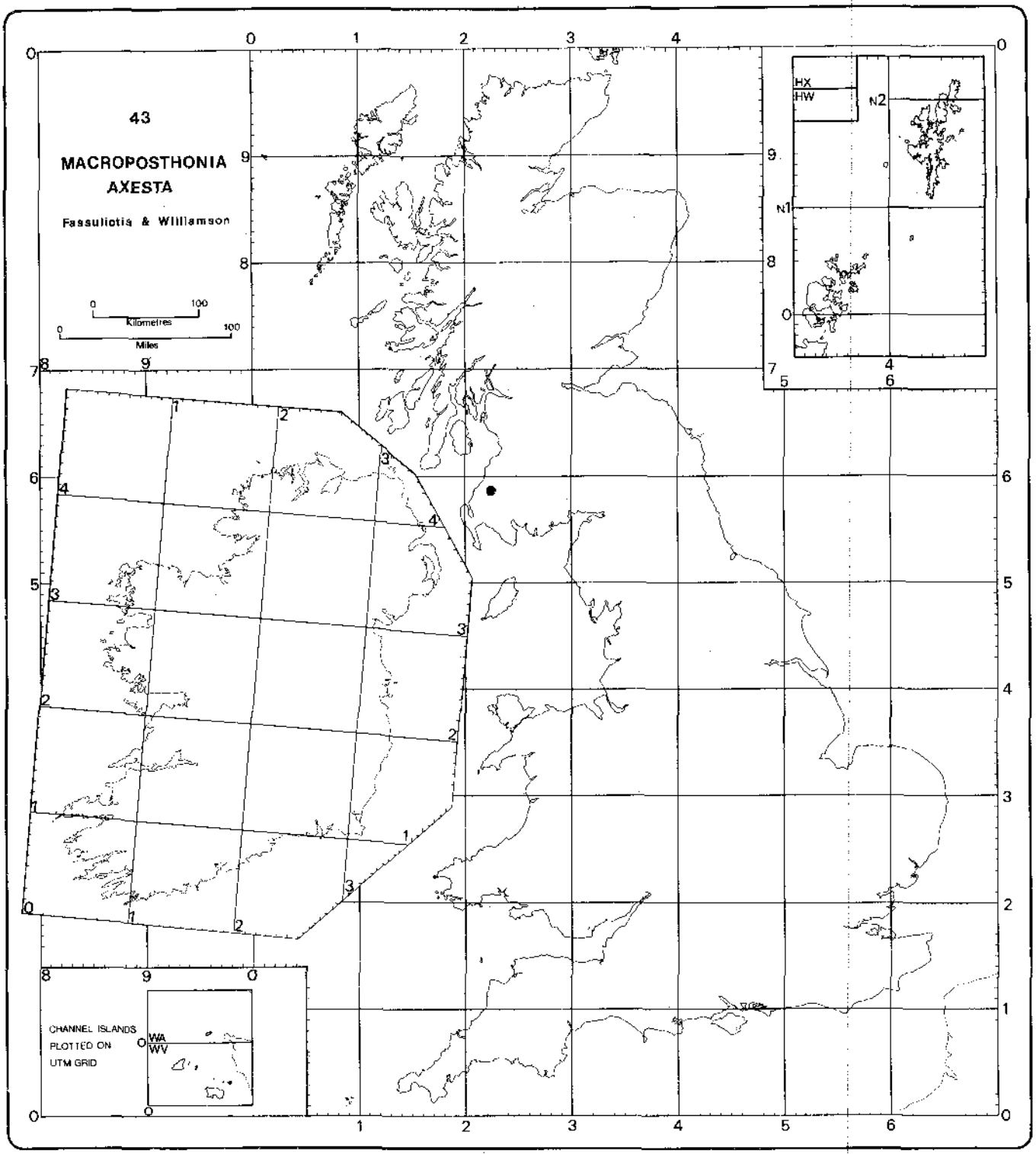

38
HEMICYCLIOPHORA
CONIDA II
Thorne
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

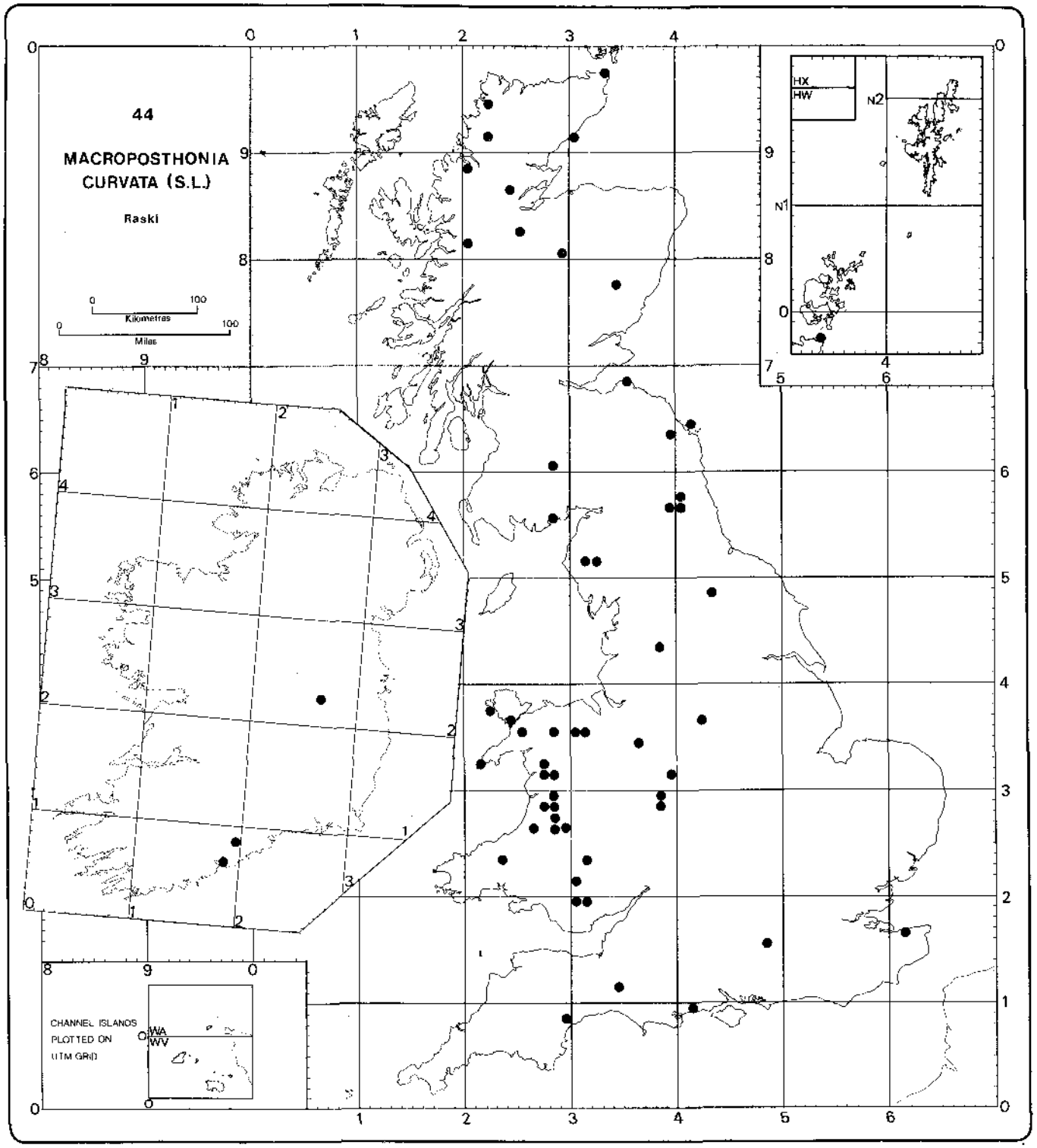

39
HEMICYCLIOPHORA
THIENEMANNI
(Schneider)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

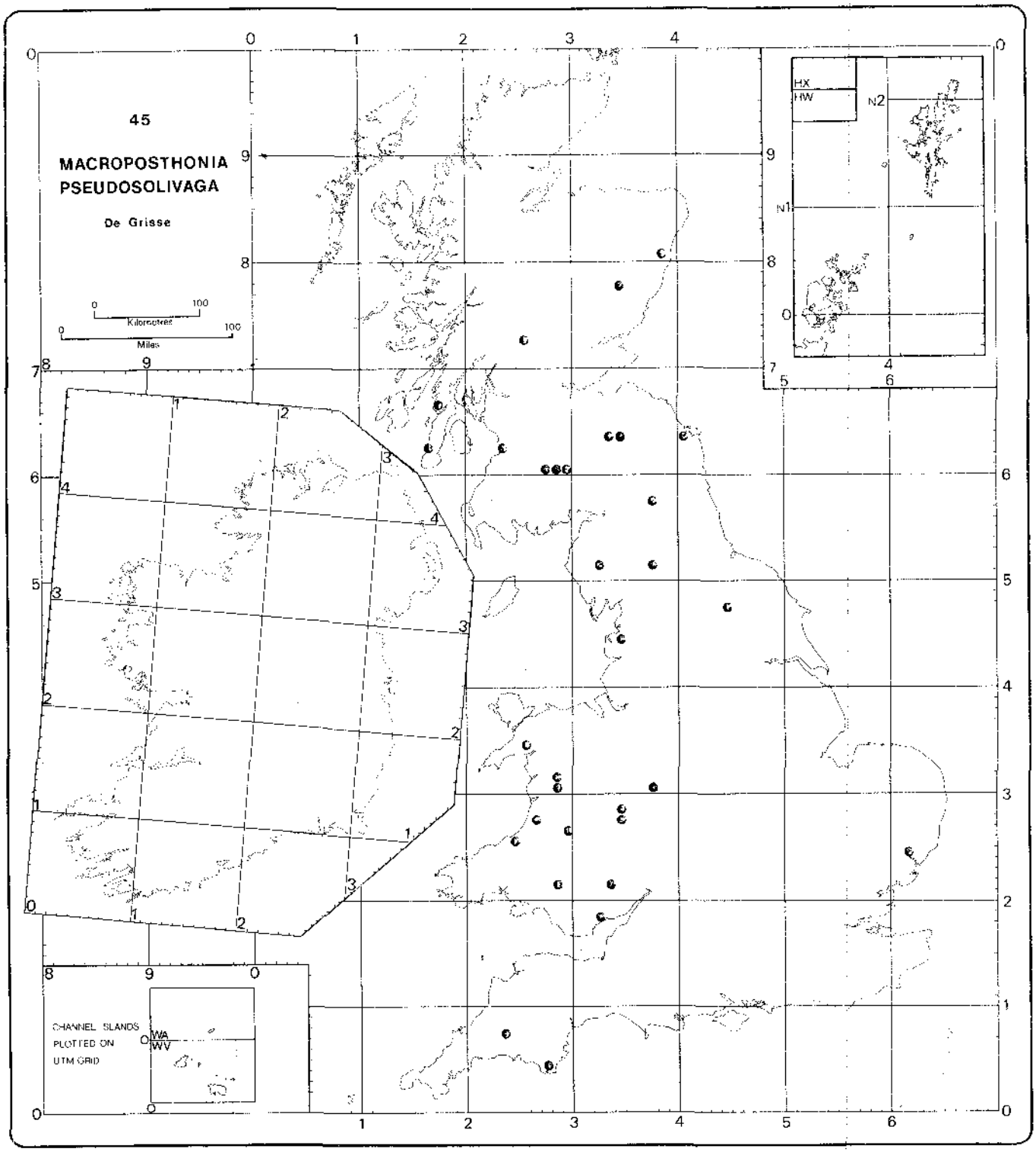

40
HEMICYCLIOPHORA TRIANGULUM
Loof
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

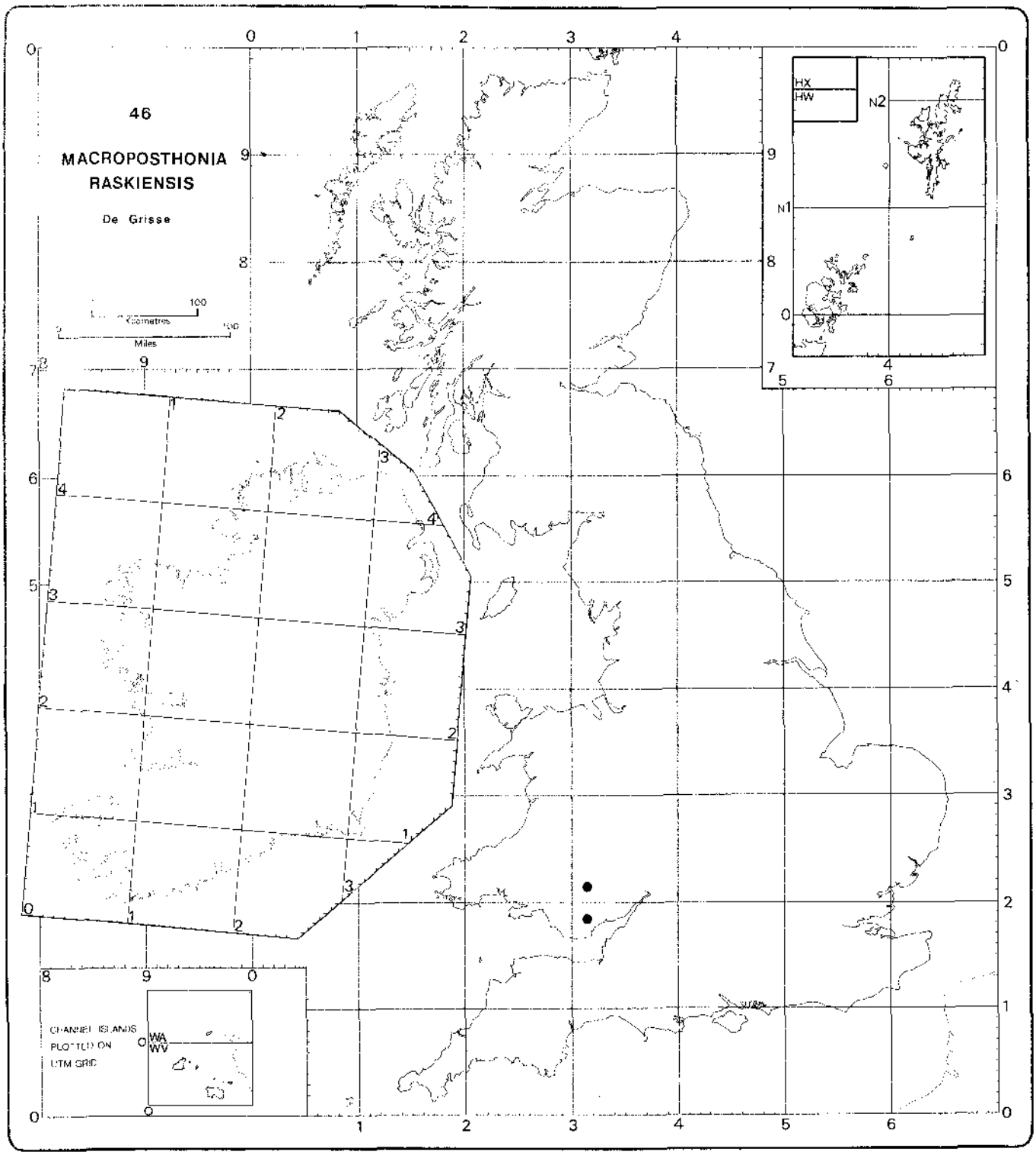

41
HEMICYCLIOPHORA TYPICA
de Man
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

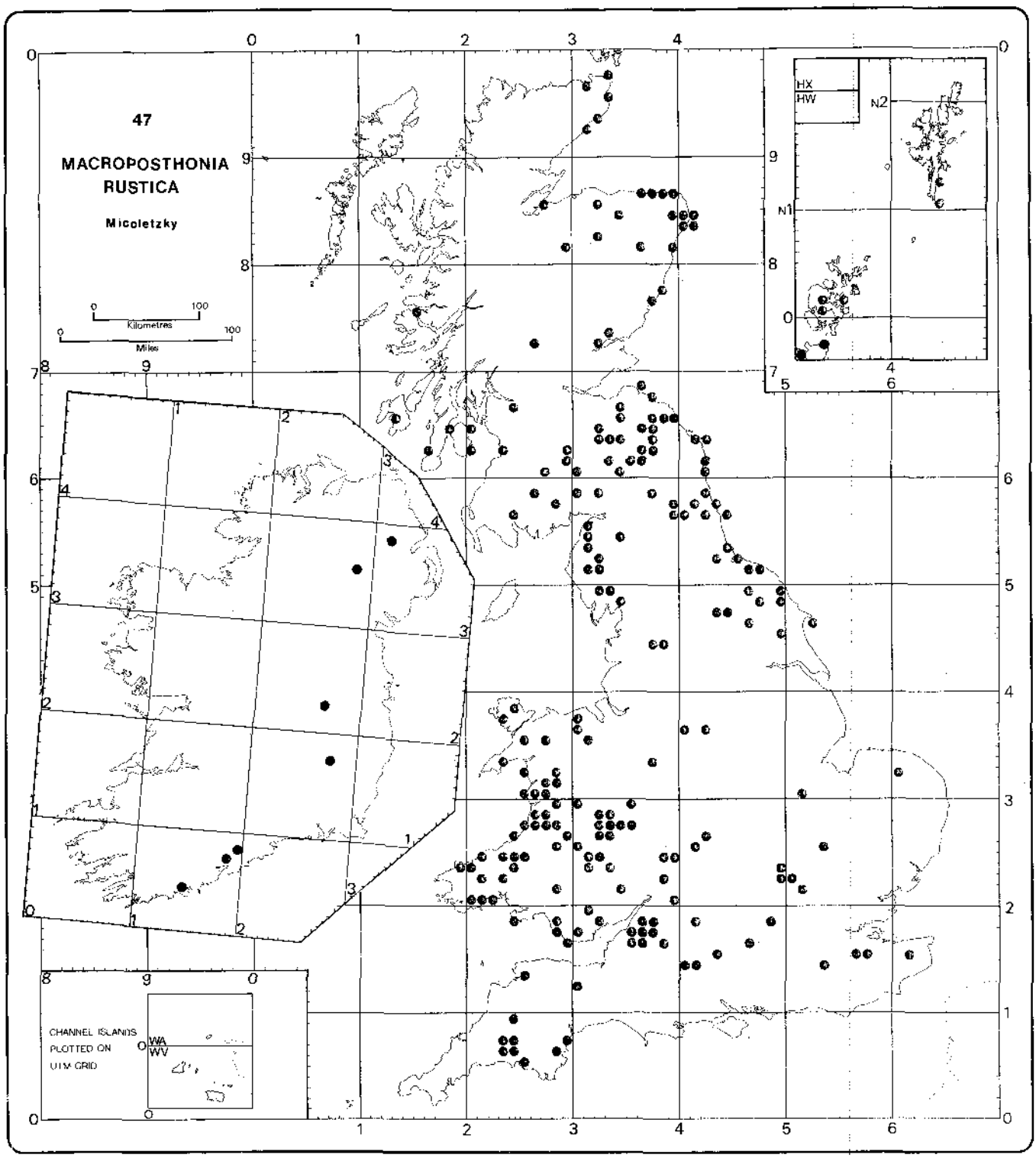

42
MACROPOSTHONIA ANNULATA
(Taylor)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

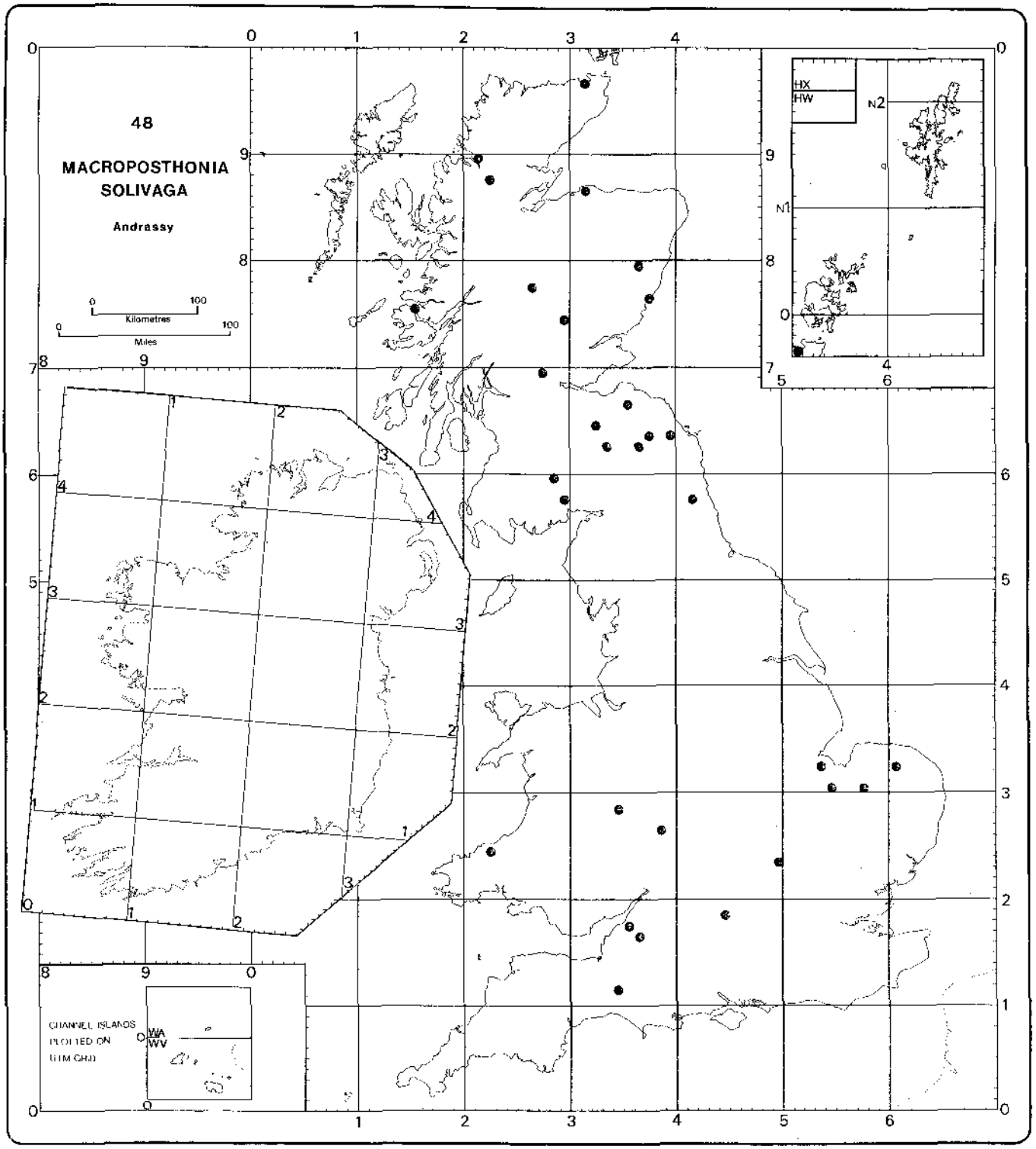

43
MACROPOSTHONIA
AXESTA
Fassuliotis & Williamson
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

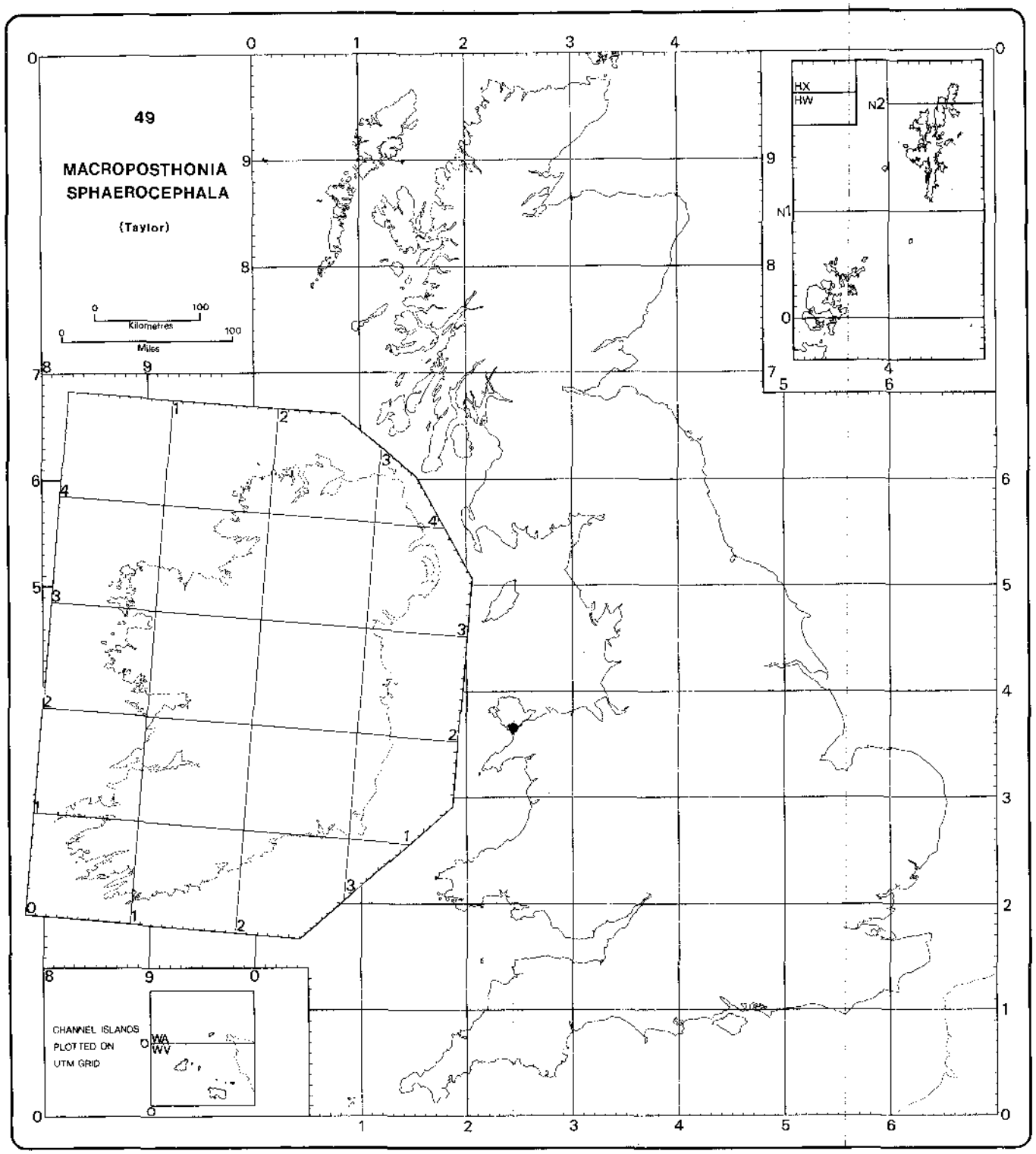

44
MACROPOSTHONIA CURVATA (S.L.)
Raski
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

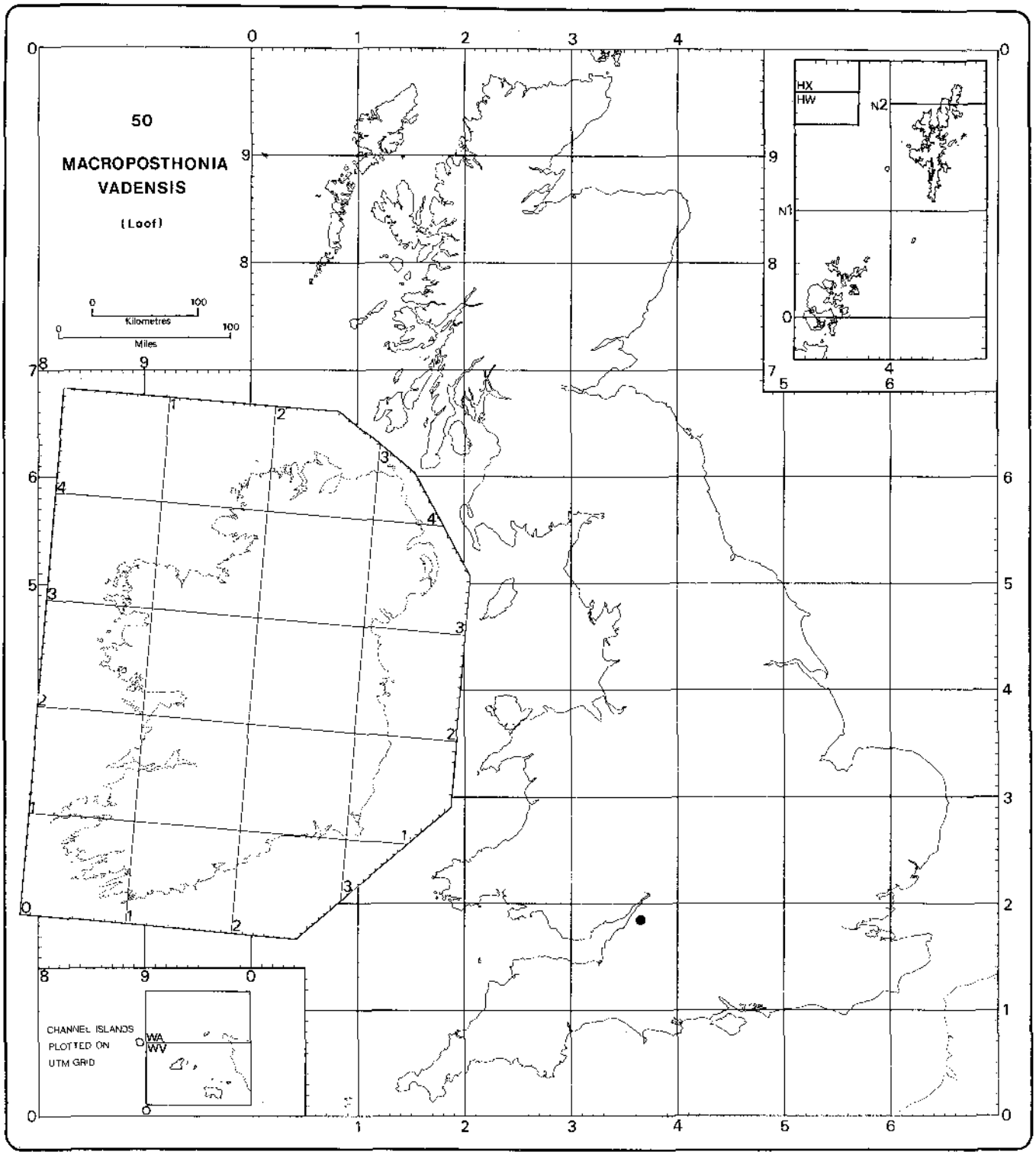

45
MACROPOSTHONIA
PSEUDOSOLIVAGA
De Grisse
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

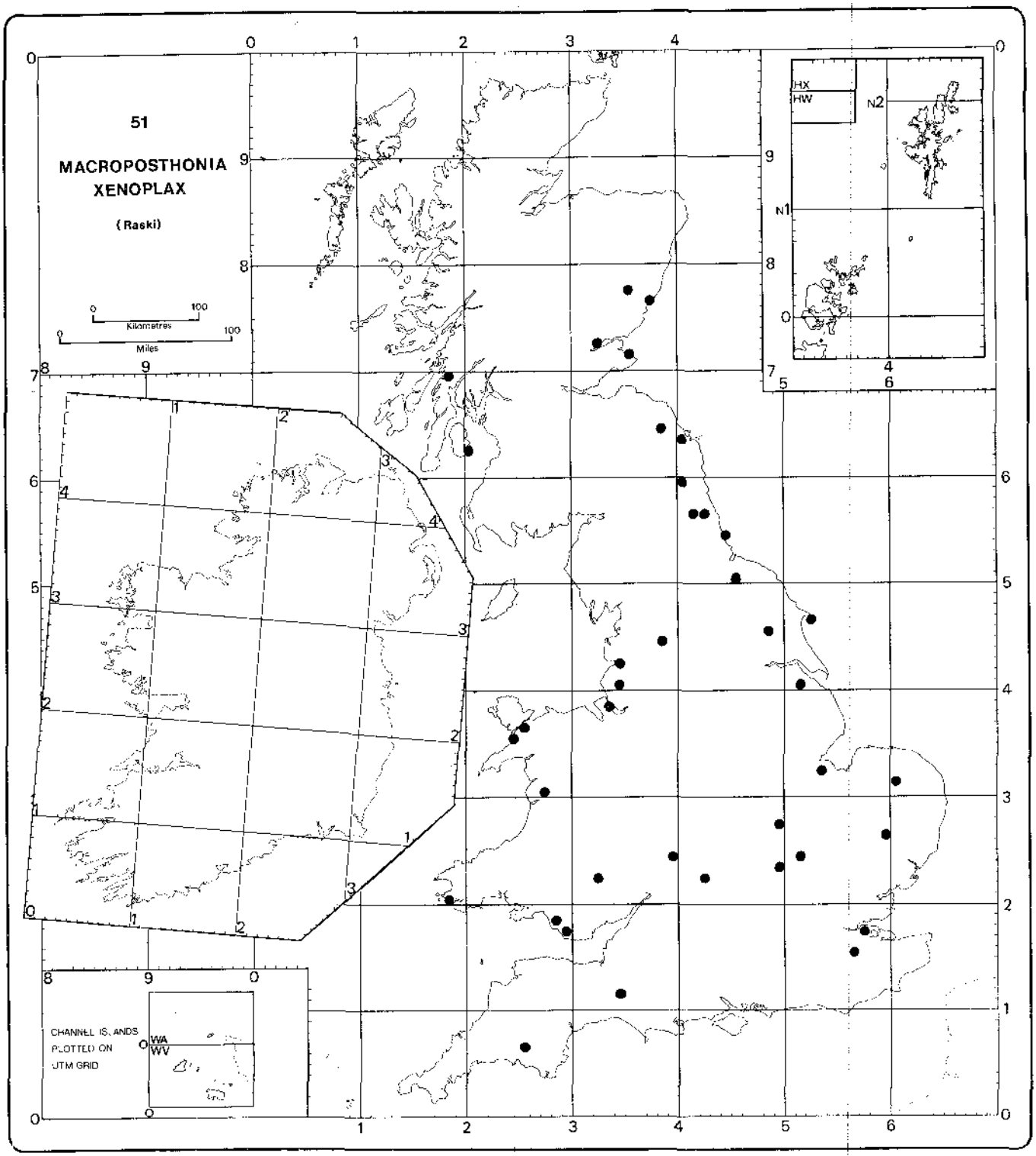

46
MACROPOSTHONIA
RASKIENSIS
De Grisse
100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

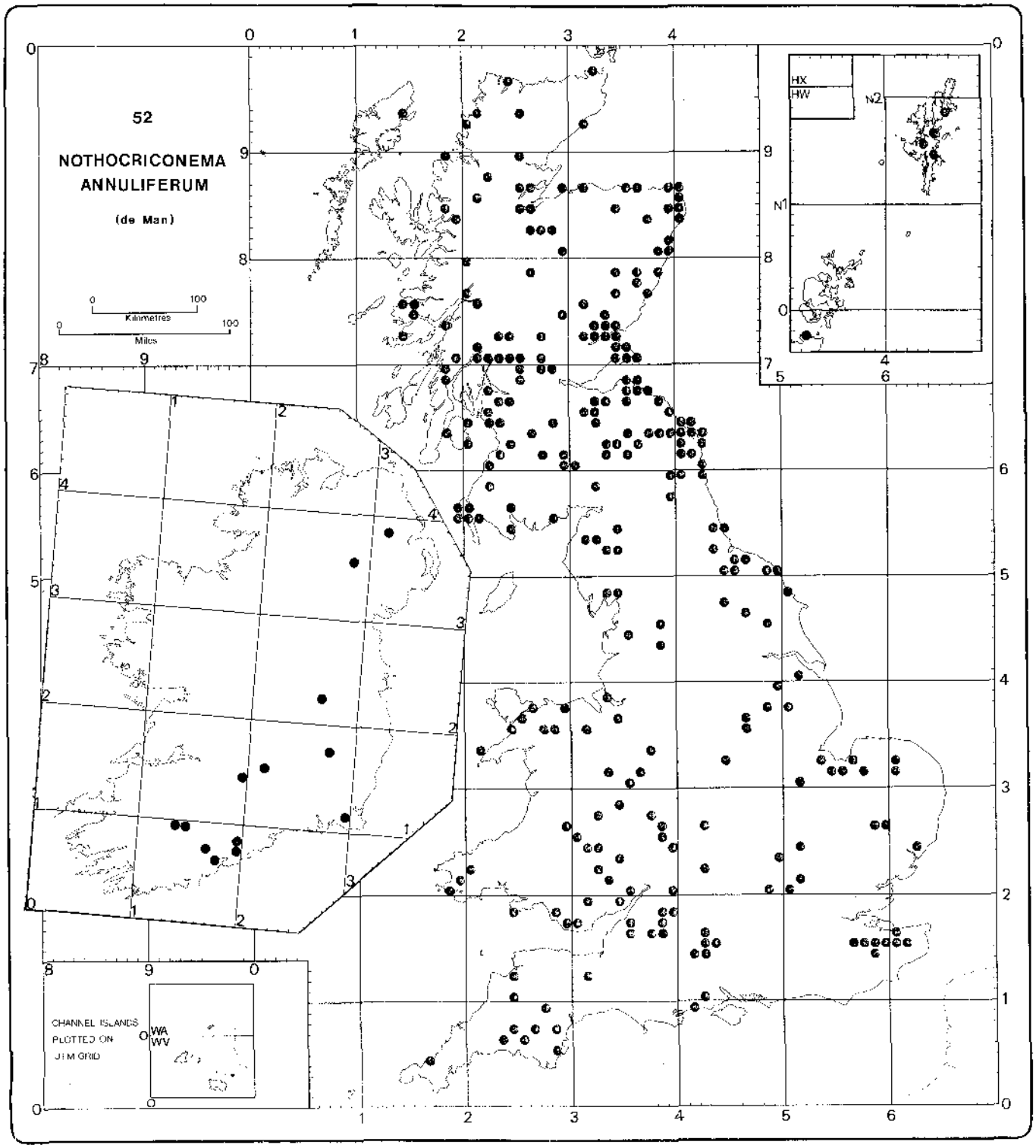

47
MACROPOSTHONIA RUSTICA
Micoletzky
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

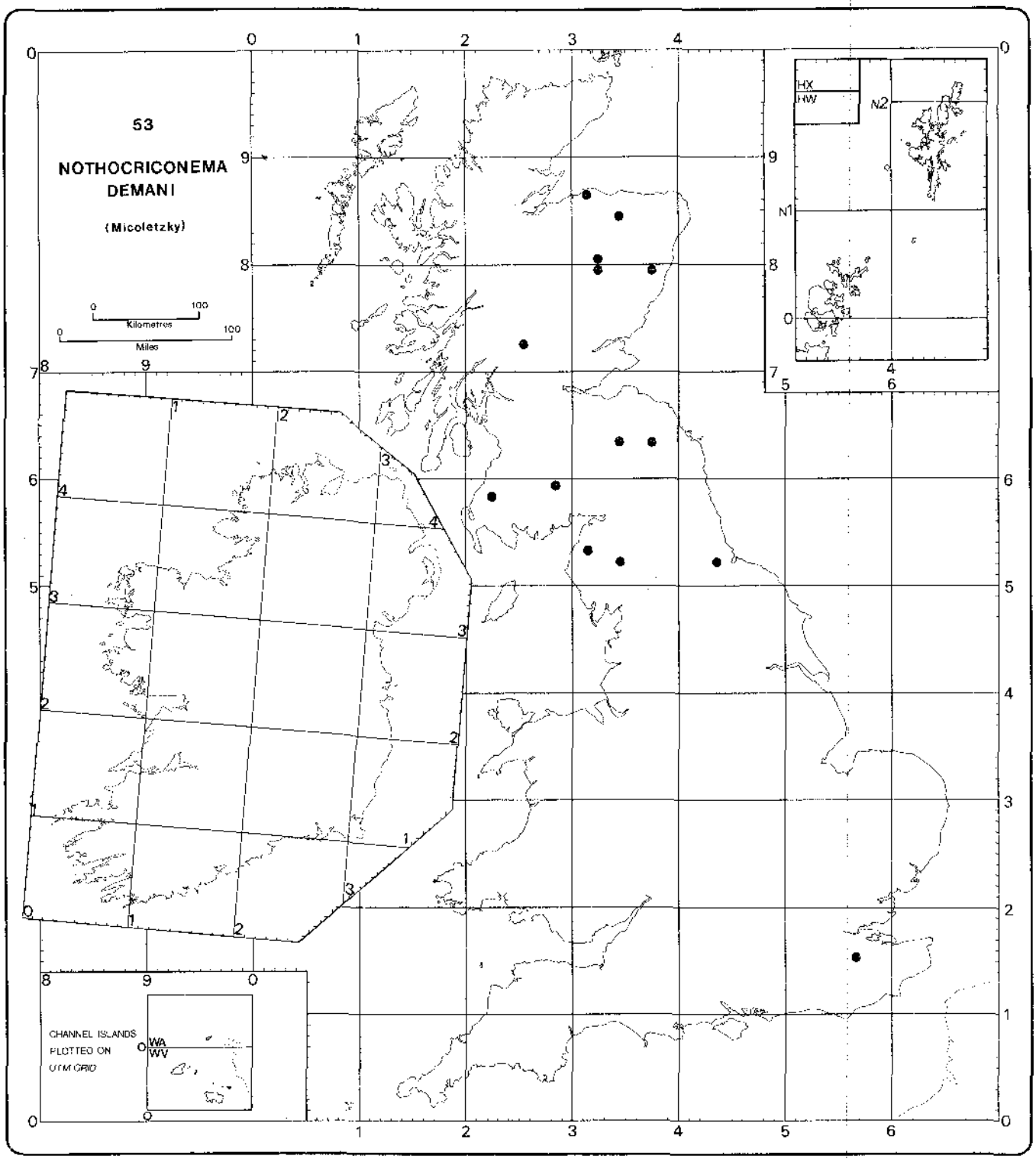

48
MACROPOSTHONIA
SOLIVAGA
Andrassy
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
10 KM GRID
WA
WV

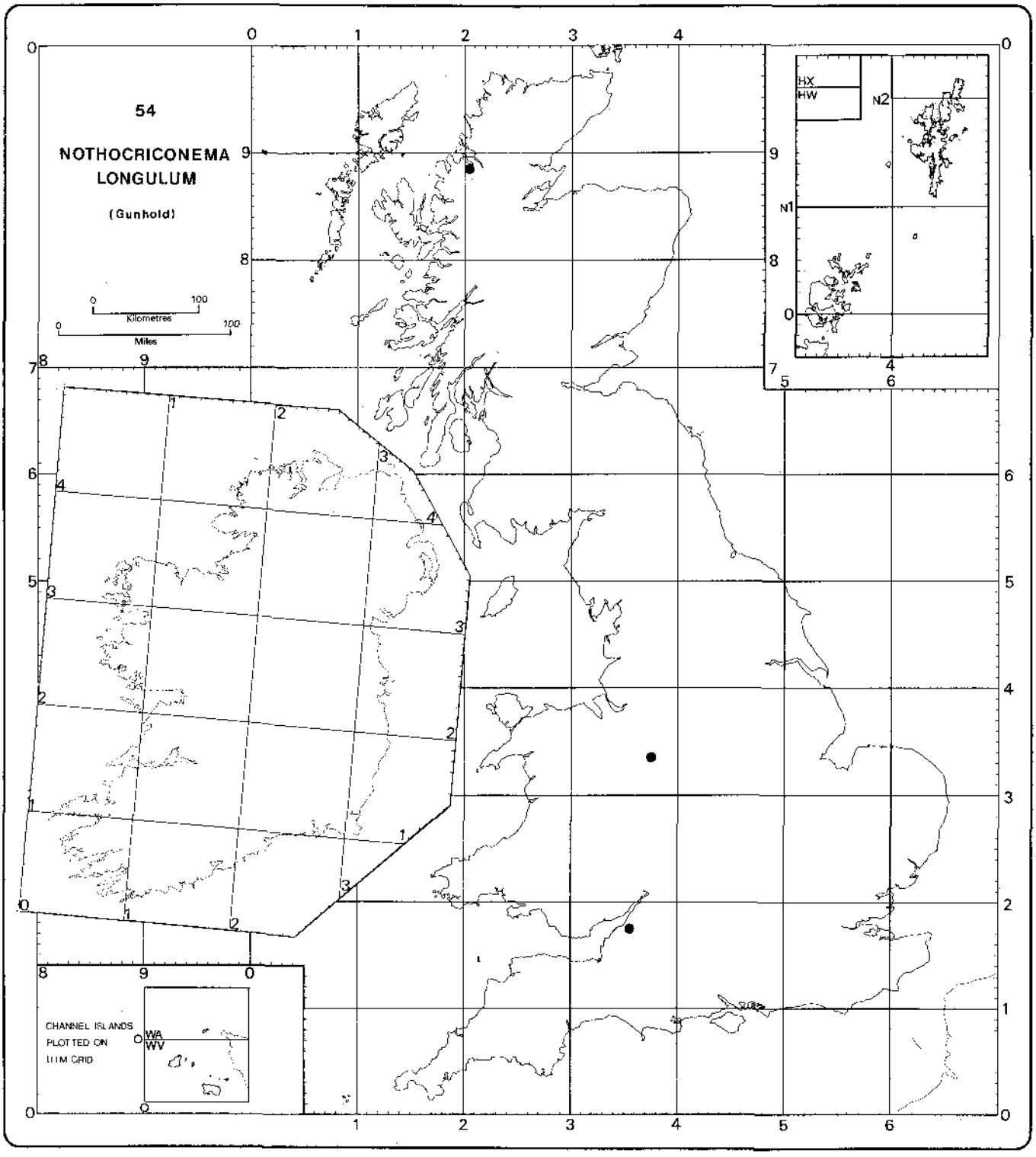

49
MACROPOSTHONIA
SPHAEROCEPHALA
(Taylor)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

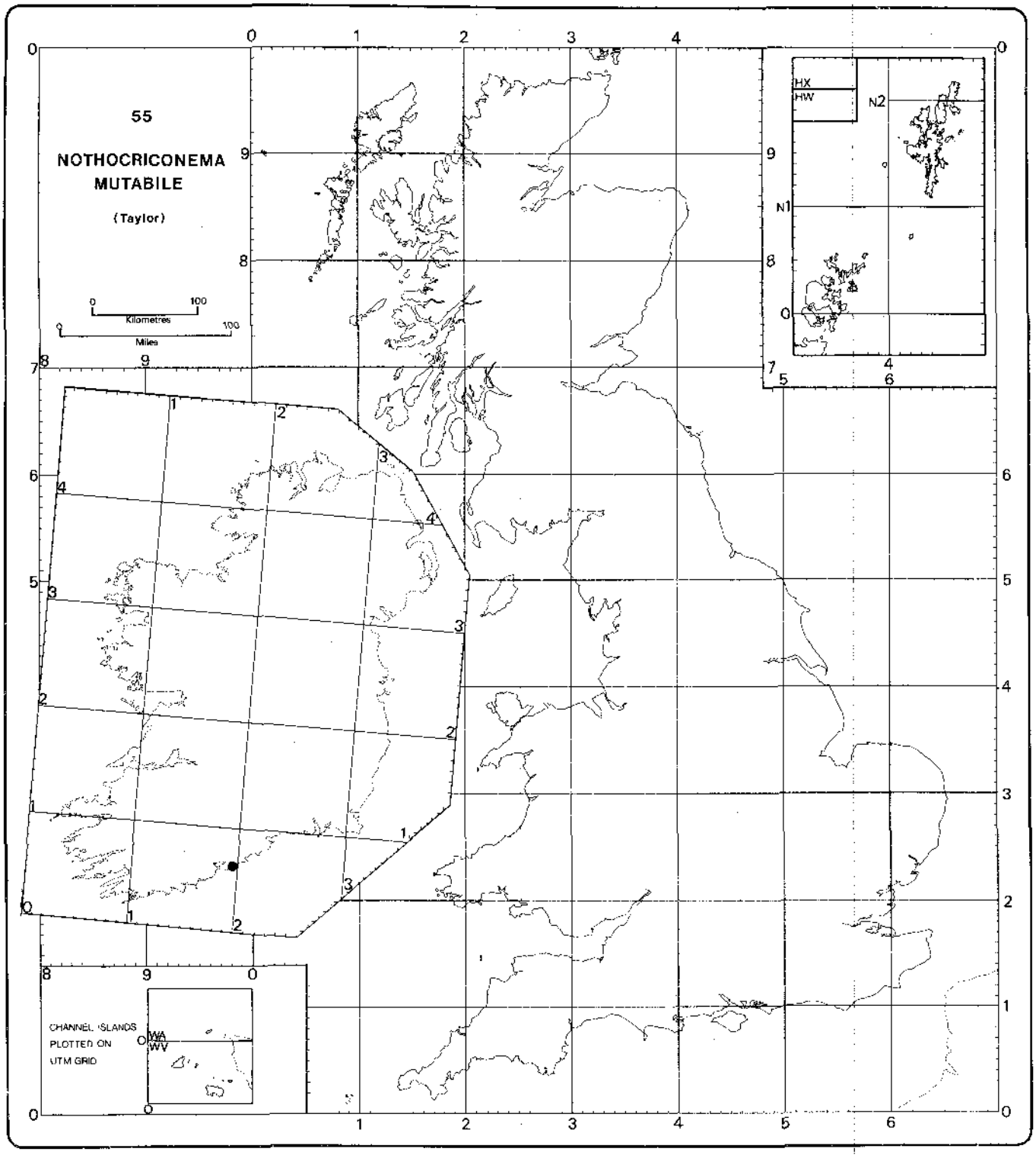

50
MACROPOSTHONIA
VADENSIS
(Loof)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

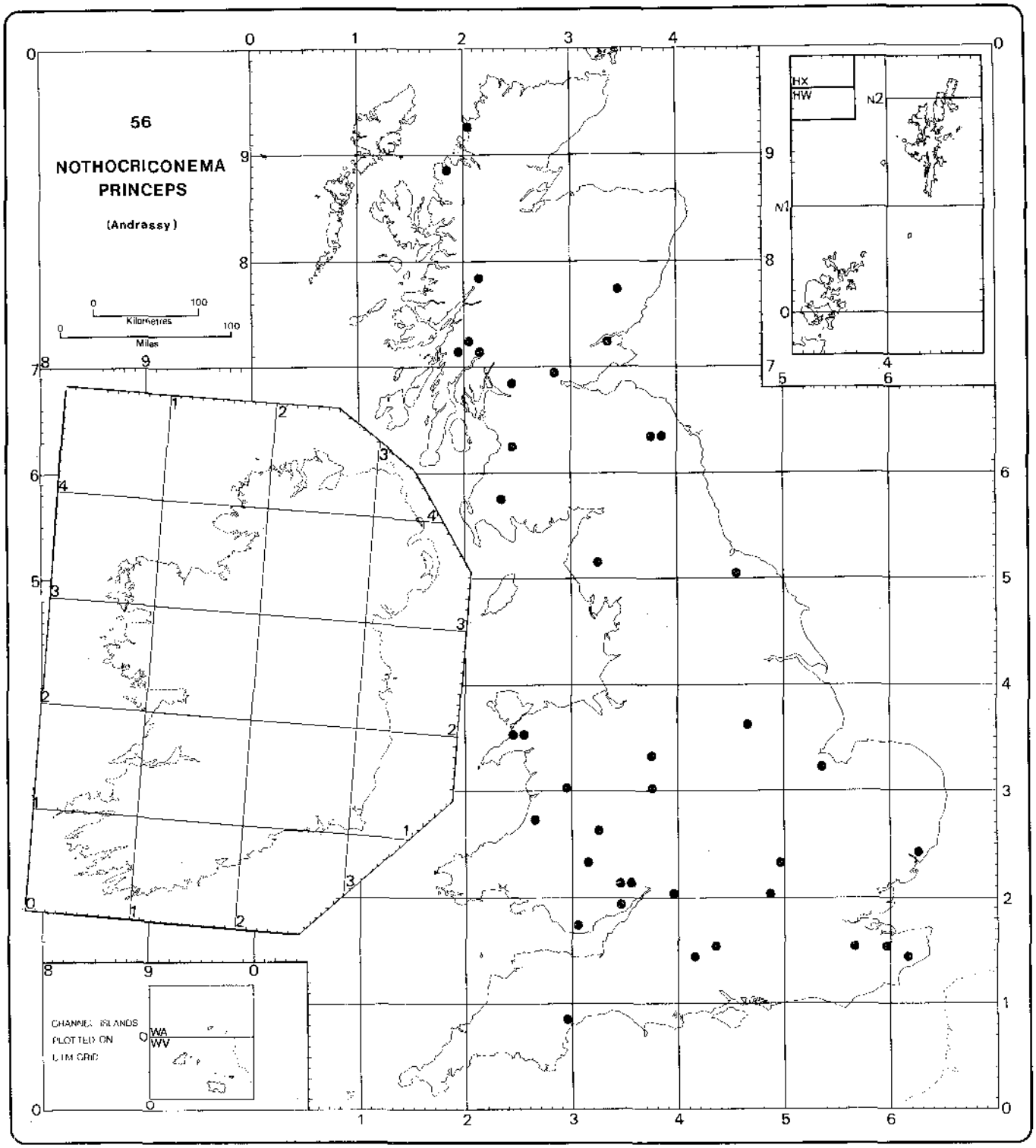

51
MACROPOSTHONIA XENOPLAX
(Raski)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV

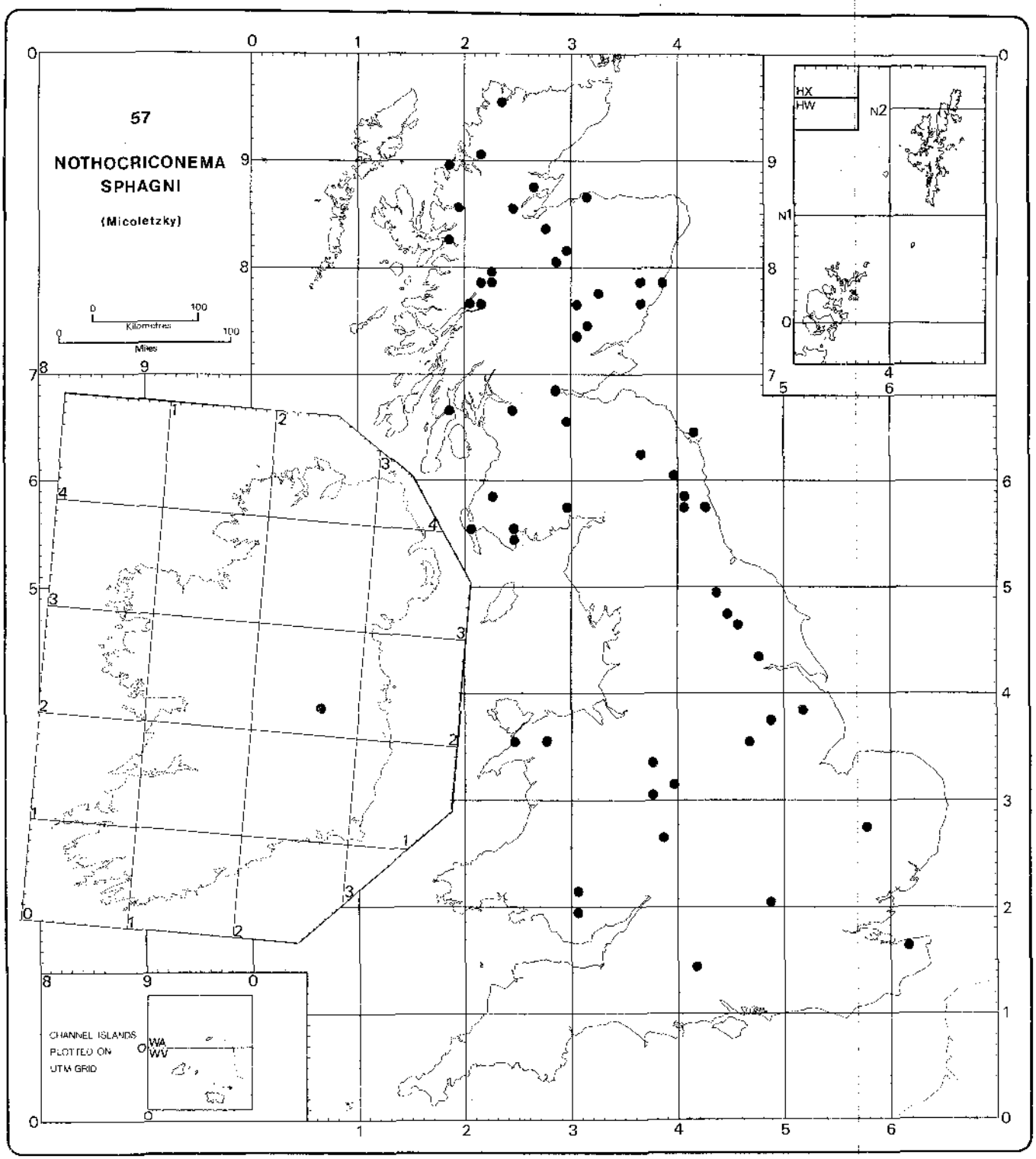

52
NOTHOCRICONEMA
ANNULIFERUM
(de Man)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
J.E.M. GRID
WA
WV

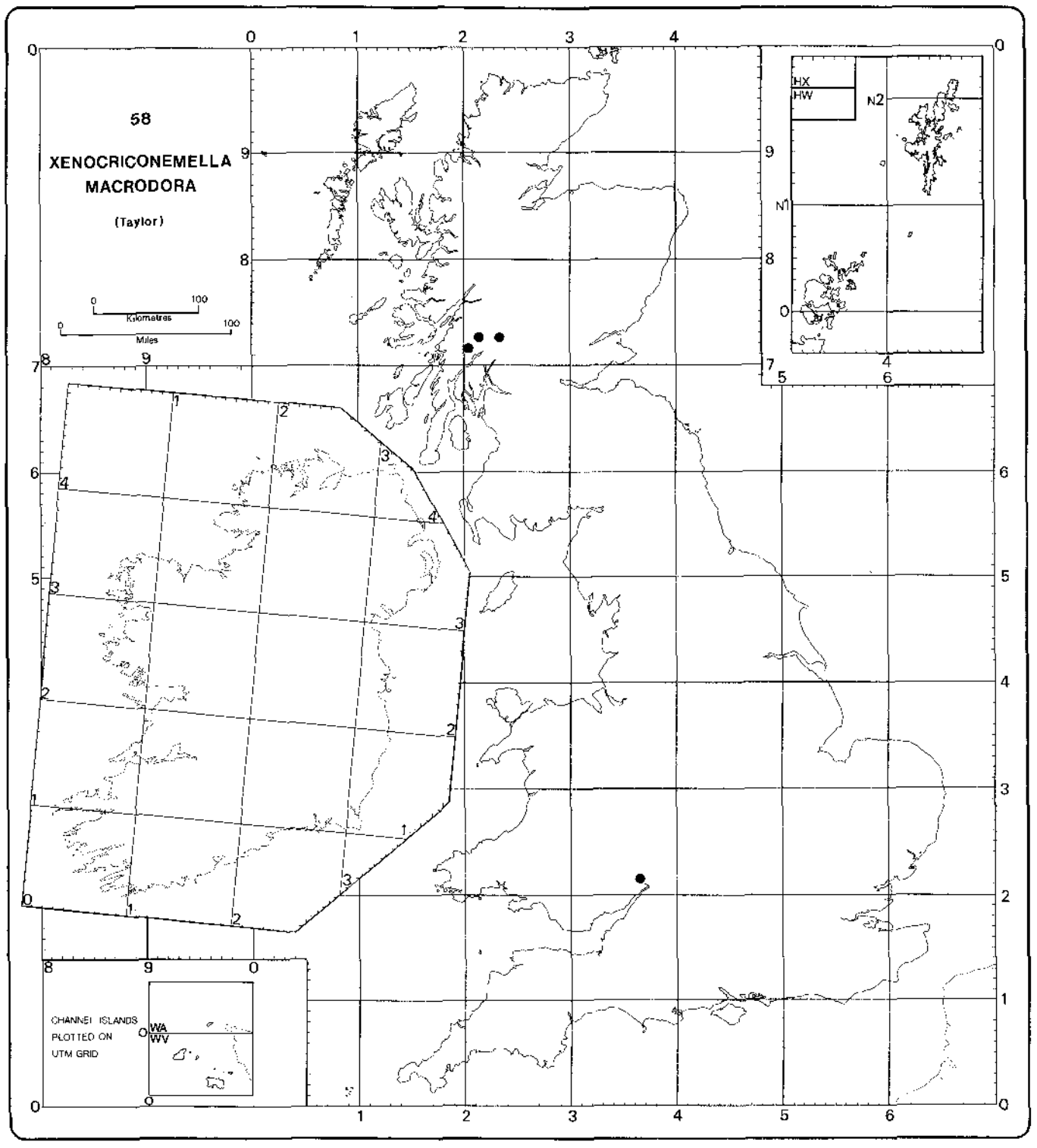

53
NOTHOCRICONEMA DEMANI
(Micoletzky)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV


54
NOTHOCRICONEMA LONGULUM
(Gunhold)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON 1 KM GRID
WA
WV


55
NOTHOCRICONEMA
MUTABILE
(Taylor)
0 100
Kilometres
100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV


56
NOTHOCRICONEMA PRINCEPS
(Andrassy)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON U.T.M. GRID
WA
WV


57
NOTHOCRICONEMA SPHAGNI
(Micoletzky)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS PLOTTED ON UTM GRID
WA
WV


58
XENOCRICONEMELLA
MACRODORA
(Taylor)
0 100
Kilometres
0 100
Miles
HX
HW
N2
N1
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV

INDEX