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Where are the Shipwrecks of the Zuiderzee?

A new version of the Shipwreck Database Flevoland (3.0), based on spatial and archaeohistorical research into wreck sites in the province of Flevoland

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Abstract: *For several decades, maritime archaeologists, state authorities and maritime-archaeological companies have worked with an outdated and inaccurate dataset (with regard to position and presence) concerning shipwrecks in part of the Zuiderzee region. The information about these wrecks was scattered over multiple databases (both analogue and digital), documenting different numbers of shipwrecks across Flevoland. In order to gain a clear and accurate overview of the shipwrecks that were discovered in the former Zuiderzee, the Shipwreck Database Flevoland (SDF) was compiled. The third version of this database is presented in this article and is mainly aimed at documenting the present condition of shipwreck sites (wrecks in situ, removed or unknown) and the accuracy of the coordinates that mark the location of the shipwreck (exact, approximate or unknown). The excavation documentation of the shipwrecks was used for retrieving accurate descriptions of wreck sites, although in most cases these descriptions referred to drainage ditches and other local topography that since have been removed or altered. Historical aerial photographs, LiDAR data and satellite images were used for tracing the course of lost but relevant drainage ditches and the exact locations of shipwrecks. Multiple wreck sites were discovered in the aerial photographs, in the form of crop- and soil-marks revealing either wrecks or former excavation trenches. These visible wreck sites correspond perfectly to the locations mentioned in the research reports and prove the accuracy and feasibility of the used methodology. The new version of the SDF therefore provides more accurate distribution and density maps of wreck sites in the province of Flevoland, which is of importance for spatial maritime archaeological research. Furthermore, the new information on the accuracy and presence/absence of shipwrecks can be used in archaeological heritage management. Only shipwrecks that are still present in the former seabed, and whose recorded location is reasonably accurate, can be effectively protected.*

Keywords: *Zuiderzee, the Netherlands, maritime archaeology, shipwrecks, spatial research, Late Middle Ages, modern era.*

1. Introduction

The study of ancient ships and especially wrecked ones, i.e. nautical archaeology, is considered the main subdiscipline of maritime archaeology (Bass 2013: 3). The maritime archaeological focus has however shifted from more or less isolated nautical studies towards interdisciplinary and spatial research in which the (maritime) landscape plays an important role. Especially the holistic concept of the maritime cultural landscape has gained a lot of traction in maritime archaeology since it was introduced by Westerdahl in the late 20th century (Westerdahl 1992; 2013). Within the boundaries of this concept, shipwrecks are still considered as major maritime features, but as part of the maritime landscape rather than as isolated objects. The analysis of shipwreck locations in relation to the landscape can for example provide information on popular sailing routes and destinations, hazardous areas or the presence of navigable water at a certain period, and thus help to reconstruct the maritime cultural landscape. This is also the starting point of the first author's dissertation, which aims to access the late medieval maritime cultural landscape of the former Zuiderzee in the central part of the Netherlands (see: Van Popta 2016; Van Popta, Westerdahl & Duncan in prep.). The discovery of hundreds of shipwrecks in this region provides information on the organization and layout of the maritime cultural landscape of the former Zuiderzee, now drained to form the province of Flevoland (see: Van Popta 2017). This particular research focuses solely on the distribution of shipwrecks across the region and therefore contributes to the more broadly-based dissertation: "*From fresh to salt. Dynamics of the maritime cultural landscape*

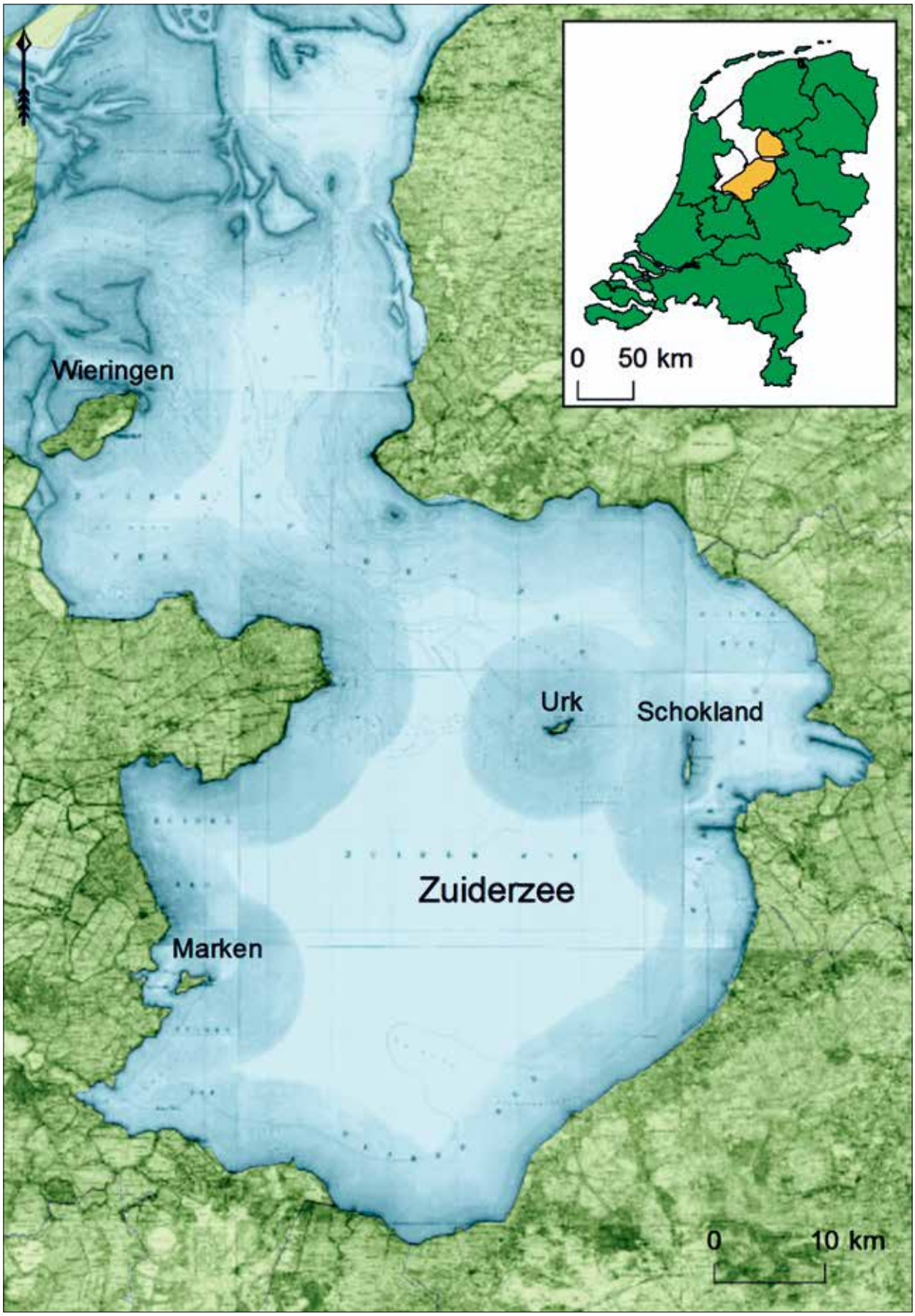

Fig. 1. The Zuiderzee region at the end of the 19th century. The inset depicts in orange the main research area, nowadays known as the province of Flevoland (Y.T. van Popta, RUG/GIA).

of the northeastern Zuiderzee between AD 1100 and 1400, an interdisciplinary and spatial approach" (Van Popta, forthcoming).

The Zuiderzee, a large inland sea in the centre of the Netherlands, existed from approximately AD 1200 until it was closed off by the Afsluitdijk dam in 1932 (fig. 1). The Zuiderzee was of great importance for the Low Countries as it was characterized by busy traffic, connecting different parts of the Netherlands to each other and to other parts of Europe. One could even state that this dense network of inland shipping, with the Zuiderzee functioning as the main traffic hub and highway, was the basis of the Dutch 'Golden Age' (17th century; Van Holk 2005: 23). This is also reflected by the large number of shipwrecks that were found after the partial reclamation of this inland sea: three large polders (Noordoostpolder, Eastern Flevoland and Southern Flevoland) were drained and are now known as the twelfth province of the Netherlands: Flevoland. Nowadays, Flevoland is famous as the 'largest terrestrial ship graveyard' in the world. The unique situation of exploring a former seabed provided a lot of work for the first archaeologists who worked in these polders; in the early years of the Noordoostpolder especially, new shipwrecks were discovered almost weekly. In many cases, this was caused by the digging of parcel ditches, the laying of drainage systems (pipes) and the first ploughing of the polder. Whenever navvies or farmers found pieces of wood (timbers) in the soil, they were almost certain to have encountered a shipwreck. The large number of discovered shipwrecks and the high pressure of work caused the archaeologists to critically judge every discovery and to work selectively. Promising and relatively complete shipwrecks were fully excavated, documented and drawn in detail, while young (19th – 20th century) and mainly iron-hulled shipwrecks were removed and scrapped without any proper documentation. Many other wrecks were, for varying reasons, briefly explored and 'reserved for future research'.

In due course, a large but very inconveniently arranged dataset was generated with information on shipwrecks in the province of Flevoland. At first, this dataset could only be consulted on paper, but most information was eventually digitalized and could therefore be accessed more easily. The descriptions of shipwreck locations were transformed into modern-day coordinates of the Dutch national triangulation grid (known as RD_new). The arrival of the digital era also saw the birth of the national archaeological database Archis. The first version was launched in 1992 and anno 2018 archaeologists are working with version 3.0 (Wiemer 2002: 103). All available shipwreck data from the province of Flevoland was added to Archis and the database is updated every now and then with new archaeological records. Research by Van Popta (2012) has however shown that in the course of time many errors concerning Zuiderzee shipwrecks had sneaked into Archis. This is caused on the one hand by the massive and inconveniently arranged database and on the other hand by the fact that non-specialists have interpreted and entered data incorrectly (Van Popta 2012: 97). For this reason, a new maritime archaeological database was created by Van Popta (2012a, 2012b), for the purpose of creating a conveniently arranged, reliable and up-to-date overview of shipwrecks in the province of Flevoland. This is known as the Shipwreck Database Flevoland or SDF. The first two versions of this database have been used by several archaeological companies, local authorities, provincial bodies and archaeologists of the Dutch Cultural Heritage Agency. This paper presents the latest version of the SDF (3.0), developed and maintained by the first author.[1] The new version contains much-improved information on the presence or removal of shipwrecks and the accuracy of shipwreck locations. The continued presence of shipwrecks has never been thoroughly examined, as there is no complete overview of which shipwrecks have been removed from the former seabed. The position of a wrecksite also has never been checked and is of importance for spatial research (shipwreck distribution) and the protection of wreck sites. The threefold main question of this research focuses on the following points: how accurate are the recorded locations of shipwrecks in Flevoland, how many shipwrecks are still present in the soil[2], and how relevant are the factors 'accuracy' and 'presence' for current maritime archaeological research in the Zuiderzee region? The answers to these questions are of course linked to the scale of the questions asked (local, regional, national).

2. Previous research

Multiple datasets were consulted to assemble the shipwreck-related information. First, all available digital scans of the shipwreck archive of Flevoland, kept by the 'Stichting Erfgoedpark Batavialand', were examined. The archive consists of thousands of pages from daily logs of shipwreck excavations, drawings,

1 The X and Y coordinates of the wreck sites are screened off in order to protect the wreck sites and are only available on request by contacting the Groningen Institute of Archaeology.

2 No figures are given for the expected total number of shipwrecks in Flevoland, because that is not the topic of this paper. On the basis of previous research by Van Popta (2012b) we estimate the maximum amount of shipwrecks that have not been found so far at about 90 wrecks (Van Popta 2012b).

photographs (transparencies), wreck-site descriptions, wreck-site notifications, artifact inventories, correspondence, and official but unpublished archaeological reports. Together, these documents form the primary source of information on shipwrecks in the province of Flevoland. For the earliest excavations (1940s and 1950s) these are often the only available source of information. The second dataset that was used for this research is the so-called Ship Catalogue (*Scheepscatalogus*, latest version 2006) created by Rob Oosting and Gerard van Haaff of the Cultural Heritage Agency of the Netherlands (RCE). This database contains basic information on shipwrecks in Flevoland, a great deal of which is derived from the shipwreck archive of Flevoland (primary dataset). The third employed dataset is the national archaeological database Archis. Using specific search terms (*e.g.* 'ESCH' as the complex type for shipwrecks), relevant data could be filtered from the massive amount of overall data.

It is thought that at least 400 shipwrecks have been examined in the Zuiderzee region, but the exact numbers differ for each of the datasets. Research by Van Popta in 2012 proved that the information on shipwrecks from both the Ship Catalogue and Archis contains a large number of errors. The most common mistakes are duplicated wreck notifications and contradictory information on specific wrecks. As a consequence, the 459 shipwrecks in Archis and the 471 wrecks in the Ship Catalogue were reduced to 423 wrecks (Van Popta 2012a: 98). In 2015, new research was conducted by the consultancy organization Periplus Archeomare (under the authority of the Nieuw Land Erfgoedcentrum, now part of Stichting Erfgoedpark Batavialand), in which it was tested whether known wreck sites and wreck remains could be detected by means of remote sensing (Muis & Van den Brenk 2015: 5). Side-scan sonar data, LiDAR data (Airborne Light Detection and Ranging), historical aerial photographs and satellite images were combined and analysed and the outcomes were added to the first version of the SDF (2012). Information was added to the SDF, mainly concerning (1) structures visible on LiDAR images and historical aerial photographs and (2) the question whether shipwrecks were still present at wreck sites or not. It was concluded that locating known wreck sites in historical aerial photographs is harder than expected. Multiple causes were given: the definition of the photographs was too low, wreck sites could not be distinguished from other features such as tree stumps, and wreck sites could not be detected owing to soil disturbance (*e.g.* ploughing) and vegetation cover (Muis & Van den Brenk 2015: 47). A total of 23 new wreck sites were eventually added to the SDF, and a further 12 wreck sites were given new and more accurate coordinates.

3. Approach

The current analysis of wreck locations in the province of Flevoland is based on the previous version of the SDF (2.0; 2015). The database (MS-Access) was connected to the Geographical Information System ArcGIS, so wreck locations could be visualized in a spatial environment, thus providing the opportunity to connect them with other spatial input. The most important ones are the Dutch LiDAR model 'AHN' (*Actueel Hoogtebestand Nederland*; version 2), 25-cm resolution satellite images of 2016 (available via ArcGIS-online), and a complete set of historical aerial photographs of the province of Flevoland.[3] The LiDAR data of the AHN 2 has a resolution of 6 to 10 points per sq. m and the possibility of making grid cells of 50 x 50 cm (Van der Zon 2013: 6). In ArcGIS, the LiDAR data was transformed into a Digital Elevation Model (DEM) for the whole region, in which soil-covered, pit-stored, removed and possibly present shipwrecks can be visualized as small humps or depressions in the land.[4] Modern satellite images (2016) reveal no wreck sites, except for those that are soil-covered or pit-stored (*in-situ* preservation methods) in Southern Flevoland, but the images are of importance for orienting and georeferencing historical aerial photographs and locating known wreck sites that lack proper coordinates.

The historical aerial photographs of Flevoland provide a detailed and chronological overview of the development of the different parts of the province. The Noordoostpolder is the oldest polder and therefore has the largest collection of aerial photographs, dating from 1947, 1949, 1960, 1971, 1981, 1989, 2000, 2003 and 2006. Aerial photographs of Eastern Flevoland are available from 1960 onwards, as the reclamation of this region was completed in 1957. The aerial photographs for Southern Flevoland are limited to 1971 and 1981-2006, as this area was not reclaimed until 1968. Especially the combination of historical aerial photographs and the information from the Flevoland shipwreck archive turned out to be fruitful for discovering the correct locations of wreck sites. The location of the oldest shipwrecks is

3 The historical aerial photographs were derived from the website www.historische-luchtfoto.flevoland.nl and manually georeferenced in ArcGIS.

4 Multiple shipwrecks have been preserved in situ after archaeological research by either pit-storage *(inkuilen)* or soil-coverage. In both cases the shipwreck is covered by soil, but in the case of pit-storage an artificial water table is created by using plastic sheeting to cover the ship and its immediate surroundings, except for a small opening for rainwater at the top.

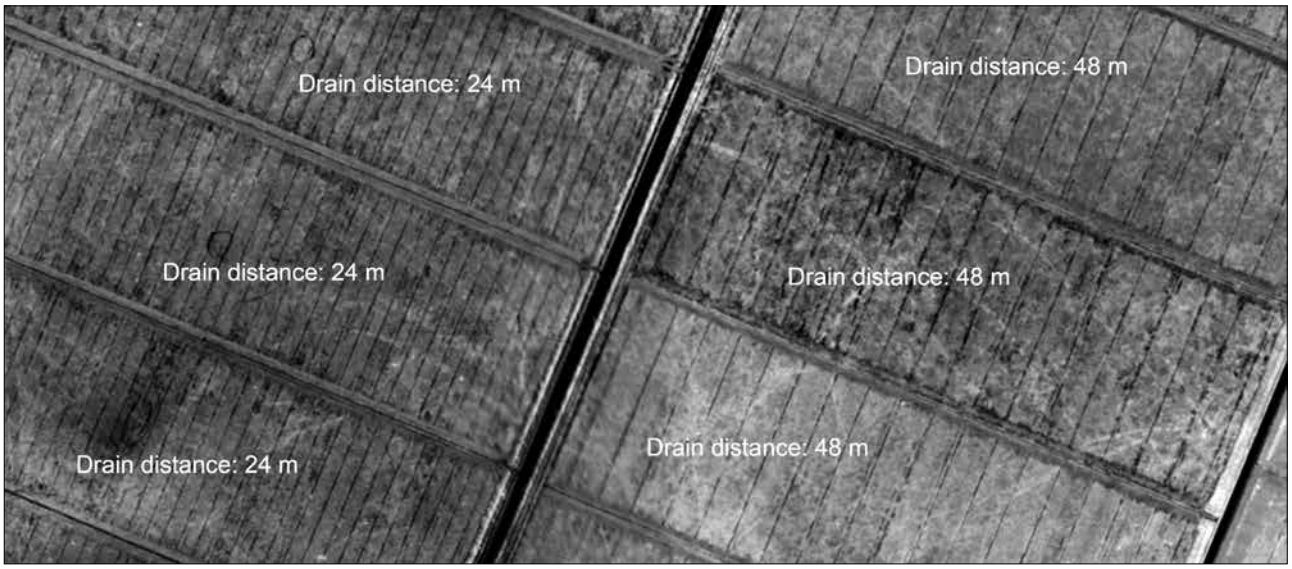

Fig. 2. An example of different drainage systems in adjacent lots in Eastern Flevoland in 1960: the distance between two drains is 24 m on the left and 48m on the right (Y.T. van Popta, RUG/GIA; aerial photographs: Province of Flevoland).

consistently described in the same way, as is demonstrated by the following example:

> *"the wreck is positioned between the ... (number) and ... (number) drainage ditch from the main watercourse* (tocht) *and is situated at approximately ... (number) metres from the ditch* (sloot) *that separates ... (lot number) from ... (lot number)".*

The distance between a wreck site and a ditch that separates two lots can be measured easily in the GIS based on satellite images. However, distances from main watercourse to shipwreck, based on the number of intervening drain ditches, are problematic for several reasons. First of all, the description of wreck sites in the shipwreck archive always refers to the old network of drains and drainage ditches. These ceramic drains have since been replaced by a different system, of synthetic drains, leaving the old system invisible and untraceable, because in many cases the old system is obsolete and no longer visible in the field. The second problematic factor is the variable distance between two drainage ditches: in general the interval between drains varied from 8 to 16 m in the Noordoostpolder and 24 - 48 m in the other parts of Flevoland. The system is not standardized, however, and old aerial photographs show a lot of variation in the distance between drains (even within a lot), especially in the eastern and southern part of Flevoland (fig. 2). It is therefore not possible to multiply the number of drains by an average interval distance in order to calculate the distance from the main watercourse to the wreck location. However, the oldest aerial photographs for each of the polders show the newly reclaimed and cultivated soils, not yet disturbed by ploughing, with the old drainage systems in most cases clearly visible as soil or crop marks. For the Noordoostpolder region, the aerial photographs of 1949 turned out to be most suitable, while the aerial photographs of 1960 were best for Eastern Flevoland and those of 1971 for Southern Flevoland.

The first step in reconstructing the distance from a main water course to a shipwreck is to precisely georeference the historical aerial photographs that show wreck sites in ArcGIS. The location of the drainage ditch mentioned in the documentation can then be found by counting all the ditches on the lot. This, together with the distance that was calculated from the ditch that separates two lots, leads to the exact location of the wreck site. The method is illustrated by the example of shipwreck NE 87 which, according to Archis and the Ship Catalogue, is located on lot NE 86, circa 250 m to the east of the road Professor Brandsmaweg and 50 m north of the ditch that separates lot NE 86 from NE 87 (fig. 3). The documentation of the shipwreck suggests a completely different location for the wreck: it should be located along the 49th drain on lot NE 87 (counting from the Professor Brandsmaweg) and 90 m south from the ditch that separates lot NE 86 from NE 87. The old drainage system was probably removed a long time ago and the 49th drain is therefore untraceable in the field and on recent satellite images. It is, however, clearly visible on the aerial photographs of 1949. By georeferencing these in the GIS, it is possible to count the number of 'old' drainage ditches (visible as white lines) from the Professor Brandsmaweg towards the east, until the 49th drain is found. Then, the distance of 90 m from the NE 86 / NE 87 ditch towards the south can be measured along the 49th drain, providing the exact location of the shipwreck. Coincidentally, in this particular case the wreck site is visible in the aerial photograph as a large, somewhat circular discoloration. Yet not every wreck

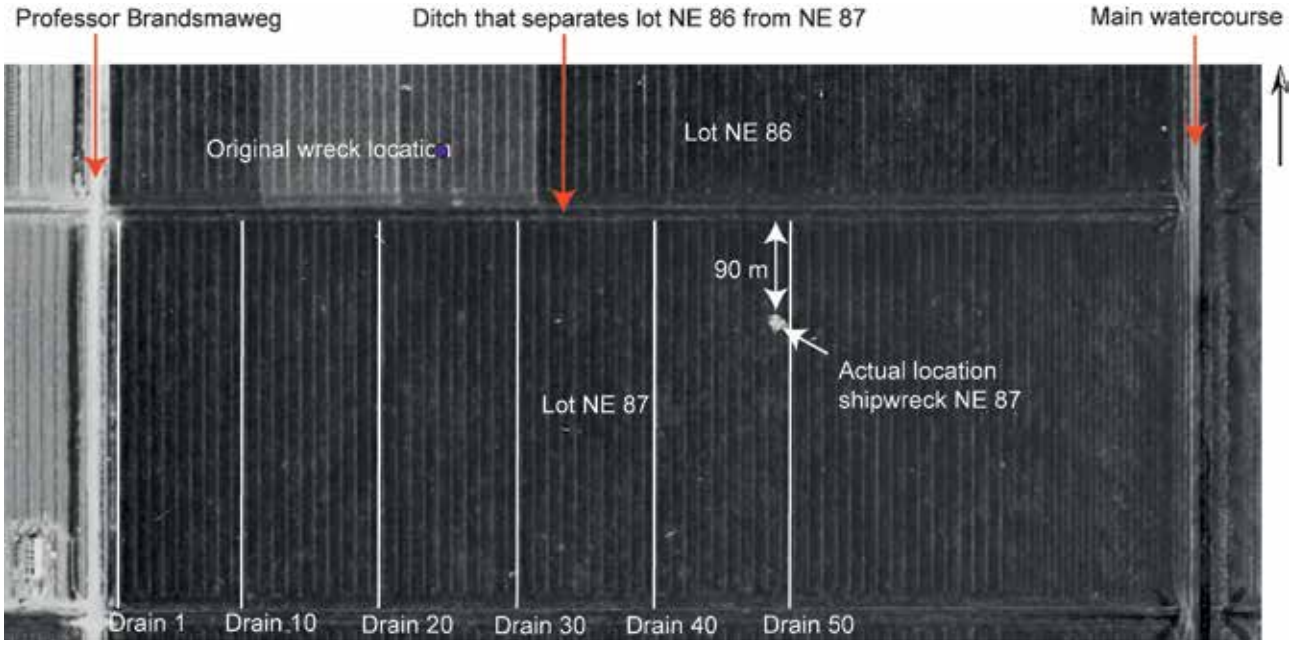

Fig. 3. Aerial photograph from 1949; marked on it are the (incorrect) recorded and (correct) actual wreck site of shipwreck NE 87 (Y.T. van Popta, RUG/GIA; aerial photographs: Province of Flevoland).

site is described in this way. In some cases, local reference points have been used that can no longer be traced, such as kilometre markers, altered or removed infrastructure (although these may be visible in historical aerial photographs) and mobile entities such as crops and technical installations. In most of these cases, the description of the wreck location was intended for the archaeologists who had to examine the wreck, i.e. for temporary use only. In order to work with the variable accuracy of wreck locations, it was decided to give each of the sites an accuracy score. A score of 1 means that the original wreck location in ArcGIS is the actual location of the wreck. In other words, the provided coordinates are positioned in the centre of the actual wreck. A score of 2 means that the shipwreck is likely to be or have been located near the stated location. This goes for a wreck-site description like: "the shipwreck is located in the utmost southeastern part of the lot", for which a random point in this area is chosen as the wreck location. A score of 3 means that the location of the wreck is unknown. As the name of a shipwreck in Flevoland in most cases refers to the lot on which it was found, a score of 3 indicates that it must be located somewhere on the corresponding lot, without an exact location within it. In such cases, centre coordinates of the lot are used. Hence, if a wreck site appears to be in the centre of a lot, it is important for the user of the database to check whether the accuracy score is 3, as several actual wreck sites (accuracy 1) happen to be positioned in the centre of a lot.

Besides the accuracy of wreck-site locations, the research has also focused on the question which shipwrecks are still present, and which have been removed in the past. The Ship Catalogue contains a column in which information about the presence or absence of wrecks is noted, but it is unclear from where this information is derived. Especially those wrecks that are marked as 'given up' are confusing: it means that the primary information on these shipwrecks is incomplete, but not necessarily that the wrecks have been removed. Periplus Archeomare (Muis & Van den Brenk 2015) also strove to create an overview of the shipwrecks still present in Flevoland, but their data and interpretations were incomplete. Therefore the results of a new study on the presence or absence of shipwrecks, based on the documentation in the shipwreck archive, have been added to the SDF 3.0. Especially the daily reports were of crucial importance, as in many cases they mention, in the final entries of the excavation, whether a wreck was removed, shifted or covered over. Frequently encountered examples are "the timbers were disassembled and transported" (wreck removed), "the timbers were burned on the land" (wreck removed) and "the wreck was covered with fabric and the excavation trench was backfilled" (wreck still present). There are, however, plenty of shipwrecks for which daily reports are lacking, making it harder to figure out whether these wrecks were removed. In some cases, correspondence between the archaeologists and the land owners/tenants reveals further relevant evidence, as when mention is made that a wreck has been removed after inspection and/or excavation. In other cases it is merely said that a wreck is of little scientific importance and has been "given up"; it then was up to the land owner or tenant whether to remove the wreck or not. Wrecks may indeed have partially survived if only the highest parts of the wreck

were removed, for example when the deepest timbers were no obstacle to ploughing. Such information might be found either in the excavation documentation or by carrying out a trial excavation. Each of the wrecks in the SDF is given a second score that indicates whether a wreck is still present (A) or removed (C). If its presence or absence is uncertain, the score B (unknown) is used.

4. Results

The first version of the SDF (1.0, 2012) contained 423 shipwreck records, while the second version (2.0, 2015) contained 446 records after Periplus Archeomare added another 23 records to the database. The third version of the SDF, presented here, at the moment of writing comprises 449 records (appendix 1). Although there appears to be a difference of just three records between the second and third versions, in fact 23 records were removed and another 26 added to the database (table 1). Also, the locations of 218 wreck sites were corrected; this amounts to almost one incorrect shipwreck location for every two records, and an average error of approximately 356 m for each of the adjusted records. The corrections of wreck-site locations can be divided into (1) records with 'centre coordinates', (2) wreck sites that were positioned in the wrong lot, (3) wreck sites with incorrect coordinates due to typing errors, and (4) wreck sites recorded with approximate or random coordinates (table 2; appendix 2).

Centre coordinates were often used to mark sites on regional topographical maps for those wrecks whose actual location was not known. The only certainty was the toponym that identified the lot in question: shipwreck NR 4 refers to Noordoostpolder (N), R section, lot number 4. As a consequence of using centre coordinates, a spurious accuracy was created, and many of these locations were adopted in national databases and never checked afterwards. On the basis of the new methodology, it was possible to accurately reposition 36 wreck sites with centre coordinates. The smallest adjustment measured just 50 m, since this shipwreck by coincidence lay near the centre of the lot. However, the majority of these wreck sites (n=20) had a deviation of 200 to 400 m. The largest adjustments came from wreck sites from the southern part of Flevoland and in three cases amounted to more than 800 m. This is no coincidence: it underlines the differences in size of the lots in the three polders. The lots in the Noordoostpolder and Eastern Flevoland are much smaller (10-40 ha) than those in Southern Flevoland (30-90 ha, table 3). It means that centre coordinates for unknown wreck locations have a greater chance of a large deviation in the southern part of Flevoland than in the other regions. In practice the deviation cannot exceed 900 metres, as the largest lots in Southern Flevoland have a diameter of approximately 1800 m (fig. 4).

The deviation of shipwrecks marked on wrong lots is far larger than for those with centre coordinates: a total of 27 wreck locations were adjusted, with a total deviation of approximately 30 km (table 2). A third of them had a deviation of more than one kilometre, with two major outliers: shipwreck NA 8 was shown 5.3 km from its actual location and the coordinates of shipwreck OY 96 were positioned 6.5 km to the northwest of its actual

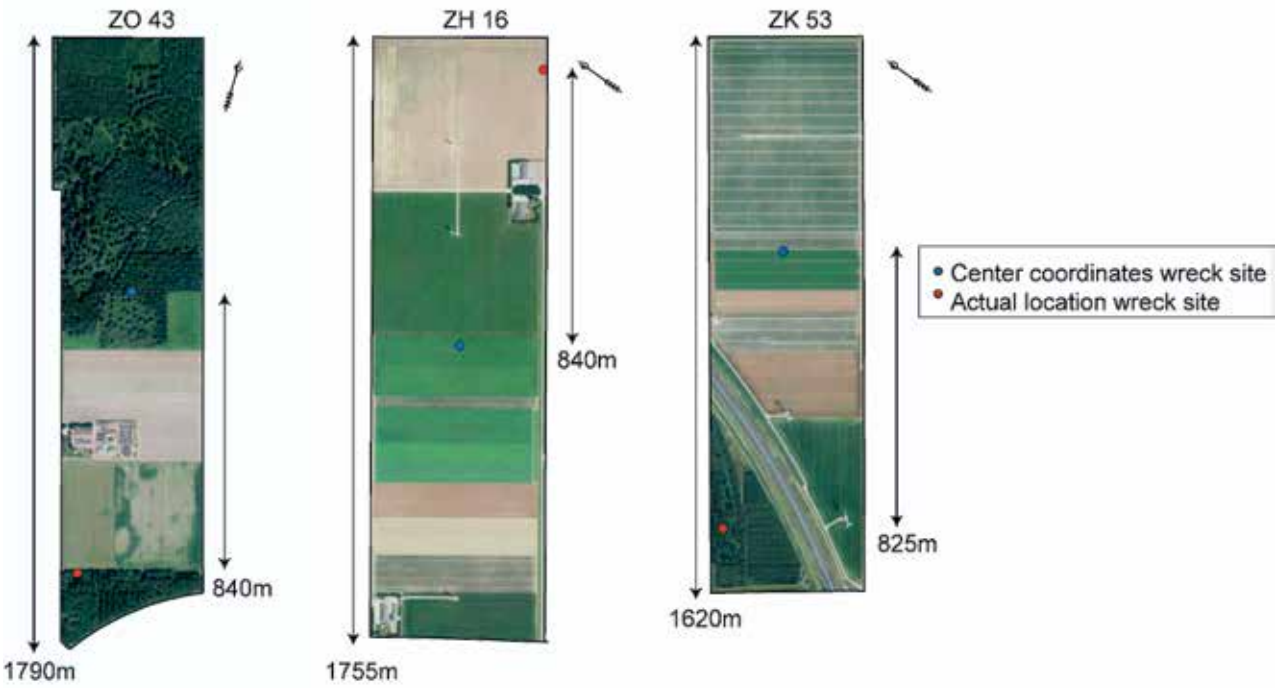

Fig. 4. Examples of large-scale deviations, due to the use of lot-centre coordinates, between incorrect recorded locations and reconstructed actual wreck site locations in Southern Flevoland (Y.T. van Popta, RUG/GIA).

Table 1. Overview of the records that were removed or added to the third version of the SDF.

Removed from SDF	Reason	Added to SDF	Ship type
NA 23	Not a shipwreck	3Z6 De Vliegende Hollander	Unknown
NA 90	Not a shipwreck	Blocq van Kuffeler	Likely a Volendammer kwak
NC 35	No wreck found	De Onderneming	Unknown
ND 2	No wreck found	IJsselmeer Urk con-1	Fishing vessel
ND 22	No wreck found	IJsselmeer Urk con-2	Unknown
NE 46	No wreck found	IJsselmeer Urk con-3	Unknown
NG 62	No wreck found	IJsselmeer Urk-roeisloep	Flatboat
NH 7	The same as NK 7	James Stewartstraat Almere	Split tree trunk with metal fittings
NK 12	No wreck found	Johanna	Unknown
NK 16/17	No wreck found	Hanzerak West	Pram/tjalk
OG 158	Mentioned twice	Ketelmeer West	Freighter
OG 33	The same as OG 34	NC 87	Unknown
OK 48	The same as OH 48	ND 86-II	Unknown
ON 6	The same as ON 6-I	NE 103	Unknown
ON 23	The same as ON 59	NE 133	Unknown
OP 71	The same as OP 72	NP 32	Unknown
OU 112	The same as OU 113	NP 34	Unknown
OZ 36	The same as ZO 36	OH 49 (Beverweg)	Unknown
ZC3	The same as 3Z6	P.I. 65	Unknown
ZK 46	The same as ZK 45/ZK 46	Vijf Gebroeders	Pram
ZN 3	The same as ZN 103	Markermeer sonarcontact 109	Unknown
ZN 13	The same as ZN 113	Markermeer sonarcontact 137	Tjalk
IJH-01	The same as IJsselmeer Houtribsluizen 1	Markermeer sonarcontact 149	Unknown
		Markermeer sonarcontact 31	Unknown
		Markermeer sonarcontact 35	Unknown
		Markermeer sonarcontact 71	Unknown

site. There is no general explanation for the errors that were made. Many of them were presumably caused by inattention and typing errors. Such errors can have a large impact on archaeological heritage management, especially when it is decided to protect a wreck site: not only would a piece of land be protected that lacks wreck remains (while the actual wreck decays), it would also wrongfully limit the farmer's operations.

A total number of six shipwrecks were mislocated merely due to errors, with a total deviation of 4500 m and an average deviation of 750 m (table 2). Although this category corresponds closely to the wrecks marked on wrong lots, an error does not necessarily mean that the shipwreck is attributed to a different lot. This is illustrated by the wrecks on lot ZA 87, of which two were mixed up owing to a misinterpretation of the toponyms of both wrecks: ZA 87-II was positioned on the wreck site of ZA 87-III and vice versa. The total error measures 235 m for both wrecks but is within the boundaries of the lot. The shipwreck on lot OH 101 too was originally marked in the wrong location within the boundaries of the lot because of a misinterpretation of the description of the wreck site. The actual description says that the wreck is positioned at 550 m from the main water course and 25 m from the ditch that separates the lots OH 101/OH 102. Instead, the wreck was marked at 500 m from the main water course and 25 m from the ditch on the other side of the lot, causing a deviation of 250 m (fig. 5). Two other shipwreck locations (NC 51 and NA 59) have a much larger misplacement due to typing errors: the X coordinate of NC 51 is 523860 while it should be 526577, causing a difference of 2.7 km between the mapped and

actual wreck site. Shipwreck NA 59 is placed 200 km north of its actual location, as the Y coordinate was miswritten: 737040 should have been 536870.[5]

The use of random or approximate coordinates has caused the largest number of deviating wreck locations in Flevoland. In total, 149 wreck locations have been adjusted with a total error distance of almost 30 km (table 2). If we look at the deviation for individual wreck sites, it is clear that the majority (60%) have an error of less than 200 m. A total of 32 wreck sites required only small adjustments (a maximum of 50 m) to their location, for example when coordinates were used of a fixed point in the direct proximity of the shipwreck (*e.g.* corner of excavation trench), instead of the centre of the actual wreck. The average deviation amounts to almost 200 m. The majority of these deviations are caused by the fact that at the beginning of the digital era, for example for the development of the national database Archis, many coordinates were estimates. The question is why approximate or even random coordinates were used to indicate wreck locations instead of accurate positioning. The lack of a systematic approach and the availability of only very basic digital tools seem to cover one side of the explanation. Furthermore, wreck locations might have been digitalized from distribution maps on paper, whose accuracy is limited to the regional level (scale 1:50,000). In general, the wreck locations on these maps are represented by drawn dots whose diameter in itself represents 50 to 100 m. Thus the scale of the first paper maps also partially determines the accuracy of later digitized maps. However, it does not explain why in some cases shipwrecks seem to have utterly random coordinates. This may be illustrated by the case of shipwreck ZM 8: the location of the wreck site is described as "183 m from the ditch that separates ZM 7 and ZM 8" and "165 m from the Roerdompweg road", which should be in the northeastern part of the lot (fig. 6). For some reason, the wreck location according to Archis and the Ship Catalogue is shown in the southwestern part of the lot, 435 m from the ditch that separates ZM 7 and ZM 8, and 820 m from the Roerdompweg. The official report even provides the correct coordinates of the wreck site, but these were ignored in both databases. As a result, a deviation of 700 m existed between the charted wreck site and its actual location.

Wreck sites in aerial photographs and LiDAR data

Aerial photographs were primarily useful for spotting the relevant old drainage ditches that used to define the locations of wreck sites. Nevertheless, it turned out that the photographs have a second function, as in specific cases they display the actual wreck sites in multiple

Table 2. Overview of the 218 adjusted shipwreck locations, divided into deviation and distance categories. Each of the deviation categories has an average deviation (per wreck site) and overall deviation.

Category	Deviation (m)	Number
Center coordinates	0-100	1
	101-200	5
	201-300	10
	301-400	10
	401-500	4
	501-600	1
	> 600	5
	Average deviation	362
	Total deviation	13040
	Total shipwrecks	36
Wrong lot	0-200	3
	201-400	5
	401-600	3
	601-800	5
	801-1000	2
	> 1000	9
	Average deviation	1113
	Total deviation	30050
	Total shipwrecks	27
Error	0-1000	3
	1001-2000	1
	2001-3000	1
	> 3000	1
	Average deviation	750
	Total deviation	4500
	Total shipwrecks	6
Estimate/random	0-100	59
	101-200	34
	201-300	18
	301-400	16
	401-500	10
	501-600	4
	601-700	3
	701-800	3
	> 800	2
	Average deviation	199
	Total deviation	29705
	Total shipwrecks	149

5 The 200 km deviation of shipwreck NA 59 (due to a typing error, at least of the first digit (7), while the other errors might be due to a mistake in the calculation of the coordinate) is omitted from the calculations of average and total deviation to avoid a large bias.

Table 3. Overview of lot sizes for different parts of the province of Flevoland.

Size lot (ha)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	> 100
Noordoostpolder	177	412	1428	38							
Eastern Flevoland	162	417	925	221	37	4		4			
Southern Flevoland	6	24	47	84	56	71	35	44	50	8	2
Total	**345**	**853**	**2400**	**343**	**93**	**75**	**35**	**48**	**50**	**8**	**2**

Fig. 5. An example of a misinterpreted shipwreck location. Originally, the wreck was marked close to the ditch that separates lots OH 100 and OH 101, while it should be close to the ditch that separates lot OH 101 from lot OH 102 (Y.T. van Popta, RUG/GIA).

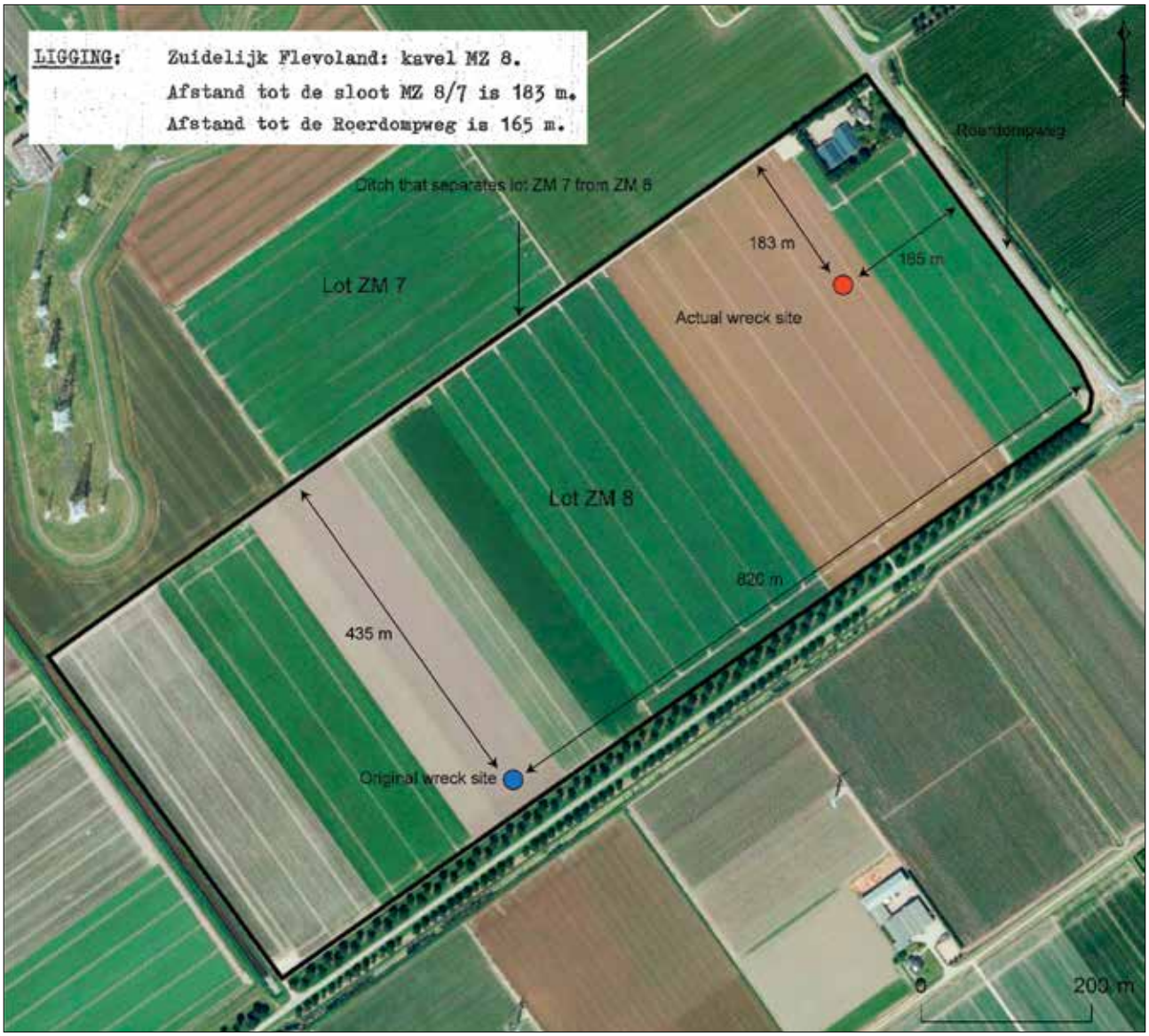

Fig. 6. This figure shows the actual wreck site of shipwreck ZM 8 (red dot) and its recorded location (blue dot). The use of random coordinates, while an accurate wreck site description was available, caused a deviation of 700 m (Y.T. van Popta, RUG).

ways. First of all, some aerial photographs show shipwreck excavation pits as the photographs were coincidentally taken during archaeological research. At least 15 excavation pits are visible in aerial photographs, of which 6 can be seen in figure 7. A close study of aerial photographs might even yield more visible excavation sites (an exercise which has not yet been undertaken). Secondly, wreck sites may also be visible as discolorations in aerial photographs (fig. 8), especially as soil marks, when the land was ploughed for the first time before any planting of crops. The soil marks are often caused by the disturbance of sediments near the wreck site due to (post-)depositional processes. For example, the wreckage of a ship can cause a turbulence in the water when the wreck sticks out of the seabed. As a consequence, quite large amounts of sand and shells may be deposited as a thick layer of sediment next to the wreck site. After the reclamations and the first phase of land cultivation, these sandy wreck sites stand out from the natural clay sediments in composition and colour and under the right circumstances become visible. All depends of course on variables like the local composition of sediments, the size and completeness of the wreck and the thickness of the sediments that cover the wreck.

The analysis of LiDAR data, providing a relief overview of the present surface of the former seabed, has proven to be ineffective when searching for wreck locations in Flevoland. One might expect surviving shipwrecks to show up as minor elevations in the land, as the soil covering and underlying shipwrecks (often with their keels on the Pleistocene subsoil) does not

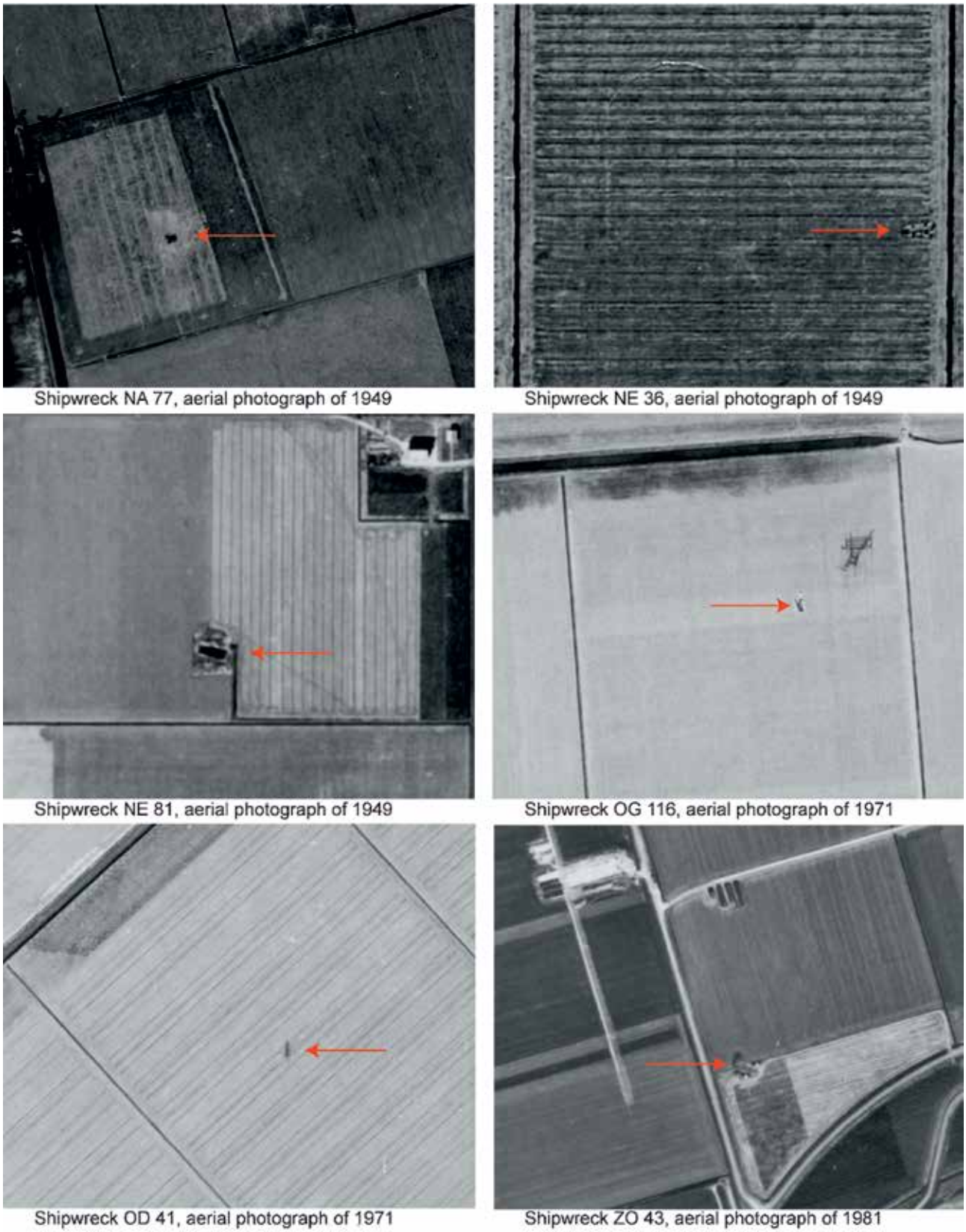

Fig. 7. Six examples of excavation trenches that are clearly recognizable in historical aerial photographs (Y.T. van Popta, RUG/GIA; aerial photographs: Province of Flevoland).

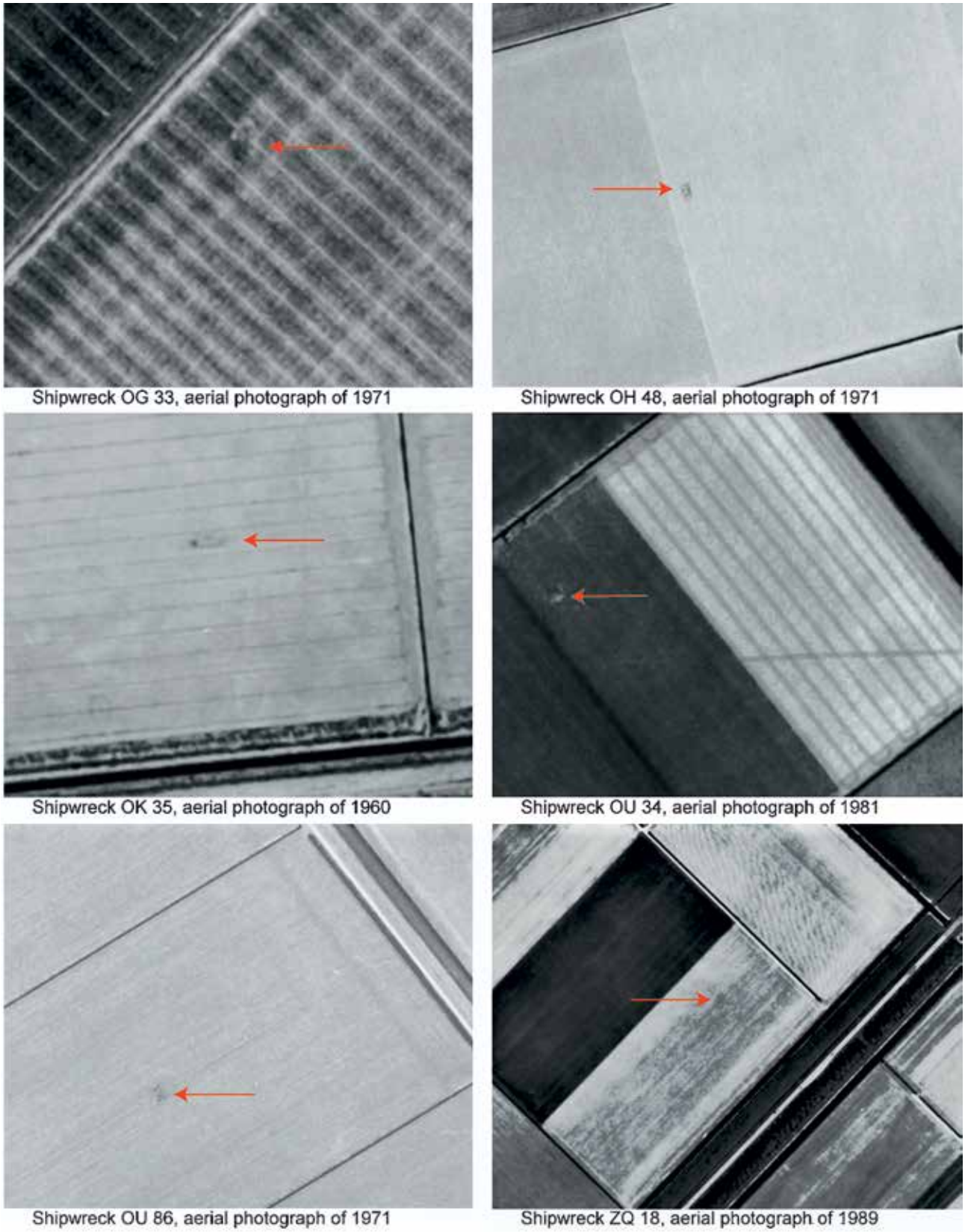

Fig. 8. Six examples of wreck sites that can be recognized as discolorations in historical aerial photographs (Y.T. van Popta, RUG/GIA; aerial photographs: Province of Flevoland).

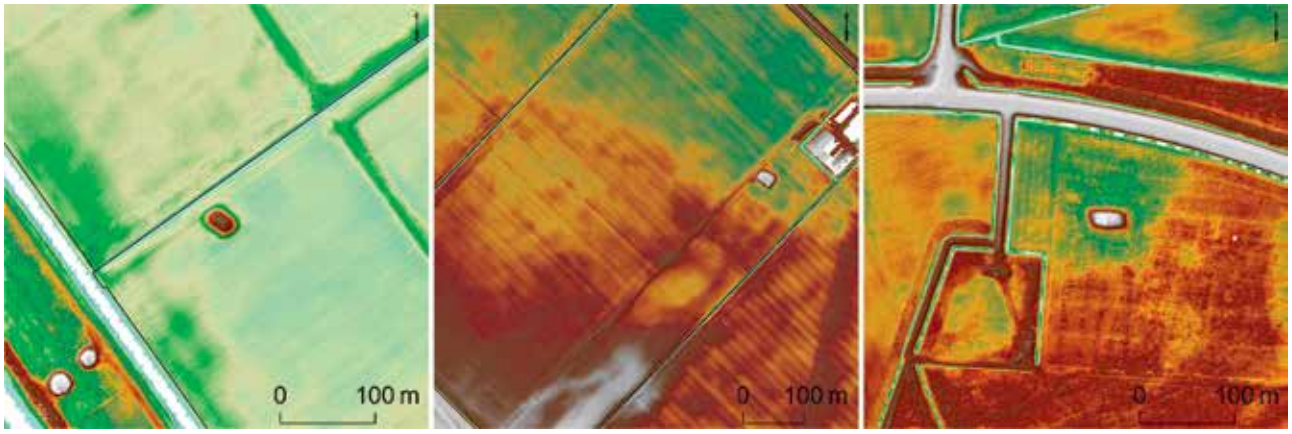

Fig. 9. LiDAR data of three wreck sites with clearly recognizable soil-covered shipwrecks (Y.T. van Popta).

compact, while their surroundings continue to settle due to drainage. It would also mean that removed wrecks should be visible as depressions in the surface. However, fields are nowadays so intensively ploughed that small differences in elevation are immediately levelled. Furthermore, former wreck-site depressions have in many cases been filled with extra soil in order to level the fields. It does not mean that all wreck sites are invisible: the wrecks that are purposely soil-covered or pit-stored (most of them in Southern Flevoland) are clearly visible on LiDAR data (fig. 9). As the exact locations of these wreck sites are already known (recorded during the on-site conservation), LiDAR data is only useful as a means of visualization.

Presence and absence of shipwrecks

It is most important for the cultural heritage management of shipwrecks in Flevoland to know the present condition of wreck sites. Those wrecks that are still present in the field should be protected (on the basis of a thorough assessment and validation of the site), while the sites of removed shipwrecks should not unnecessarily be legally protected (which does not mean that they cannot be commemorated by some sort of marker). Protection would only create a pointless obstacle to the owner and/or user of the land. Until now, a clear and complete overview of still present and removed shipwrecks in Flevoland was lacking. There were some lists with information about still present shipwrecks, but they focused largely on the most obvious (pit-stored and soil-covered) ones. The current status of the majority of the wreck sites in Flevoland was unclear. For this research the documentation of the shipwreck archive was checked for relevant information on any removal of wreckage. The results were as follows: at least 96 wrecks are preserved *in situ* and 271 wrecks have been removed. This means that the present situation of 82 wreck sites remains uncertain. Of the 96 shipwrecks still present, 42 are embedded in the former seabed with little or no protection, 24 wrecks are lying under water and 30 wrecks are either soil-covered or pit-stored. There are 82 wrecks of which the present situation is uncertain. The uncertainty regarding their condition mainly results from poor documentation (no daily reports, no site reports) and vague updates and notifications like 'wreck given up', 'not found during reconnaissance' and 'might have been removed'. Some wrecks are known to have been excavated in the past, while there is no explicit mention of whether such a wreck was afterwards removed. There is however an indirect way to find out: if a shipwreck is excavated and a detailed description is provided of the construction of the hull, it would mean that the ceiling and frames were removed (this is often mentioned). Therefore it indicates that the wreck was excavated in a destructive way, rather than aiming at *in situ* preservation. So even though such a report does not explicitly mention the removal of a wreck, it is likely that the timbers have been removed, transported and deselected. If a shipwreck has not been found during a reconnaissance and no further details are provided, the present situation of the wreck has been marked as 'unknown' (B).

It is important to keep in mind that once a shipwreck has been removed, it need not mean that this wreck site is archaeologically written off. Maritime archaeologists focus mainly on the shipwreck itself, i.e. the largest number of connected timbers. Loosely connected parts of the ship (rudder, mast, rigging, leeboards, deck construction) are often separated from a ship as it founders, and are rarely found during excavation. Even a whole side of the ship may drift away as soon as the ships' transverse structural elements break down. Therefore, limiting the research to the main wreck site may result in overlooking other wreck parts in the vicinity. This can be illustrated by the excavations of shipwrecks in Flevoland by the International Fieldschool for Maritime Archaeology Flevoland (IFMAF). In the summer of 2011 and 2012, a late-sixteenth-century freighter (OE 34) was excavated near Lelystad (Van Holk 2017). Preceding the excavation, a short geophysical research programme

Table 4. Classification of shipwrecks based on the two main factors for maritime archaeological heritage management: presence or absence, and accuracy of wreck location.

Category	Presence or absence shipwreck	Accuracy wreck location	Number of wrecks
A1	Present (A)	Exact (1)	94
B1	Unknown (B)	Exact (1)	26
C1	Absent (C)	Exact (1)	140
A2	Present (A)	Estimated (2)	0
B2	Unknown (B)	Estimated (2)	24
C2	Absent (C)	Estimated (2)	66
A3	Present (A)	Unknown (3)	2
B3	Unknown (B)	Unknown (3)	32
C3	Absent (C)	Unknown (3)	65

Fig. 10. The largely intact and well-preserved rudder of shipwreck OR 49 that was discovered outside the excavation trench (Y.T. van Popta, RUG/GIA).

was carried out to test whether any wreck parts would be visible on the maps generated from the geophysical data. As the results came in late, it turned out that multiple anomalies (parts of the wreck) had been located outside the excavation trench (in part caused by the fact that the trench is kept as small as possible, to minimalize disturbance of farmland). More or less the same thing happened during the excavation of the 17th-century shipwreck OR 49 in 2015. At the end of the excavation campaign, the immediate surroundings of the excavation trench were examined with a metal detector. A strong signal was picked up close to an edge of the trench and it was decided to excavate that area as well. It turned out that the signal came from metal fittings and pintles (*roerhaak*) that were part of the largely intact rudder of the ship (fig. 10). Rudders are not often found as they easily get detached from ships during the process of foundering. This specific rudder also became disconnected from the ship but sank quite close to the wreck. If the archaeological research had been limited to the trench, this rare and relevant part of the ship would have been missed. Furthermore, it is likely that objects from the ships' inventory are taken by the waves during wreckage and therefore are spread around the wreck site. The most obvious way to illustrate this is by looking at the eroded and disturbed sediments (*verspoelingslaag*) that surround shipwrecks: they often contain all kinds of objects belonging to the ship's artifactual inventory. This was also observed during the IFMAF campaigns when dozens of objects were found outside and even underneath the wrecks. The main point is that even if the documentation mentions that a shipwreck has been removed after archaeological research, there is a chance that structural parts and objects belonging to the ship's inventory still remain in the vicinity. Therefore, shipwrecks with a presence-absence score of C (removed) should be interpreted as: "the shipwreck was removed, but this is still a wreck site". So from a management point of view we should pay attention to these sites too. A distinction could be made between sites that have been excavated and afterwards left alone and sites that have been destroyed.

5. Discussion and comparison

This research is a further step in creating a more reliable dataset of shipwrecks in Flevoland, but the end has not yet been reached. There still are plenty of wreck sites about which primary information is (partially) lacking. First of all, the exact location of 260 wrecks is now known, but there still are 90 wrecks whose site is approximate and 99 wrecks whose location is completely unknown. Secondly, the present condition of wreck sites is still partially unclear: 96 wrecks are preserved *in situ* and 271 are known to have been removed, but this means that it is uncertain whether the remaining 82 wrecks are still present or have been

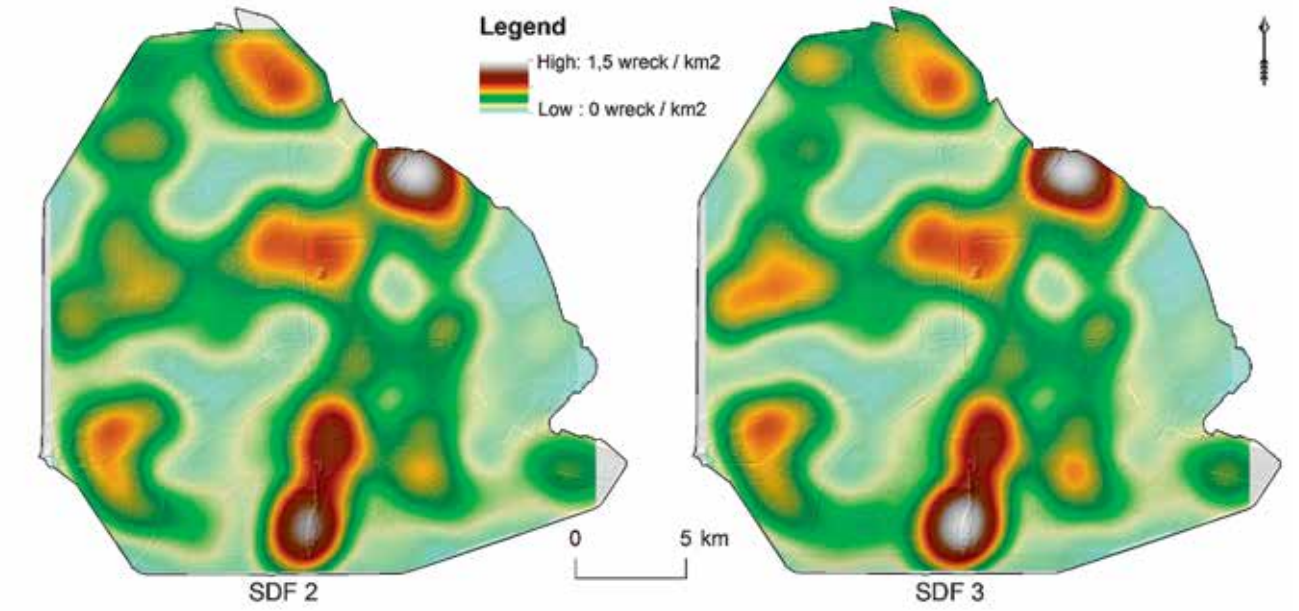

Fig. 11. Density analysis (kernel density) of wreck sites in the Noordoostpolder, based on the SDF 2 (2012) and SDF 3 (Y.T. van Popta, RUG/GIA).

removed. Archaeological fieldwork would be useful to improve the data even further by focusing on unknown and approximate wreck locations and the shipwrecks whose present condition is unknown. The sites in question might have been deselected for various reasons in the past, but the criteria for deselection have changed dramatically over the years, which justifies renewed investment. The information regarding both categories (accuracy and presence-absence) can also be combined in order to select the shipwrecks that should be given priority (table 4). Shipwrecks from the categories A1 and C1 need no further attention, as their locations are accurate and their present status (present or absent) is known. The wrecks belonging to the categories C2 and C3 are also of less importance (with the proviso, mentioned earlier, that the surroundings of the excavation trench might contain archaeological remains) as these wrecks have already been removed, although it would be useful if accurate wreck site locations were to be established eventually. The 82 wrecks of categories B1, B2 and B3 need to be examined more closely to tell whether they have been removed or are still present. Special attention should be given to the 32 wrecks that belong to category B3 as both their location accuracy and present condition are unclear. High priority should also be given to the two wrecks of category A3 that are known to be present but whose exact location is unknown. Both wrecks lie within the nature reserve Oostvaardersplassen and are presumably preserved under water. As no ploughing and soil disturbance are allowed in the region, the preservation of both wrecks should be assured, since the water-saturated timbers are hardly affected by oxygen (although this should be checked in the field). So, although neither wreck is threatened at the moment, this situation might change overnight. Moreover, an exact location is also necessary for monitoring purposes.

Improving the quality of the SDF by creating a higher accuracy of wreck locations and making an inventory of still-present shipwrecks serves not only scientific purposes but also archaeological heritage management. It results in more accurate distribution and density maps of shipwrecks (scientific purposes) and helps in appropriately protecting the remaining shipwrecks (heritage management). For a regional and spatial wreck analysis it is important to keep in mind that the foundering of a ship, for example due to a leak or a heavy storm, might take place at a random location, although some areas would be more or less likely. On the other hand, a ship might initially founder at a one location and end up on the seabed at a totally different spot, miles away. An average deviation of 200 m will therefore not change the general overview and interpretations of a regional spatial analysis. This can be demonstrated by comparing the old and new density and distribution maps of shipwrecks, derived from the oldest and newest version of the SDF (fig. 11). The new density map has not changed much, although several high-density areas are smaller or different in shape. The spatial differences between the old (blue dots) and new (red dots) shipwreck locations are however clearly visible in the distribution map (fig. 12). These differences are of particular importance for research on a local scale, for example when new archaeological finds may be connected to known shipwreck sites, or when historical information about wrecks (often given in latitude/longitude with Amsterdam as the prime meridian) can be related to actual wreck sites.

Fig. 12. Distribution map of shipwrecks in Flevoland. The blue dots represent wreck sites of the SDF 2 that proved incorrect or spurious, the red dots represent the wreck locations of the SDF 3 (Y.T. van Popta, RUG/GIA).

The new results are also of particular importance for maritime archaeological heritage management in three ways. First of all, the wrecks that are preserved *in situ*, whose actual location is known, should receive the highest degree of protection (category A1). Secondly, the wrecks that have been removed with certainty (categories C1, C2 and C3) need no further protection, unless new wreck parts are found in the vicinity of the wreck location. The unnecessary protection of the site of removed shipwrecks would only be troublesome for the landowners. The wrecks whose present condition is unknown and whose location is exact or approximate

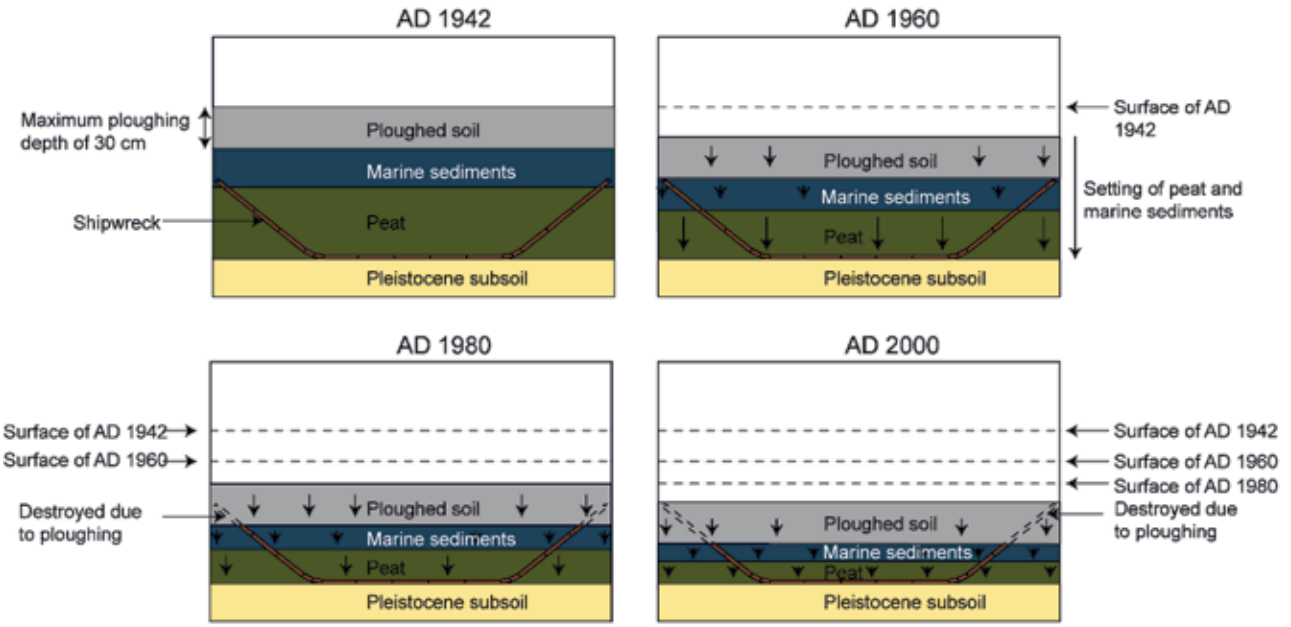

Fig. 13. Simplified model of the effects of soil subsidence and the gradual destruction of shipwrecks (Y.T. van Popta, RUG/GIA).

(categories B1 and B2) should have minor protection until more details are available through archaeological reconnaissance. The (possibly) present shipwrecks whose location is completely unknown (categories A3 and B3) cannot be protected by any kind of heritage management as it is too problematic for the users of the land (mostly farmers) to sacrifice a complete lot. These guidelines have already been adopted by the archaeological firm RAAP Archaeological Consultancy who are developing a new archaeological (policy) map of the Noordoostpolder municipality (Ten Anscher *et al.* 2017).[6] They advised to surround the wreck locations of category A1 with a protective buffer of 50 m, and the wrecks of categories B1 and B2 with a buffer of 100 m, as their location is less exactly known (Ten Anscher *et al.* 2017: 71). Within this buffer, soil disturbance to a depth of more than 30 cm is allowed only with a permit. However, one should realise that allowing a maximum ploughing depth of 30 cm is only a limited and rather inadequate way of protecting shipwrecks. Soil compaction of the former seabed will continue through the coming years, while the shipwrecks do not subside, causing them to come closer to the surface (see: Van Tuinen & Van den Bersselaar 2005; De Lange *et al.* 2012). When the top of a wreck reaches the plough zone in this process, every year a few centimetres of the top of the wreck will be destroyed by ploughing (fig. 13). In most cases, the land user will not even notice that a shipwreck is being destroyed, as the highest parts of the shipwreck already are in poor condition (oxygen reaching the timbers closest to the surface) and will pulverize upon being hit by a plough. This theory is founded on evidence collected in the field: during multiple shipwreck excavations in the province of Flevoland, the level of the highest parts of the shipwreck corresponded exactly with the maximum depth of the plough zone (fig. 14). If no action is undertaken, a substantial part of the wrecks 'preserved' *in situ* will suffer from yearly erosion until the entire wrecks are destroyed.

The results of the study on the location and presence-absence of shipwrecks in Flevoland can also be compared with the research of Periplus Archeomare (Muis & Van den Brenk 2015). Their research focused on the question whether known and unknown shipwrecks and wreck remains in Flevoland might be traced by remote sensing. To this end, they used practically the same data: historical aerial photographs from 1947-2006, LiDAR data (AHN 2) and modern satellite images. In their conclusions they stated that finding wreck sites and shipwrecks by studying historical aerial photographs proved harder than expected for three reasons. First of all, they presumed that wreck sites were most clearly visible just after the reclamations and before the former seabed was disturbed by ploughing and vegetation growth. They stated that the vegetation was responsible for making the landscape harder to interpret. Furthermore, the resolution of the aerial photographs was considered too low for spotting wreck sites. Lastly, as mentioned earlier, they found that large parts of the former seabed contained other features, such as

6 In addition, the archaeological firm ADC Archeoprojecten is currently using the content of the SDF 3 for heritage management purposes, as an update of the Archaeological Monuments Map of the province of Flevoland is needed.

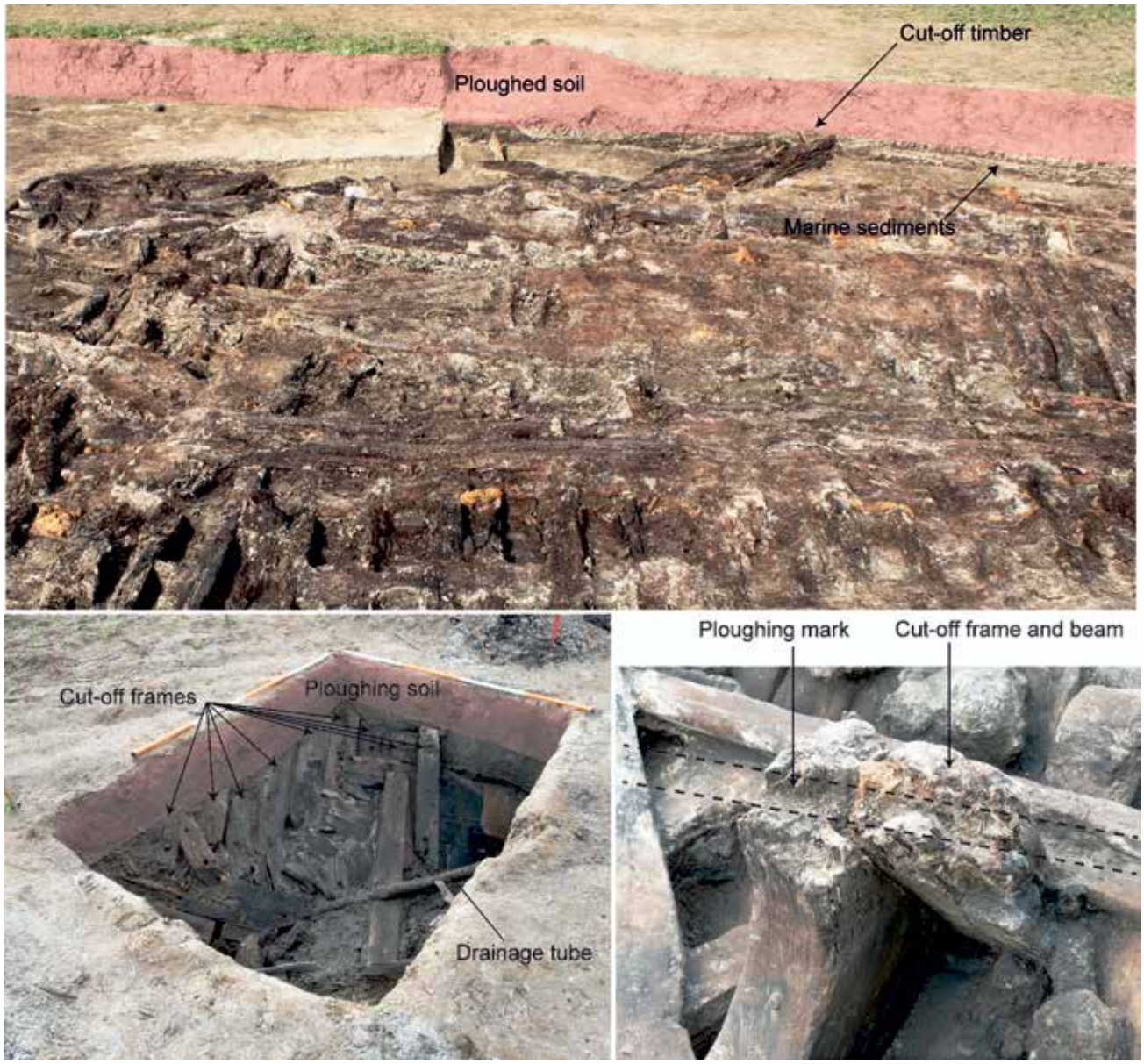

Fig. 14. Examples of shipwrecks excavated in the province of Flevoland, parts of which have been destroyed by ploughing. The maximum depth of the plough soil corresponds to the cut-off wreck parts (Y.T. van Popta, RUG/GIA).

tree stumps, that cannot easily be distinguished from shipwrecks (Muis & Van den Brenk 2015: 47). For each of the wreck sites in Flevoland they described what could be seen in the oldest aerial photographs. This resulted in 7 possible sites (shipwrecks NA 57, NE 131, NE 157, NO 28, NQ 75, NT 57 and ZQ 48/49), 24 possible anchor trails and 415 wreck sites with insufficient evidence for the presence of a shipwreck (ploughed, disturbed, no traces, ditch, open water, no data). The analysis of the second dataset (LiDAR) also resulted in very limited evidence of wreck sites. The only wrecks that could be recognized were those that were pit-stored or soil-covered. Muis & Van den Brenk (2015: 36) remarked that the coordinates of some of these specific wreck sites did not match the actual wreck location. Therefore they recommended checking the locations of other wreck sites as well. Despite their own warning, they failed to do so in their remote-sensing study. The present research has shown that half of the original wreck locations have a relatively large deviation of at least 100 – 200 m. Which means that 50% of the results of the remote-sensing analyses by Periplus Archeomare are based on incorrect and inaccurate wreck locations. A substantial part of the other 50% of the wrecks consists of wreck sites with centre (artificial) coordinates of the lot, which unfortunately makes the majority of their remote-sensing analyses unusable. The current research has shown that by checking the correct wreck locations, it is possible to recognize wreck sites in historical aerial photographs either as a disturbance/discoloration in the field or fortuitously as an excavation trench.

6. Concluding remarks

The third and newest version of the Shipwreck Database Flevoland has provided a lot of new and detailed information on the present status of shipwrecks in the Zuiderzee region (preserved *in situ*, unknown, removed) and the accuracy of the locations of these shipwrecks. Using the documentation from the shipwreck archive and several remote-sensing techniques, it became clear that the locations of 218 shipwrecks had to be adjusted. The total deviation amounts to some 77 km and the average deviation for each of the originally incorrect wreck sites is approximately 356 m. Most of the deviations were caused by the use of random and approximate coordinates: all that had previously mattered was that each ship was placed in the right lot. A total of 27 wrecks were even marked in the wrong lot. Other deviations were caused by typing errors and the use of lot-centre coordinates. After the adjustments, the new version of the SDF contains 260 shipwreck records with exact wreck locations. However, there still are 90 wrecks with approximate locations and 99 wrecks whose location remains unknown: more work needs to be done in order to establish the exact locations of these wrecks as well. Examining the original excavation documentation also made it possible to compile a list of preserved and removed shipwrecks. Until now, there was no clear overview of which Zuiderzee wrecks are still *in situ*. It transpired that at least 96 wrecks are still present in the seabed of the former Zuiderzee. This is a minimum number, as there are 82 wrecks whose present condition is unclear due to vague, incomplete or absent information. For 271 shipwrecks there is sufficient evidence to conclude that they have been removed from the former seabed.

The results of this research and the new version of the SDF provide a more reliable dataset for further scientific research. The large-scale deviations of wreck locations and the new adjustments have no major consequences for spatial research on a regional scale, but one should realise that solid spatial research, especially on a local scale, is possible only if the distribution pattern of shipwrecks is accurate and well-founded. The deviations will have consequences for archaeological research on a local scale, especially when studies are made of specific wreck sites in combination with archaeological, historical and geographical data. Furthermore, the current version of the SDF can be used for appropriate archaeological heritage management within the Zuiderzee region for the proper protection of those shipwrecks that need to be protected. It should be realized that this rich maritime dataset is not of unlimited proportions. Most of the 96 wrecks that still lie in the former seabed are in a process of constant degradation that will not be stopped by 'protecting' the wrecks with a maximum ploughing depth of 30 cm. New plans should be made to carefully protect these wrecks (after validation), as they are highly valuable for understanding the maritime history of the Netherlands.

To conclude, the third version of the SDF will most certainly not be the final version of the database, as a lot of information still needs to be added to the database. First of all, the remaining wreck sites with partially unknown data about their present condition or exact location should be examined more closely. Then, future research should also focus on other parameters such as 'ship type' and 'moment of wreckage', which should be updated and expanded. For now, the SDF 3 provides a largely improved and more detailed overview of the shipwrecks of the former Zuiderzee, which can be used by scientists as well as policymakers.

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Appendix 1. Primary data on all 449 shipwrecks in the SDF 3

WNG	Name	Acc.	Pres.	Type	Wreckage
60166	2E-West; (ZA 32) Wijk 13 De Almeerder Kogge	1	C	cog	1400-1450
55205	3Z6 (ZC3) De Vliegende Hollander	1	A	unknown	unknown
400424	Blocq van Kuffeler	2	C	Volendammer kwak	1900 (or shortly after)
	De Onderneming	2	C	tjalk	1916 (14-12)
30873	Dijkvak 1	2	C	jolly	1000-1500
60254	Dijkvak 2	2	C	unknown	1800-1810
	Hanzerak West	1	C	pram/tjalk-like	1860-1890
47869	IJsselmeer Houtribsluizen 1	1	A	unknown	1465-1510
46550	IJsselmeer Rotterdamse hoek	1	A	unknown	unknown
408303	IJsselmeer Urk 1	1	A	unknown	unknown
412597	IJsselmeer Urk 2	1	A	unknown	unknown
423970	IJsselmeer Urk 3	1	A	unknown	unknown
	IJsselmeer Urk con-1	1	A	fishing vessel	unknown
	IJsselmeer Urk con-2	1	A	unknown	unknown
	IJsselmeer Urk con-3	1	A	unknown	unknown
	IJsselmeer Urk-roeisloep	1	A	flatboat	1900-2017
400425	James Stewartstraat Almere	2	C	unknown	unknown
	Johanna	1	C	tjalk	1913 (14-03)
47945	Ketelmeer 1	1	A	freighter	1750-1800
	Ketelmeer West	1	A	freighter	unknown
46507	Markermeer Enkhuizerzand 1	1	A	galleon	unknown
46527	Markermeer Enkhuizerzand 2	1	A	unknown	unknown
46902	Markermeer Enkhuizerzand 3	1	A	unknown	1700-1800
46903	Markermeer Enkhuizerzand 4	1	A	unknown	1850-1950
50562	Markermeer Enkhuizerzand 5	1	A	unknown	1867?
47878	Markermeer Kuil van Marken 1	1	A	tjalk-like	1700-1800
	Markermeer sonar contact 109	1	A	unknown	1500-1700
	Markermeer sonar contact 137	1	A	tjalk (Eendracht)	1918 (01-03)
	Markermeer sonar contact 149	1	A	unknown	1600-1800
	Markermeer sonar contact 31	1	A	unknown	1600-1700
	Markermeer sonar contact 35	1	A	unknown	1600-1700
	Markermeer sonar contact 71	1	A	unknown (Kendragt?)	unknown
47300	NA12-I	1	C	merchantman	1600-1700
	NA12-II	2	B	unknown	unknown
	NA16	3	C	fishing vessel	unknown
28986	NA31	1	A	pram	1770-1800
54839	NA55	1	A	freighter	1800-1900
54840	NA57	1	C	cog	1275-1300
54841	NA59	1	C	unknown	1700-1900
47301	NA77	1	C	merchantman	1617-1650
54833	NA8	3	C	unknown	1550-1600
54842	NA82	3	C	unknown	1900-2000
54845	NB11	3	C	fishing vessel (?)	1500-1650
423396	NB36	1	A	freighter	1475-1525
54846	NB39	2	C	unknown	1500-1650
405020	NB47	1	A	freighter	1550-1575
54847	NB6	1	C	tjalk	1787

WNG	Name	Acc.	Pres.	Type	Wreckage
54848	NB97	1	A	unknown	1500-1650
54861	NC114	2	C	unknown	unknown
54863	NC117/NC118	2	C	barge	1850-1950
29035	NC12	2	B	waterschip	1600-1700
405021	NC120	2	B	freighter	1500-1600
54864	NC130	2	C	tjalk-like	1831
54849	NC23	2	C	unknown	1875-1900
54850	NC24	3	C	unknown	1700-1900
28988	NC40	2	B	merchantman	1625-1650
54853	NC51	1	A	merchantman	1734-1780
54854	NC53	2	B	unknown	unknown
54857	NC59	2	C	unknown	unknown
54858	NC69	1	A	unknown	unknown
54859	NC82	1	C	kat	1790-1800
54860	NC85	1	C	merchantman	1600-1700
	NC87	3	C	unknown	unknown
54873	ND113	3	C	unknown	unknown
54868	ND12	3	C	unknown	unknown
54874	ND124	2	C	unknown	unknown
54870	ND25	1	B	unknown	1500-1700
409599	ND86-I	1	A	unknown	> 1700
436940	ND86-II	1	A	unknown	unknown
54871	ND92	1	C	unknown	unknown
54872	ND93	1	C	unknown	unknown
	NE103	3	C	unknown	unknown
54882	NE114	3	C	unknown	1900-2000
54888	NE131	2	C	unknown	> 1800
	NE133	3	C	unknown	unknown
54889	NE155	3	C	unknown	1500-1650
27767	NE157	2	C	unknown	> 1800
54890	NE159	3	C	unknown	1600-1700
54891	NE160	2	C	waterschip	1650-1700
47304	NE161	1	C	tjalk-like	1750-1775
47306	NE163	2	C	pram-like	1843-1900
54892	NE164	2	C	tjalk	1890-1910
54894	NE165	1	C	pram	1700-1710
54895	NE172	2	C	unknown	> 1800
60277	NE25	1	A	freighter	1740-1760
54876	NE39	1	C	merchantman	1600-1625
54877	NE42/NE43	1	C	unknown	1600-1700
54879	NE59	2	B	unknown	1500-1700
54875	NE7	1	C	unknown	1700-1900
47303	NE72	2	B	schokker	1820 (or shortly after)
54880	NE81	1	C	pinas	1650-1675
54881	NE87	1	C	bok	1600-1700
54896	NF1/NF2	1	C	punter	1500-1650
54897	NF14	3	C	freighter	1790-1800
54898	NF36	1	A	tjalk-like	1825-1850
54899	NF86	2	C	punt-like	1500-1600
48144	NG11	2	C	unknown	1650-1850
47628	NG29	1	C	waterschip	1700-1900
	NG30	3	C	freighter	1600-1700

WNG	Name	Acc.	Pres.	Type	Wreckage
	NG34-I	3	C	unknown	1600-1700
	NG34-II	3	C	schokker	1600-1700
404911	NG35	1	A	freighter	1425-1450
	NG37	1	C	cog-like	1200-1300
49494	NG43	1	A	unknown	unknown
54902	NG45	1	A	unknown	unknown
54903	NG60	2	C	unknown	1600-1700
54905	NG67/NG68	3	C	unknown	unknown
54955	NG87	1	C	steamer (Reserve I)	1921
54909	NG98	2	C	unknown	unknown
47308	NH49	2	C	pram	> 1850
54910	NH50	1	C	unknown	> 1800
49849	NH57	1	A	unknown	1500-1600
54911	NH61	3	C	unknown	unknown
27541	NH62	3	C	unknown	unknown
54912	NH71/NH72	1	A	fishing vessel	1800-1850
54913	NH73	1	C	pram	1775-1800
54936	NJ129	2	C	flatboat/jolly	1900-2000
54937	NJ130	1	A	jolly	1650-1700
54938	NJ137	1	C	freighter	1450-1500
27964	NJ7	1	C	merchantman	1650-1650
54914	NJ76	1	C	flatboat	1900-2000
54915	NJ88	1	C	unknown	unknown
60278	NK1	2	C	tjalk/boyer-like	unknown
54958	NK23	3	C	unknown	1600-1700
47310	NK28	1	C	freighter	1900-1925
47311	NK34/NK35	1	C	unknown	1850-1900
54959	NK38	3	C	unknown	unknown
54960	NK47-I	2	B	unknown	unknown
418467	NK47-II	1	A	merchantman	1700-1750
54961	NK53	2	B	unknown	1700-1800
54964	NK56	1	A	unknown	unknown
	NK7	2	B	freighter	1875-1925
54975	NL23	3	C	unknown	1800-1900
54976	NL46	3	C	unknown	unknown
47312	NL61	1	C	tjalk-like	1775-1825
54977	NL63	3	C	unknown	unknown
54979	NM10	2	C	unknown	1800-1825?
60167	NM107	1	A	cog	1380-1380
54984	NM131	2	C	unknown	unknown
54985	NM133-I	3	C	cog	1000-1500
	NM133-II	1	A	unknown	1850-1950
	NM14	3	C	freighter	unknown
47314	NM20	1	C	tjalk-like	1815-1825
54981	NM24	3	C	unknown	1904-1925
54982	NM30	3	C	unknown	1875-1900
54983	NM39	1	C	unknown	1500-1700
47315	NM40	2	B	cog-like	1500-1600
47834	NM46	1	A	yawl	unknown
401597	NM49	2	C	unknown	unknown
54978	NM9	3	C	unknown	1700-1800
47369	NM93	1	C	fishing vessel (cog/pram)	1575-1625

WNG	Name	Acc.	Pres.	Type	Wreckage
47370	NN14/NN15	1	C	barge	1600-1800
54986	NN30/NN31	2	C	unknown	1800-1900
47371	NN38	1	C	Zeeuwse poon	1876-1876
55031	NN43	3	C	unknown	unknown
55038	NN45	3	C	unknown	unknown
54997	NO103	3	C	unknown	unknown
54990	NO27	2	B	unknown	1200-1600
47372	NO28	1	C	cog/hulk	1400-1500
54992	NO38	3	C	freighter	unknown
54993	NO41	3	C	freighter	unknown
54994	NO42	3	C	unknown	unknown
54995	NO50	3	C	freighter	1600-1625
54996	NO52	1	C	unknown	unknown
	NO79-I	3	C	freighter	1600-1700
47373	NO79-II	1	C	pram	1650-1700
60279	NO9	3	C	jolly	unknown
47374	NO90	2	B	fishing vessel	1600-1700
47375	NO99	2	C	fishing vessel	1590-1610
55000	NP15	1	C	flatboat/punt	1800-1850
54998	NP2	2	C	unknown	1800-1900
55001	NP23-I	1	C	schokker	1650-1800
47381	NP23-II	1	C	fishing vessel	1600-1700
	NP32	3	C	unknown	unknown
55003	NP33	1	C	waterschip	1600-1650
	NP34	3	C	unknown	unknown
47383	NP40	1	C	waterschip	1550-1650
47377	NP4-I	2	C	fishing vessel	1600-1625
54999	NP4-II	2	C	freighter	1675-1700
55004	NP77	3	C	unknown	1850-1875
47384	NP83	2	C	schokker	1600-1700
55005	NP84	1	A	unknown	< 1800
55006	NQ11	3	C	unknown	unknown
55028	NQ36	3	C	unknown	unknown
47385	NQ38	1	B	freighter	1580-1590
55007	NQ40	3	C	fishing vessel	1900-2000
55008	NQ65-I	1	C	unknown	1600-1650
47387	NQ65-II	1	C	fishing vessel	1800-1825
55009	NQ70	3	C	unknown	unknown
55010	NQ74	2	C	unknown	unknown
12465	NQ75	2	C	cog	1300-1325
47389	NQ80/NQ81	2	C	freighter	1750-1800
28989	NQ83	1	A	fishing vessel	1440-1460
55011	NQ95	1	C	unknown	unknown
47427	NR13	2	C	waterschip	1640-1650
55017	NR14	2	C	unknown	unknown
55013	NR1-I	1	C	cog/pram-like	1300-1700
55014	NR1-II	1	C	pram	1500-1600
55012	NR1-III	1	C	unknown	1500-1600
	NR1-IV	3	C	fishing vessel	1700-1800
55015	NR2	3	C	dugout canoe	unknown
55016	NR3	2	C	freighter	1775-1825
49935	NR4	1	C	freighter	> 1593-1600

WNG	Name	Acc.	Pres.	Type	Wreckage
47428	NR43	2	C	pram	1650-1700
55018	NR45	3	C	unknown	1690-1710
55019	NR62/NR63	1	C	pram	1500-1600
55020	NR77	3	C	unknown	unknown
	NR84	3	C	unknown	unknown
55021	NR85-I	1	C	unknown	1900-2000
55022	NR85-II	3	C	flatboat	1900-2000
60238	NS101	3	C	freighter	1900-1925
55023	NS83	2	C	fishing vessel	1700-1800
55024	NT100	2	B	pram	1700-1800
55025	NT103	2	C	fishing vessel	1800-1850
55036	NT118	3	C	jolly	unknown
408616	NT25	1	A	cog-like	1300-1400
55029	NT3	3	C	unknown	unknown
55037	NT35	3	C	unknown	unknown
55032	NT57	3	C	freighter	1800-1900
55033	NT70	2	B	ferry	unknown
47607	NT85	2	C	dugout canoe	700-300 BC
55034	NT88	2	C	unknown	unknown
60246	OA16	1	B	fishing vessel	unknown
60247	OA40	1	C	unknown	unknown
28996	OA55	1	A	fluyt	1650-1700
60248	OA58	3	C	jolly	unknown
55046	OA61	3	C	jolly	unknown
55047	OB13	1	C	pram-like	1600-1625
55048	OB19	1	C	mud scow	1650, around
49924	OB20	1	B	fishing vessel	1550-1600
55049	OB51	1	C	pram	1675-1700
55162	OB55-I	1	C	pram-like	1500-1525
55163	OB55-II	1	C	tjalk	1731 (or shortly after)
60249	OB71	1	C	freight boyer	1620, around
28997	OC19	1	A	waterschip	1500-1600
55051	OC52	1	C	pram-like	1850-1875
28998	OC60	1	A	waterschip	1600-1700
55054	OD15	1	C	pram-like	> 1740
55055	OD16	1	B	freighter	unknown
55053	OD2	1	C	freighter	1850-1875
55056	OD25	1	A	fishing vessel	1690-1710
55057	OD31	1	C	jolly	unknown
55058	OD37	2	C	unknown	unknown
28999	OD41	1	A	pram-like	1840-1860
55060	OE14	1	B	pram	1783 (or shortly after)
55062	OE34	1	C	tjalk	1572
55063	OE46	1	B	tjalk-like	1851-1900
55064	OE48	1	C	freighter	1768-1900
55165	OF12	1	A	waterschip	1600-1625
55166	OF18	2	C	punter	unknown
47791	OF3 - Zeehond	1	C	Groninger tjalk (Zeehond)	1886
55065	OF34	1	B	tjalk	1700-1725?
55167	OF60	2	B	botter-like	1875-1885
55168	OG116	1	C	freighter	1600-1630
415489	OG158	2	B	unknown	1500-1850

WNG	Name	Acc.	Pres.	Type	Wreckage
28991	OG29	1	A	freighter	1600-1650
55068	OG34	1	C	waterschip	1625-1650
55069	OG35	3	B	unknown	< 1600
	OG42	3	B	unknown	unknown
29037	OG43	1	B	freighter	1739
55658	OG64	1	C	fishing vessel	1525-1550
55072	OG73	2	C	unknown	unknown
49690	OG77	1	A	cog-like	1400-1600
55088	OH101	1	C	unknown	unknown
28967	OH107	1	C	pram	1675-1725
55170	OH121	2	C	barge-like	<1800
55075	OH27	3	C	freighter	1637-1675
55076	OH31	3	B	unknown	1920-1940
55077	OH32	3	B	unknown	unknown
55078	OH34	1	C	unknown	unknown
29038	OH38	2	B	tjalk	1700-1800
29596	OH41-I	3	B	unknown	1600-1800
55169	OH41-II- de Ventjager	1	C	ventjager	> 1710
55081	OH46	3	B	unknown	1850-1950
55080	OH48 - Lutina	1	C	pram/barge (Lutina)	1888 (20-11)
437889	OH49 (Beverweg)	1	B	unknown	unknown
49594	OH51	3	B	freighter	1800-1900
28970	OH60	1	B	freighter	1800-1850
29039	OH61	1	C	fishing vessel	< 1650
55084	OH66	1	B	unknown	1600-1700
55074	OH7	3	B	unknown	unknown
55085	OH71	1	C	pram-like	1825-1875
55086	OH92	1	C	pram-like	1890-1910
55087	OH97	1	B	unknown	1500-1600
55091	OJ68-I	1	A	pram=like	1700-1800?
55092	OJ68-II	1	C	fishing vessel	1800-1950
55090	OJ9	1	A	fishing vessel	1500-1700
55093	OK1	3	B	unknown	unknown
55095	OK10-I	1	C	fishing vessel	1900-1950
55096	OK10-II	1	C	fishing vessel	1900-1950
55097	OK18	1	C	fishing vessel	1800-1950
55098	OK23	3	C	merchantman	unknown
55099	OK35	1	C	unknown	1800-1950?
55100	OK37	2	C	jolly	1800-1950?
55101	OK45	1	C	tjalk-like	1672-1673
55102	OK63A	1	C	yawl	1800-1950
55103	OK64	1	C	pram-like	1800-1825
55104	OK73/OK74	1	C	freighter	> 1458-1500
55105	OK76	2	C	tjalk	1870-1900?
55172	OK83	3	B	unknown	1500-1700
49615	OK84-I	1	C	tjalk	1550-1600
55174	OK84-II	1	C	waterschip	1575-1600
55106	OL10	1	C	steamer	1900-1950?
55107	OL79	1	C	freighter	1795 (or shortly after)
55108	OL84	1	C	pram-like	1825-1850
55109	OL85	1	B	yawl	1800-1810
28971	OL89	1	C	peat boat	>1558

WNG	Name	Acc.	Pres.	Type	Wreckage
	Olnn	3	B	pram-like	1890-1900
55112	OM11 - Biddinghuizer Colfschip	1	C	freighter	1540, around
	OM42	3	B	unknown	1850-1900
28980	OM61	2	B	cog	1290-1340
55114	OM65	1	B	lighter	1697-1710
55111	OM8	1	A	pram-like	1700-1750
45654	ON10	1	C	fishing vessel	1650-1850
55119	ON10/ON11	1	B	waterschip	1600-1700
55120	ON24	3	B	unknown	unknown
55121	ON39	1	C	unknown	unknown
55123	ON42	1	C	freighter	1850-1900
55124	ON44	3	B	unknown	1500-1700
55125	ON45	1	A	freighter	1675-1725
55126	ON47-I	1	C	unknown	unknown
55127	ON47-II	2	C	freighter	1500-1700
55128	ON47-III	2	C	unknown	1600-1700
55115	ON5	1	C	cog-like	1320-1330
55175	ON59 (ON 23)	3	B	fishing vessel	unknown
55176	ON64	3	C	unknown	unknown
	ON66	3	B	fishing vessel	unknown
55130	ON67-I	3	C	unknown	1700-1800
55131	ON67-II	3	B	unknown	1700-1900
28969	ON6-I	1	B	unknown	unknown
28969	ON6-II	3	B	freighter	1600-1610
55132	ON96	1	C	unknown	1500-1600
55133	OO2	1	C	freighter	1825-1850
55134	OO29	2	B	fishing vessel	unknown
55135	OO30	1	C	fishing vessel	unknown
28975	OO64A	1	A	freighter	>1741
55137	OO65	3	C	pram	1840-1860
29045	Oostvaardersplassen, wreck 90	3	A	freighter	> 1500
55140	OP104-I	2	C	fishing vessel	1900-1938
55141	OP104-II	2	C	fishing vessel	1900-1940
55142	OP104-III	2	C	fishing vessel	1900-1940
55143	OP104-IV	2	C	fishing vessel	1900-1950?
55138	OP72	1	C	freighter	1600-?
55139	OP86	1	C	unknown	unknown
60274	OQ105/Het Spijk IV	1	C	unknown	unknown
60275	OQ106/Het Spijk III	1	C	fishing vessel	1850-1950
60271	OQ55/Het Spijk I	2	C	fishing vessel	unknown
60273	OQ57/Het Spijk II	2	C	unknown	unknown
	OR35	3	B	unknown	unknown
28978	OR49	1	C	merchantman	1650-1700
55145	OS19	1	A	merchantman	1625-1650
55144	OS2	2	B	steamer	1900-1910
55146	OT21	2	C	tjalk-like	1791-1830
55147	OT23	1	C	waterschip	1600-1650
400421	OT3	3	B	unknown	unknown
55148	OT34	2	B	fishing vessel	unknown
55153	OU105	1	B	tjalk	1700-1850
28985	OU113	1	A	waterschip	1750-1800
55149	OU34	1	C	merchantman	1530-1550

WNG	Name	Acc.	Pres.	Type	Wreckage
28982	OU41	1	B	waterschip	1500-1850
55151	OU43	1	C	unknown	unknown
55152	OU86	1	C	fishing vessel	1600-1625
55156	OW10	1	C	waterschip	1560, around
55157	OY11	1	B	fishing vessel	unknown
55158	OY96	1	C	fishing vessel	1900-1950
55159	OY97	1	C	freighter	unknown
28984	OZ27	1	B	pram	1700-1800
55161	OZ73	3	B	fishing vessel	1600-1625
	P.I. 65	2	C	fishing vessel	1917 (28-06)
	Vijf Gebroeders	2	C	tjalk	1926 (13-11)
29012	ZA105 De Ravage	1	A	freighter	1640-1670
29015	ZA114 De Slagzij	1	A	freighter	1500-1700
29016	ZA115 De Werkschuit	1	A	construction vessel	1900-1925
401601	ZA121 De Roerdomp	1	A	fishing vessel	unknown
29018	ZA41 Het Kalkschip	1	A	freighter	1650-1700
400423	ZA70	3	B	unknown	unknown
55201	ZA71 De Pram	1	C	pram	1775-1800
29003	ZA79 De Visbun	1	A	fishing vessel	1600-1625
29007	ZA87-II De Modderschouw	1	C	mud scow	1600-1700
	ZA87-III De Rechthoek	1	A	unknown	unknown
29006	ZA87-IV De Zuiderzeeparel	1	A	freighter	1400-1500
55203	ZA88	1	B	unknown	1600-1650
29011	ZA89 De Tjalk	1	A	tjalk	1650-1700
29044	ZA91 De Golf	1	A	waterschip	1800-1850?
400034	ZA97	1	C	tjalk-like	1869
55204	ZB6	2	C	flatboat	1900-1925
55206	ZC29	1	C	unknown	unknown
33664	ZC41 De Molensteen	1	A	unknown	1500-1650
47211	ZC46	3	A	cog	1300-1350
60160	ZF24 De Bomenboot	1	A	freighter	1500-1550
29013	ZG13 Het Hanzeschip	1	A	cog-like	1525-1575
55207	ZG50	2	C	unknown	unknown
29014	ZG59	1	A	fishing vessel	1700-1800
29022	ZG80 De Branding	1	A	waterschip	1625-1650
55209	ZH16	1	C	freighter	1620-1630
55208	ZH7	1	C	flatboat	unknown
29004	ZH9	1	A	waterschip	1600-1700
29000	ZJ40/ZJ41	1	A	waterschip	1550-1575
405235	ZK05	3	B	unknown	1750-1800
29024	ZK45/ZK46 De Parabool	1	A	freighter	1775-1900
29025	ZK47 Visserijoorlog	1	A	waterschip	1550-1575
55210	ZK53	1	C	waterschip	unknown
55211	ZL1	1	C	pram-like	> 1605
29026	ZL26	1	A	freighter	1774-1800
	ZL27	3	B	unknown	unknown
29023	ZL5	1	A	cog	1475-1500
	ZL6	3	B	pram	1664-1700
55212	ZL8	1	C	fishing vessel	1750-1800
55215	ZM22	1	C	waterschip	unknown
55217	ZM23	1	C	unknown	unknown
29002	ZM25	1	A	freighter	1600-1800

WNG	Name	Acc.	Pres.	Type	Wreckage
55218	ZM41	1	C	botter	1875-1925
55219	ZM42-I	3	B	unknown	unknown
55220	ZM42-II	3	B	unknown	unknown
55221	ZM43/ZM44	3	B	unknown	unknown
55213	ZM6	2	C	mud scow	1600-1610
55214	ZM8	1	C	tjalk-like	unknown
29027	ZN103	1	A	unknown	1550-1600
29029	ZN113	1	A	waterschip	1525-1550
	ZN42-I	3	C	cog	unknown
	ZN42-II	1	C	waterschip	1550-1575
55226	ZN43	2	B	cog	1400-1500
55227	ZN43/ZN44	1	C	waterschip	1500-1550
55228	ZN51/ZN52	2	B	unknown	unknown
29030	ZN61	1	A	fishing vessel	1600-1625
55229	ZN66W-I	1	C	cog-like	1400-1500
55230	ZN66W-II	1	C	freighter	> 1774
55231	ZN74-I	1	C	waterschip	1500-1550
55232	ZN74-II	1	C	waterschip	1500-1550
29034	ZO31	1	A	waterschip	1500-1525
29337	ZO36	1	A	cog	1325-1375
29043	ZO39	1	A	waterschip	1550-1600
400648	ZO43	1	B	cog-like	1275-1300
55233	ZO45	1	C	jolly	1900-2000
55234	ZO65	3	B	unknown	unknown
55235	ZO69	1	C	waterschip	1625-1675
55236	ZO71	1	C	tjalk	1685 (or shortly after)
55237	ZP15	3	B	freighter	unknown
55238	ZP33	1	A	freighter	1700-1750
	ZP37-I	1	B	pram-like	1720-1740
29028	ZP37-II	1	B	freighter	1750, around
55240	ZP49-I	1	B	fishing vessel	unknown
	ZP49-II	3	B	dugout canoe	unknown
55242	ZP5/ZP6	1	A	pram-like	1900-1950
55241	ZP52	1	C	freighter	unknown
55243	ZQ18	1	C	tjalk-like	1890-1910
55244	ZQ4	1	C	construction vessel	1900-1950
55245	ZQ48/ZQ49	2	C	unknown	1800-1950
408589	ZW76	3	B	unknown	unknown

Appendix 2. Overview of the 218 records in the SDF that were adjusted

Wreck name	Type adjustment	Explanation	Dev.
3Z6 - De Vliegende Hollander	estimate/random	Coordinates do not match description of actual wreck site	360
NA12-II	estimate/random	Distance to the road is adjusted (300m), other distance is unknown	100
NA55	estimate/random	Wreck was found in ditch instead of on the lot itself	50
NA59	other error	Incorrect coordinates in Shipwreck Catalog	
NA77	center coordinates	Center coordinates adjusted: the real location of the wreck site is visible on the aerial photographs from 1949	350
NA8	wrong lot	The coordinates provided were those of the center of lot NB 8 instead of NA 8	5300
NB6	center coordinates	Coordinates adjusted because of detailed description of wreck site in documentation	50
NB97	estimate/random	Incorrect location: wreck lies near the farm, not in the southern part of the lot	440
NC51	other error	Wrong Y-coordinate: 523860 is 526850	2730
NC53	estimate/random	Coordinates do not match description of actual wreck site	155
NC59	estimate/random	Coordinates do not match description of actual wreck site	255
NC69	estimate/random	Coordinates do not match description of actual wreck site	50
NC82	estimate/random	Coordinates do not match description of actual wreck site, wreck site clearly visible on aerial photograph from 1981	100
NC85	estimate/random	Coordinates do not match description of actual wreck site	30
ND25	center coordinates	Center coordinates adjusted: based on discoloration on aerial photographs and description of wreck site in documentation	265
ND92	estimate/random	Coordinates do not match description of actual wreck site	330
ND93	estimate/random	Coordinates do not match description of actual wreck site	400
NE155	wrong lot	The coordinates provided are those of the center of lot NE 162 instead of NE 155	795
NE160	wrong lot	The description of the wreck site in Archis and the Shipwreck Catalog contains a type error and the wreck is therefore wrongfully positioned on lot NE 161	250
NE161	estimate/random	Coordinates do not match description of actual wreck site	155
NE163	estimate/random	Coordinates do not match description of actual wreck site	260
NE39	estimate/random	Coordinates do not match description of actual wreck site. Furthermore, the aerial photographs from 1949 clearly depict the wreck site	170
NE42/43	estimate/random	Coordinates in Archis are incorrect, they do not match description of the actual wreck site	455
NE59	estimate/random	Coordinates do not match description of actual wreck site, only distance to ditch was traceable	230
NE7	wrong lot	The coordinates provided were those of lot NE 6	350
NE81	estimate/random	Coordinates do not match description of actual wreck site. Aerial photographs from 1960 clearly depict the true wreck site	445
NE87	wrong lot	The coordinates provided were those of lot NE 86. The wreck is however clearly visible on lot NE 87 on the aerial photographs from 1949	275
NF1/2	estimate/random	Coordinates do not match description of actual wreck site	65
NF36	estimate/random	Coordinates do not match description of actual wreck site	150
NF86	estimate/random	Incorrect wreck location in Archis and the Shipwreck Catalog. Exact location not clear, but a discoloration on aerial photographs might be an indication	210
NG11	estimate/random	Coordinates of Archis and Shipwreck Catalog contradict and are unreliable, those of Archis fit best to the description of the wreck site	260

Wreck name	Type adjustment	Explanation	Dev.
NG29	estimate/random	Wreck site description does not match coordinates of Shipwreck Catalog. Archis coordinates seem most reliable	120
NG35	estimate/random	Small adjustment to relative precise location	30
NG37	estimate/random	Coordinates do not match description of actual wreck site	90
NG43	estimate/random	Coordinates do not match description of actual wreck site	425
NG45	estimate/random	Coordinates do not match description of actual wreck site	350
NG87	estimate/random	Small adjustment to relative precise location	22
NH49	estimate/random	Coordinates do not match description of actual wreck site	160
NH50	estimate/random	Coordinates do not match description of actual wreck site	170
NH57	estimate/random	Coordinates do not match description of actual wreck site	70
NH71/72	estimate/random	Coordinates do not match description of actual wreck site. The number of drains on the aerial photographs reveal the true location of the shipwreck	570
NH73	estimate/random	Coordinates do not match description of actual wreck site	65
NJ129	estimate/random	Wreck is depicted in northern part of the lot, while it should be located in the southeastern part	555
NJ130	wrong lot	Wreck is depicted in a forest, while the real wreck site lies next to a school (detailed drawing in documentation)	400
NJ137	estimate/random	Coordinates do not match description of actual wreck site	70
NJ7	estimate/random	Wreck lies by coincidence in the center of the lot, small adjustment to provided coordinates	30
NJ76	center coordinates	Center coordinates adjusted: aerial photographs and description of wreck site reveal real location	240
NJ88	estimate/random	Coordinates do not match description of actual wreck site	90
NK1	wrong lot	The coordinates provided were those of lot NA 1	1045
NK28	estimate/random	Coordinates do not match description of actual wreck site	160
NK34/35	estimate/random	Coordinates do not match description of actual wreck site	70
NK38	wrong lot	The coordinates provided were those of lot NK 36. No wreck site description available, therefore center coordinates of NK 38 adopted	120
NK47-I	estimate/random	Coordinates do not match description of actual wreck site	65
NK56	estimate/random	Coordinates do not match description of actual wreck site	300
NK7	wrong lot	The coordinates provided were those of lot NH 7	850
NL61	estimate/random	Coordinates do not match description of actual wreck site	80
NM107	estimate/random	The provided coordinates are those of the present location of the wreck, the actual wreck site is 25m to the northeast	25
NM131	wrong lot	Coordinates do not match description of actual wreck site, wreck should be close to the channel	1035
NM133-II	estimate/random	Coordinates do not match description of actual wreck site	365
NM20	estimate/random	Coordinates do not match description of actual wreck site	50
NM39	estimate/random	Coordinates do not match description of actual wreck site, the timbers might belong to the wreck on lot NM 40	115
NM46	estimate/random	Coordinates do not match description of actual wreck site	35
NM93	estimate/random	Coordinates do not match description of actual wreck site	45
NN38	estimate/random	Coordinates do not match description of actual wreck site	20
NO27	center coordinates	Center coordinates adjusted: real location unknown, but description of wreck site used as indication	305
NO28	estimate/random	Small adjustment to relative precise location	20
NO52	estimate/random	Coordinates do not match description of actual wreck site	60
NO79-I	estimate/random	Coordinates do not match description of actual wreck site	30
NO79-II	estimate/random	Coordinates do not match description of actual wreck site	55
NP15	estimate/random	Coordinates do not match description of actual wreck site	45
NP2	estimate/random	Coordinates do not match description of actual wreck site, no clear description of the real wreck location	200
NP33	estimate/random	Coordinates do not match description of actual wreck site	50
NP40	estimate/random	Coordinates do not match description of actual wreck site	70

Wreck name	Type adjustment	Explanation	Dev.
NP84	center coordinates	Coordinates do not match description of actual wreck site	325
NQ36	other error	The provided coordinates from Archis position the wreck on lot NP 91, the Ship Catalog uses center coordinates that are also used in this database	1050
NQ38	estimate/random	Coordinates do not match description of actual wreck site	75
NQ65-I	estimate/random	Coordinates do not match description of actual wreck site	50
NQ65-II	estimate/random	Coordinates do not match description of actual wreck site	105
NQ74	estimate/random	Coordinates do not match the approximate description of actual wreck site	410
NQ95	estimate/random	Coordinates do not match description of actual wreck site	190
NR14	center coordinates	Center coordinates adjusted: wreck was found underneath the Uiterdijkenweg	515
NR1-I	estimate/random	Coordinates do not match description of actual wreck site	350
NR1-II	estimate/random	Coordinates do not match description of actual wreck site	575
NR1-III	estimate/random	Coordinates do not match description of actual wreck site	170
NR4	estimate/random	Coordinates do not match the real coordinates that were derived during the excavation in 2009	255
NR43	estimate/random	Small adjustment to relative precise location	15
NR85-I	center coordinates	Center coordinates adjusted: there is no clear description of the wreck site, but the excavation pit is clearly visible on aerial photographs	280
NS83	center coordinates	Coordinates do not match description of actual wreck site, partially adjusted due to a lack of detailed information	270
NT35	wrong lot	The coordinates provided were those of lot NT 36. There is no description of the real location, therefore center coordinates of lot NT 35 are used	565
NT70	estimate/random	Coordinates do not match description of actual wreck site	425
NT88	estimate/random	Coordinates do not match description of actual wreck site	90
OA58	wrong lot	The coordinates provided were those of lot OA 60 (center). The real location can only be estimated as the documentation mentions “southeast corner” of lot OA 58	860
OB55-I	estimate/random	Small adjustment to relative precise location	30
OB55-II	estimate/random	Small adjustment to relative precise location	20
OC60	estimate/random	Small adjustment to relative precise location	11
OD15	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	250
OD16	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	180
OD2	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	220
OD31	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	220
OD37	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	430
OE14	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	310
OE46	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	240
OE48	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	460
OF18	estimate/random	Coordinates do not match description of actual wreck site	130
OF3	wrong lot	The coordinates provided in the official report wrongfully position the wreck on lot OF 2, while real location of the wreck is visible on aerial photographs and field drawings	310
OF34	center coordinates	Center coordinates adjusted, using the original wreck site description and aerial photographs	400
OF60	estimate/random	Coordinates do not match description of actual wreck site	155

Wreck name	Type adjustment	Explanation	Dev.
OG116	center coordinates	Center coordinates adjusted, using aerial photographs from 1971 that depict the exact location of the excavation	360
OG34	center coordinates	Center coordinates adjusted, aerial photographs from 1971 clearly depict the real wreck site	130
OG73	estimate/random	Coordinates do not match description of actual wreck site	70
OH101	other error	The description of the wreck site is incorrect: it says 500m from main water course and 25m from H100/101, while it should be 550m from main water course and 25m from H101/102	250
OH121	wrong lot	The coordinates provided were those of lot OH 9. The documentation provides a more detailed description of the wreck site on lot OH 121 (before called OH 115)	460
OH34	estimate/random	Coordinates do not match description of actual wreck site	355
OH48	estimate/random	Wreck is depicted too far to the north, despite detailed wreck site description. Site clearly visible on aerial photographs from 1971	95
OH66	estimate/random	Coordinates do not match description of actual wreck site	125
OH71	estimate/random	Coordinates do not match description of actual wreck site	125
OH92	estimate/random	Coordinates do not match description of actual wreck site	125
OH97	estimate/random	Coordinates do not match description of actual wreck site	125
OJ68-II	estimate/random	Coordinates do not match description of actual wreck site	80
OK10-I	estimate/random	Coordinates do not match description of actual wreck site	165
OK10-II	estimate/random	Coordinates do not match description of actual wreck site	120
OK18	estimate/random	Coordinates do not match description of actual wreck site	700
OK35	estimate/random	Coordinates do not match description of actual wreck site. The wreck site is however clearly visible on aerial photographs from 1960	130
OK37	estimate/random	Coordinates do not match description of actual wreck site, the wreck should be close to the road	85
OK45	estimate/random	Coordinates do not match description of actual wreck site	120
OK63a	wrong lot	The name OK 63a refers to a lot that formerly was known as OK 50a (in between OK 50 and OK 33), but has nothing to do with OK 63 in which it is positioned. The real location is visible on aerial photographs from 1960	1000
OK64	estimate/random	Coordinates do not match description of actual wreck site	155
OK76	estimate/random	Coordinates do not match description of actual wreck site	180
OK84-I	estimate/random	Coordinates do not match description of actual wreck site	265
OK84-II	estimate/random	Coordinates do not match description of actual wreck site	70
OL10	wrong lot	The coordinates provided were those of lot OL 26. Based on the original site description and the aerial photographs from 1971, the real location was found	1300
OL84	estimate/random	Coordinates do not match description of actual wreck site	380
OL85	estimate/random	Coordinates do not match description of actual wreck site	170
OL89	estimate/random	Small adjustment to relative precise location	15
OM11	estimate/random	Coordinates do not match description of actual wreck site	110
OM65	center coordinates	Center coordinates adjusted, real wreck site is visible as an discoloration on aerial photographs from 1971	150
OM8	center coordinates	Center coordinates adjusted, based on description of wreck site. Coordinates in official report are incorrect: they depict the wreck on lot OM 7	150
ON10	estimate/random	Small adjustment to relative precise location	20
ON10/11	estimate/random	Small adjustment to relative precise location	15
ON39	center coordinates	Coordinates do not match description of actual wreck site	290
ON42	center coordinates	Center coordinates adjusted, actual wreck site based on aerial photographs from 1960 (they depict the Romney cabin)	340
ON47-I	center coordinates	Center coordinates adjusted, actual site location based on original site description and aerial photographs from 1960	455
ON47-II	estimate/random	Coordinates do not match description of actual wreck site	130
ON47-III	estimate/random	Coordinates do not match description of actual wreck site	80

Wreck name	Type adjustment	Explanation	Dev.
ON5	estimate/random	Small adjustment to relative precise location	12
ON64	wrong lot	The coordinates provided were those of lot ON 65. As there is no clear location description, the center coordinates of ON 64 are used	140
ON66	estimate/random	No clear site description available. Therefore, center coordinates used	25
ON6-I	estimate/random	Coordinates do not match description of actual wreck site. Real site location determined by original site description	770
ON6-II	estimate/random	Coordinates match description of real wreck site of ON 6-I. Real site location of ON 6-II based on original site description	110
ON96	wrong lot	Wreck is depicted on lot ON 97, while the actual location is next to the N307 road near lot ON 96	160
OO2	estimate/random	Coordinates do not match description of actual wreck site	265
OO29	estimate/random	Coordinates do not match description of actual wreck site, but exact location remains unclear	100
OO30	wrong lot	The coordinates provided were those of lot OO 31. The actual wreck location could be derived from the original documentation	750
OP104-I	estimate/random	The wreck locations on lot OP 104 are placed next to each other at a random location. The original documentation provides a better indication of the real locations	235
OP104-II	estimate/random	The wreck locations on lot OP 104 are placed next to each other at a random location. The original documentation provides a better indication of the real locations	140
OP104-III	estimate/random	The wreck locations on lot OP 104 are placed next to each other at a random location. The original documentation provides a better indication of the real locations	30
OP104-IV	estimate/random	The wreck locations on lot OP 104 are placed next to each other at a random location. The original documentation provides a better indication of the real locations	45
OP72	center coordinates	Center coordinates adjusted, based on the original description of the wreck site	125
OP86	center coordinates	Center coordinates adjusted, based on the original description of the wreck site	220
OQ105/Het Spijk III	estimate/random	Small adjustment to relative precise location	70
OQ106/Het Spijk IV	estimate/random	Small adjustment to relative precise location	50
OQ55/Het Spijk I	estimate/random	Small adjustment to relative precise location	60
OQ57/Het Spijk II	estimate/random	Coordinates do not match description of actual wreck site, but exact location remains unclear	770
OS2	estimate/random	Coordinates do not match description of actual wreck site	420
OT21	center coordinates	Center coordinates adjusted, based on the original description of the wreck site	360
OT23	center coordinates	Center coordinates adjusted, the actual wreck site is visible on aerial photographs from 1971	400
OT3	wrong lot	Unclear whether this is a wreck. The provided coordinates represent a location on lot OS 71a. Center coordinates of OT 3 used as adjustment	1250
OT34	estimate/random	Coordinates do not match description of actual wreck site	435
OU105	estimate/random	Small adjustment to relative precise location	65
OU113	estimate/random	Small adjustment to relative precise location, based on modern aerial photographs (wreck site cleared of crops)	15
OU34	center coordinates	Center coordinates adjusted, based on aerial photographs from 1981 that clearly depict the wreck site	315
OU86	estimate/random	Coordinates do not match description of actual wreck site, wreck site clearly visible on aerial photographs from 1971 that match the location description	126
OY11	estimate/random	Coordinates do not match description of actual wreck site	114
OY96	wrong lot	The coordinates provided were those of lot OU 106. The actual wreck site location was found by using the original documentation	6420
OY97	estimate/random	Coordinates do not match description of actual wreck site	340
OZ27	estimate/random	Coordinates do not match description of actual wreck site	455

Wreck name	Type adjustment	Explanation	Dev.
ZA71	center coordinates	Center coordinates adjusted, the aerial photographs from 1989 depict the actual wreck site	500
ZA87-II - De Modderschouw	other error	Wreck ZA 87-II is wrongfully depicted on the location of wreck ZA 87-III	235
ZA87-III - De Rechthoek	other error	Wreck ZA 87-III is wrongfully depicted on the location of wreck ZA 87-II	235
ZA87-IV De Zuiderzeeparel	estimate/random	Coordinates do not match description of actual wreck site, the aerial photographs from 1989 depict the actual wreck site	175
ZA88	estimate/random	Coordinates do not match description of actual wreck site	335
ZA97	estimate/random	Coordinates do not match description of actual wreck site	120
ZC29	estimate/random	Coordinates do not match description of actual wreck site	235
ZG50	estimate/random	Coordinates do not match description of actual wreck site. The wreck remains were found somewhere along the incline of the Gooiseweg (center coordinates used)	1120
ZH16	center coordinates	Center coordinates adjusted, based on original documentation	840
ZH7	center coordinates	Center coordinates adjusted, based on original documentation	730
ZK53	center coordinates	Center coordinates adjusted, based on original documentation	825
ZL1	estimate/random	Coordinates do not match description of actual wreck site. The excavation pit is visible on aerial photographs from 1989	350
ZL26	estimate/random	Coordinates do not match description of actual wreck site. The covered wreck is clearly visible on recent aerial photographs	55
ZL5	estimate/random	Small adjustment to relative precise location	15
ZL8	estimate/random	Coordinates do not match description of actual wreck site	130
ZM22	wrong lot	The coordinates provide were those of lot ZM 14. The actual wreck site location is based on the original documentation	650
ZM23	wrong lot	The coordinates provide were those of lot ZM 15. The actual location is based on the original documentation. It is possible that the few timbers belong to ZM 22	1500
ZM41	wrong lot	The coordinates provide were those of lot ZQ 21. The actual wreck site location is based on the original documentation	1640
ZM8	estimate/random	Coordinates do not match description of actual wreck site	700
ZN42-I	estimate/random	Coordinates do not match description of actual wreck site. Actual wreck site location unclear, therefore center coordinates at the back of the lot are used	440
ZN42-II	estimate/random	Coordinates do not match description of actual wreck site	250
ZN43	wrong lot	The coordinates provide were those of lot ZN 42. The actual wreck site location is based on the original documentation	245
ZN43/44	estimate/random	Coordinates do not match description of actual wreck site	760
ZN51/52	wrong lot	The coordinates provide were those of the ditch in between lot ZN 49 and ZO 29. The actual wreck site location is based on the original documentation	1780
ZN61	estimate/random	Small adjustment to relative precise location	34
ZN66w-I	estimate/random	Coordinates do not match description of actual wreck site	216
ZN66w-II	wrong lot	The coordinates provide were those of lot ZN 66o. The actual wreck site location is based on the original documentation	600
ZN74-I	estimate/random	Coordinates from the official report do not match description of wreck location. The actual wreck site is visible on aerial photographs from 1981	280
ZN74-II	estimate/random	Coordinates from the official report do not match description of wreck location. The actual wreck site is visible on aerial photographs from 1981	250
ZO36	estimate/random	Coordinates do not match description of the location. The actual wreck site was found by analyzing LiDAR data and topographic drawing of the excavation pit	320
ZO39	estimate/random	Small adjustment to relative precise location	15
ZO43	center coordinates	Center coordinates adjusted, based on recent aerial photographs and those from 1981	840

Wreck name	Type adjustment	Explanation	Dev.
ZO45	estimate/random	Coordinates do not match description of actual wreck site	240
ZO69	estimate/random	Coordinates do not match description of actual wreck site	255
ZO71	center coordinates	Coordinates do not match description of actual wreck site. The coordinates in the official report (160500,480280) represent a location on lot ZO 72	660
ZP33	estimate/random	Coordinates do not match description of actual wreck site. The location is clearly visible on aerial photographs from 1971 and 1981	310
ZP37-I	estimate/random	Coordinates do not match description of actual wreck site. The location is clearly visible on aerial photographs from 1971	580
ZP49-I	estimate/random	Coordinates do not match description of actual wreck site	380
ZP5/6	estimate/random	Coordinates do not match description of actual wreck site	300
ZP52	estimate/random	Coordinates do not match description of actual wreck site	320
ZQ18	estimate/random	Coordinates do not match description of actual wreck site. The real location is clearly visible as an discoloration on aerial photographs from 1989	330
ZQ4	estimate/random	Coordinates do not match description of actual wreck site	125