Unlocking Historical Sea Level Records through Digitisation—A Review and Inventory

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Abstract

Multi-decadal to centennial sea-level time series are essential for quantifying historic trends in mean and extreme sea levels, refining future projections, calibrating coastal models, and supporting coastal management and adaptation strategies. Data archaeology can increase the spatial coverage and length of timeseries through the recovery of historical observations from paper-based records. However, locating, scanning, digitising, and quality-controlling these records remains labour-intensive. Here, we review published sea-level data archaeology studies and compile a global database of historical tide records identified within them, alongside an inventory of tools available for digitising paper-based datasets. Across 53 published studies, 872 historical sea-level records were identified (representing ~15,264 years of sea-level data). Of these, 241 records have been digitised (~7,823 years of data), while 631 remain undigitised (~7,441 years of data). Most of these records are ledgers (systematic handwritten or printed logbooks of sea-level observations at discreet intervals); there are also marigrams (plots showing continuous records of sea-level variations over time). Manual digitisation remains the dominant recovery method used in most studies. Only one study applied citizen science to capture historic records, and 14 studies used semi-automated algorithms. A broader review of data archaeology across other disciplines identified 20 tools with potential application to digitising sea-level records. By compiling identified records, past recovery efforts and available tools, this inventory provides a foundation for more efficient, consistent, and strategic recovery of historical sea-level data in the future. We aim to update these databases as new records are identified or digitised and encourage researchers to contribute information on records not yet included, helping to improve the completeness of these databases.

Keywords: data archaeology, historical tide record, digitisation, digitisation tools

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1.0 Introduction

Sea-level rise (SLR) is one of the most certain and economically consequential impacts of a warming climate (Rizzo et al. 2025; IPCC, 2023). Since the early 20th Century global mean sea level has risen by 0.2m (Fox-Kemper et al. 2021), with rates reaching ~4.5mm/yr in 2023 (Hamlington et al. 2024). Global sea level rise has accelerated at a rate of 0.02±0.01mm/yr^2 between 1807-2009 (Jevrejeva et al. 2014), and is expected to continue accelerating through the 21st century, with an estimated likely increase in global sea level between 0.15–1.01m by 2100 depending on emission scenarios (IPCC, 2022), although higher increases remain possible (van de Wal et al. 2022).

This rise drives an increase in exceedances of high sea levels and coastal flooding (Taherkhani et al. 2020). Further compounded by coastal urbanisation and population growth (Neumann et al. 2015), and widespread subsidence affecting coastal populations (Nicholls et al., 2021), continued SLR will increase the risk of coastal flooding (Vitousek, et al. 2017; Vousdoukas et al. 2018; Hermans et al. 2023), erosion (Hinkel et al. 2013; Vousdoukas et al. 2020; Hanson et al. 2026), loss of important ecological habitats (Schuerch et al. 2018; Rosencranz et al. 2018; Capistrant-Fossa and Dunton, 2024) and saltwater intrusion (Nicholls and Cazenave, 2010). The IPCC (Intergovernmental Panel on Climate Change) Sixth Assessment Report (2022) estimates the potential risks will grow dramatically; and globally 200 to 900 million people and \$9 to \$14 trillion worth of assets might be threatened by coastal flooding under the highest emissions RCP8.5 scenario by 2100.

Accurate sea-level projections are essential for maximising the success of coastal adaptation strategies and mitigating some impacts of SLR (Slangen et al. 2017; Nicholls and Ballesteros, 2026). Multi-decadal to centennial sea-level time series underpin the quantification of historic trends, refinement of future projections, calibration of coastal models, and support for coastal management (Haigh et al. 2025; Slangen et al. 2017; Seeger and Minderhoud, 2026). To robustly analyse long-term sea-level trends, Douglas (1997) recommends that the dataset span at least 60 years.

In addition to improving sea-level projections, long time series are valuable for developing a deeper understanding of climate variability phenomena, such as El Ninô-Southern Oscillation or the North Atlantic Oscillation (Lai and Dzombak, 2019) as well as identifying unusual and/or extreme flooding events. These records are essential for validating flood models and supporting preparation for, responding to and recovering from major coastal flood events

(Hawkins and Sutton, 2009; Machado et al. 2015; Zerbini et al. 2017; Jevrejeva et al. 2017; Talke et al. 2018).

The Global Sea Level Observing System (GLOSS) is an international sea-level monitoring programme established in 1985 by the Intergovernmental Oceanographic Commission (IOC). It currently comprises 90 participating nations and relies on the coordinated efforts of an international network of agencies. One such agency is the Permanent Service for Mean Sea Level (PSMSL; https://psmsl.org). The global PSMSL dataset comprises monthly mean sea level data from 1611 sites (Holgate et al. 2013), of which only 357 have records are longer than 50 years in length, and 71 have records that are longer than 100 years. Similarly, in the latest global dataset of higher frequency (at least hourly) sea-level records from the Global Extreme Sea Level Analysis (Version 4.1) (GESLA; https://gesla787883612.wordpress.com; Haigh et al. In review) there are only 98 tide-gauge records that are longer than 100 years, and 614 records longer than 50 years. Substantial quantities of paper-based sea-level observations remain in archives. Recovering and digitising these records can substantially extend sea-level time series and improve their value for scientific analysis.

The identification, recovery and use of historical paper-based records is commonly referred to as 'data archaeology' or 'data rescue' (Latapy et al. 2023). The Global Oceanographic Data Archaeology and Rescue (GODAR) project defines data archaeology as *"the process of seeking out, restoring, evaluating, correcting, and interpreting historical data sets"*, and data rescue as *"the effort to save data at risk by digitising manuscript data, copying to electronic media, and archiving these data into an internationally available electronic database"* (Caldwell, 2012). These activities have been undertaken across a wide range of scientific disciplines for decades, with the aim of extending observational records and recovering valuable historical data. Examples include, the digitisation of ship logs (Elms et al. 1993; García-Herrera et al. 2005; Brohan et al, 2008; Allan et al. 2011; Wilkinson et al. 2011; Teleti et al. 2019; Petrakis et al. 2020), weather observations (Page et al. 2004; Ryan et al. 2018; Hawkins et al. 2019; Capozzi et al. 2020; Lorrey et al. 2022; Hawkins et al. 2023; Engström et al. 2023; Noone et al. 2024), seismographs (Chai et al. 2020; Pérez-Campos et al. 2020; Conti et al. 2022), and tide records which is the focus of this paper.

Ideally all data, both paper-based and digital records, should adhere to the FAIR principles for data stewardship (Findability, Accessibility, Interoperability, and Reusability) (Wilkinson et al. 2016). However, in their undigitised state, historical tide records do not meet these standards, as they are often difficult to locate, access, and analyse, and remain vulnerable to permanent loss (Talke and Jay, 2017). This vulnerability is illustrated by records from Portsmouth Naval Base (UK), where systematic sea-level observations began in 1813, but data prior to 1936 have been lost (Haigh et al. 2009).

Given the importance of understanding regional and global sea level variability, and its direct societal implications (Oppenheimer et al. 2019), the preservation and digitisation of these records should constitute a key priority. A crucial first step towards achieving this is through the creation of comprehensive and consistent catalogue of historical tide records. This study builds on and extends previous compilation efforts (e.g. Pouvreau, 2008; Caldwell, 2012; Talke and Jay, 2017) by developing such a catalogue at a broader scale. It also addresses a key knowledge gap identified by Latapy et al. (2023) by compiling an inventory of tools available for the digitisation of historical sea-level records. Accordingly, this paper provides a brief history of paper-based tide records and conducts a detailed review of previous data archaeology studies focused on recovering historical sea-level datasets. Specifically, this paper aims to develop:

1. a consistent and updatable global catalogue of digitised and undigitised historical sea-level records, including metadata on location, temporal coverage, data completeness, format, and digitisation methods; and
2. an inventory of digitisation software tools applicable to the recovery of paper-based sea-level records.

This study aims to build on the previous efforts of researchers who compiled historical sea-level records and data rescue methods, e.g. Pourveau (2008), Caldwell (2012), Talke and Jay (2017) and Latapy et al (2023). While conducting similar research as the forementioned studies, this study differs by increasing the scale of historical record compilation while also creating an easily updatable catalogue so that newly recovered records may be added. Additionally, this study creates the largest inventory of digitisation software tools with potential application to the digitisation of historical sea-level records to date.

For traceability, this review focuses on sea-level data archaeology studies that recover high-frequency records published in the academic literature. Here, high-frequency data are defined as records recovered at a temporal resolution equal to or finer than daily observations.

In addition to high-frequency records, extensive data archaeology efforts have also been undertaken to recover or compile lower-frequency sea-level datasets, defined here as records recovered at temporal resolutions coarser than weekly observations. We identified 17 such studies, comprising 55 records and ~2300 years of digitised data. However, due to the inherent differences in scale between these datasets and high-frequency records, they are not discussed further here. Instead, they are compiled in the online inventory alongside high-frequency, and undigitised records, as well as records from the PSMSL (available at: https://ckenw77.github.io/TideVault/).

We recognise that many unpublished data archaeology efforts have also been undertaken and aim to incorporate these in future work; our catalogue has been designed to be easily extensible, with the aim that this effort will encourage organisations and researchers holding historical data to engage and contribute.

2.0 Measuring Sea Level and Data Types

This section describes the two principal historical methods of measuring sea level (Section 2.1), tide poles and float-based tide gauges, and the main data formats associated (Section 2.2).

2.1 Sea-Level Measurement

Sea-level measurements can be regarded as one of the oldest examples of environmental observations (Pugh, 1987; Cartwright, 1999). Measurement techniques and data formats have evolved over time and vary between locations.

The earliest known method for measuring sea level was the use of a tide pole (or tide staff; Figure 1a). Marked with a graduated scale, tide poles enabled observers to determine water levels directly from the markings (Gill and Schultz, 2001). The scale was either inscribed on a pole or cut into a dock wall (Woodworth, 2022). To ensure that measurements were comparable across a local port or coastal area, tide poles can be connected via a permanent shore benchmark (Pugh and Woodworth, 2014).

Tide poles were also employed by ship captains who were encouraged to make tidal measurements and establish local benchmarks during their voyages. One example is James Clark Ross, who recorded the tide at Port Louis, Falkland Islands, between May and December 1842, while awaiting the completion of ship repairs (Woodworth et al. 2010).

Tide poles were widely used for centuries due to their low cost, ease of installation, and adaptability to a range of coastal environments (Pugh, 1987). Despite limitations in the frequency and accuracy of recordings (Thompson, 1926; Knight et al. 2021), tide poles were used extensively until the development of the tide gauge, whereafter, they were primarily employed as calibration and comparison tools for tide gauges (Talke and Jay, 2017). or short-term measurements to support hydrographic surveys.

Float gauges (Figure 1b) are the earliest form of tide gauge, with designs by Sir Robert Moray and Athanasius Kircher emerging at similar times in the 17th Century (1666) (Pugh, 1987; Woodworth, 2022). These designs used a float within a stilling well to minimise wave influence, with water levels recorded through either manual observation of the position of the float or a recording dial (Woodworth, 2022). Like tide poles, they were linked to permanent land-based benchmarks (Pugh and Woodworth, 2014). These early gauges lacked self-recording capability, and recorded observations were entirely reliant on human interaction (Woodworth, 2022).

The first autonomous self-recording float gauge (Figure 1c) was constructed in 1831 by Henry Palmer (Jan et al. 2022). In these instruments, the vertical motion of the float was conveyed by a wire to a pen that continuously recorded sea-level variations on a rotating paper drum, producing an analogue record of tidal variation, known as a marigram or tide chart (Bradshaw et al. 2015). Bradshaw et al. (2015) provide a detailed description of the mechanics of self-recording float gauges.

Self-recording float gauges were installed widely by many maritime nations and by 1850 had become common at numerous ports (Cartwright, 1999). Tidal observations were of growing importance for economic, military, and scientific purposes. As noted by Reidy (2008), *"leadership of the modern world required access to, understanding of, and control of the world's maritime frontier."* Consequently, extensive archives of paper-based tide-gauge records were accumulated worldwide (Reidy, 2008; Talke and Jay, 2017).

With technological advances, tide gauge networks have evolved, and traditional float gauges have largely been replaced by pressure, acoustic, and radar systems (Salama et al. 2020). These systems record data digitally. As this paper focuses on the identification and recovery of historical paper-based records, they are not discussed further. Woodworth et al. (2015) provide detailed descriptions of these systems.

2.2 Data Formats

Different measurement techniques have led to a variety of data formats, which can be broadly classified into two principal categories: (1) Ledgers (Figure 1d), mostly (but not always), associated with readings taken from tide poles; and (2) Marigrams (Figure 1e), associated with float tide gauge recordings. Distinguishing between these formats is essential, as they differ in temporal resolution, data structure, and digitisation requirements.

Ledgers refer to handwritten documents in which sea-level data were recorded as discrete numerical values in tabular form (Latapy et al. 2023). In their simplest form, they include the date and time of observation alongside the corresponding water level. In some cases, additional annotations containing meteorological observations and operator remarks are included (Bradshaw et al. 2015), providing useful metadata for retrospective analysis. The temporal resolution of the ledgers varies depending on the source of observation, derived either from tide poles, float gauges or from marigrams. Records may range from hourly measurements to entries of only high and low water levels, or, in some cases, solely high tides (Bradshaw et al. 2015; Woodworth et al. 2011; Inayatillah et al. 2022). Ledger formats also vary because of differing operational practices, locations, and handwriting. As a result, the recovery of data from ledgers remains a complicated and time-consuming process.

Marigrams are continuous graphical records produced by self-recording float tide gauges (Latapy et al. 2023). In these records, sea level is plotted on the y-axis and time on the x-axis. The appearance and format of marigrams vary considerably between records due to the absence of standardised recording procedures. Variations occur in paper type, ink colour, and the frequency with which the recording paper was replaced.

The type of paper used for the recording marigrams varies between records. Some marigrams were produced on pre-gridded paper to aid interpretation and analysis (Murdy et al. 2015), while others were recorded on blank paper (Talke and Jay, 2017). Marigrams also varied substantially in size, largely reflecting the wide range of tide-gauge designs used over time. The extent of this variation is illustrated by records from Bombay (India), which measured approximately 1.6 m in length and 0.6 m in width (Thompson, 1926), whereas those from Poole (UK) were approximately to 210 mm in length 297 mm in width (Inayatillah et al. 2021).

Inconsistencies in the colour of the ink used for the tidal signal and the gridlines introduce further variation between marigrams. Additional complexity arises when the recording ink fades or runs out during operation, resulting in sections of the tidal trace appearing faint or containing gaps. Although these differences may appear minor, such heterogeneity in marigram presentation creates significant challenges for the digitisation of large historical datasets, as multiple approaches may be required to accurately extract data from different records.

One major source of variation was the frequency with which the recording paper was replaced. To conserve paper and reduce the operator's workload, some stations reused recording sheets, superimposing multiple tidal curves onto the same graph paper, following recommendations by Thomson et al. (1881). Consequently, the duration represented on an individual marigram varied substantially, ranging from a single day to a week or even a fortnight. However, practices were not globally standardised, and paper replacement intervals were typically determined by the individual operator.

3.0 Review of Past Studies and Data Catalogue

In this section we describe how we identify past sea level focused data archaeology studies and provide a brief review of these investigations (Section 3.1) and then we detail the data catalogue we have compiled (Section 3.2).

3.1 Identification and Review of Past Studies

To identify past data archaeology studies, we undertook systematic searches of Web of Science and Google Scholar. We also used the application of backward snowballing whereby relevant studies were identified from the reference lists of more recently identified publications. It is important to note that all searches were conducted in English. Although some non-English papers were translated, relevant studies in other languages were likely missed. We also relied on previous efforts to catalogue historical sea-level records by Pouvreau (2008) (globally), Caldwell (2012) (globally) and Talke and Jay (2017) (North America).

In total we identified 53 published studies, or studies currently under review, that have conducted sea-level data archaeology exercises. Of these, 47 have recovered or compiled high-frequency sea-level data (daily resolution or finer). Figure 2 shows the frequency of publication of these high-frequency studies, grouped into five-year intervals. The earliest study, by Pugh (1982) recovered hourly recordings from tidal ledgers in Ireland. Similar studies did not reappear until over two decades later (e.g. Caldwell, 2003). Activity has since increased, with 13 studies published between 2021 and 2026.

Alongside studies focused on compiling and recovering records, Bradshaw et al. (2015), Talke and Jay (2017), and Latapy et al. (2023) detail the methodologies required to locate, safeguard, and digitise historical tide records. Collectively, these developments reflect a growing recognition of historical sea-level records as invaluable archives of long-term sea-level change.

We briefly review what motivated these sea-level data archaeology studies to better understand their aims and scope. In the instances where studies report multiple motivations, all are noted. Extending mean sea-level time series was the most frequent motivation, cited in 38 of the 53 studies, with 35 subsequently using the data they digitised to quantify trends in SLR at the sites considered. 24 studies identified improving understanding of extreme sea levels as their key motivation for undertaking their digitisation efforts, although only 11 undertook analysis of extreme sea levels. 18 studies identified interest in evolution of astronomical tide (i.e. changes in tidal range) as a motivation. These studies included assessing changes in tides resulting from sea level variability (Talke and Jay, 2013) or anthropogenic influences, including dredging (Familkhalili and Talke, 2016) and land reclamation (Talke et al. 2014). 36 of the 53 studies highlighted the importance of data archaeology in supporting flood-risk assessment and coastal management. Finally, seven studies described the risk of irreversible loss, through physical deterioration, misplacement, or disposal, as a key motivator for their digitising efforts.

Next, we briefly review common data archaeology challenges highlighted by the published studies. One of the most frequently discussed difficulties is linking historical measurements to local benchmarks and common vertical datums, a process that is essential for accurately determining long-term trends in mean and extreme sea levels. The importance, and difficulty, of this task is underscored in 43 studies. Without reliable datum control, historical observations cannot be confidently compared with modern measurements, limiting their usefulness for quantifying long-term sea-level change. Pugh et al. (2021) highlights this issue by stating *"An essential ingredient in historical mean sea-level studies is the traceability of the benchmark lineage"*, a point further supported by Woodworth et al. (2012), who, in their study recovering tidal data from Ascension Island, note that *"without the survival of the 1955 benchmark, the scientific value of the study is reduced"*.

Additional difficulties arise in correcting uncertainties and interpreting anomalous tidal signals, which may result from faults with the tide gauge. Talke and Jay (2013) noted that the accumulation of silt in the stilling well of the tide gauge hindered the reliability of the collected data. This highlights the need for careful contextual interpretation of historical records.

Another major challenge mentioned in 17 papers, is the highly time-intensive nature of identifying, digitising, and quality-controlling paper-based sea-level records. McLoughlin et al. (2024) note in their paper that *"The accurate digitisation of these records is time-consuming. Overall, it can take up to 6 days to process a year of data"*. Given that some records are longer than 100 years (Wöppelmann et al. 2014), this challenge significantly limits the rate at which historical records can be recovered. Beyond the recovery of records themselves, Caldwell (2012) observed that *"determining what records exist can be just as daunting as the actual transformation into digital, science-ready form"*. This demonstrates the time-consuming nature of the entire data archaeology process.

3.2 Data Catalogue

To capture the data we identified, we compiled a systematic catalogue of identified and digitised historical sea-level records and their metadata across all 53 studies (Kenwright et al. 2026). Consistent metadata formats were developed for digitised records and records that were identified but not digitised. For each digitised record, we recorded the location, country, latitude, longitude, record start year, record end year, number of recorded years, number of recorded missing years, the dates of missing years, data type, method of digitisation, temporal resolution of the record, and a link to the published paper; see an example in Table 1. For the records identified but not digitised, the same information was recorded, excluding the method of digitisation; see an example in Table 2.

In total, across the 53 studies, historical sea-level data were identified from 872 historical sea-level records, representing ~15,264 years of sea-level data. Of these, 241 records have been digitised to date across the published studies, ~7,823 years of data. A simplified summary of these digitised records is provided in Table S1. 631 historical sea-level records remain undigitised, ~7,441 years of data; these are listed in Table S2 in similar format to Table S1.

The locations of digitised and undigitised records are shown in Figure 3a and 3b respectively, while Figure 4a illustrates the accumulation of records over time by continent. The figures show that Europe and North America contain the largest number of identified records. Although North America has digitised a greater proportion (109 digitised from 253 total records), Europe retains the larger overall archive (89 digitised from 367 total records). In contrast, South America (28 total records), Asia (67), Africa (103) and Oceania (45) contain significantly fewer identified records. Overall, records are concentrated in the Northern Hemisphere. While it is unrealistic to expect complete coverage of all coastlines, this imbalance highlights the need for continued international efforts to identify, preserve, and digitise historical records, particularly those from the Southern Hemisphere. Equally, given the high concentration of the coastal population in south, south-east and east Asia (~70% of global coastal population) (Nicholls et al. 2021) these regions also deserve attention.

Figure 4b shows the accumulation of records over time organised by data type. Among the digitised records, ledgers accounted for 181 sea-level records, while marigrams accounted for 53 records. For a further 7 records, the data type was not specified in the corresponding studies. Among the undigitised records, ledgers represented 348 sea-level records, while marigrams accounted for 104 records. The data type was unspecified for 179 records. These results are also summarised in Table 3.

Pugh (1982) represents the earliest identified study to digitise historical tide-gauge ledgers. However, this was followed by a gap of approximately two decades before further published work appeared, with Caldwell (2003) compiling subsequent ledger recovery efforts. Ledger digitisation has since accelerated considerably. Between 2020 and 2026, 66 ledger records were digitised, while a further 13 were newly identified during the same period. Together, these records represent ~2,908 years of sea-level data.

Despite this increase in the absolute number of digitised ledgers, their relative contribution to the total number of identified records has declined over time. Between 1980 and 2005, ledgers accounted for all identified historical tide records, whereas between 2020 and 2026 they represented 82.5% of records. This shift reflects the increasing identification and digitisation of marigram records in recent years.

Despite the widespread historical use of self-recording float tide gauges, only 157 marigram records were identified in published studies, the majority of which remain undigitised. Testut et al. (2006) presented the first effort to transcribe marigrams into a digital format, recovering ~1.26 years of data at Port-aux-Français, Kerguelen Island. In contrast to ledger digitisation, marigram recovery progressed rapidly thereafter, with several studies recovering substantial quantities of data within a short period (Wöppelmann et al., 2006; Colosi and Munk, 2006; Pirazzoli et al., 2007). Recovery has accelerated further since 2020, with 16 records digitised and a further 26 identified between 2020 and 2026, representing ~1,211 years of data.

The temporal resolution of the recovered data varies, reflecting both the recovery methodologies employed and the nature of the original source material. Hourly observations are the most commonly recovered format, accounting for 40.2% of digitised records, followed by high- and low-water measurements (24.5%). In contrast, very high-frequency records, including 15-minute (1.2%), 5-minute (0.4%), and continuous measurements (3.3%), are comparatively rare, likely reflecting the increased technical difficulty associated with recovering such detailed data. Coarser sub-daily resolutions, such as 6-hourly records (1.2%) and daily means (2.1%), are also relatively uncommon within the compiled dataset.

A further 12 records had undefined temporal resolution, while 186 lacked a description of data format. Although such information can often be determined by examining the original records, its absence may hinder future recovery efforts. Without clear metadata describing data format and temporal resolution, it becomes difficult to identify appropriate recovery methodologies, assess the potential resolution of undigitised records, or determine whether the resolution of existing digital datasets can be improved. For example, if a marigram has only been digitised at high tides, substantial additional data may still be recoverable. In contrast, if a ledger has been digitised at the same temporal resolution, this may already represent its maximum achievable resolution.

Furthermore, the absence of such metadata reduces the ability to plan and prioritise the recovery of particularly valuable or at-risk records. Accordingly, one of the aims of this catalogue was to establish a consistent framework for describing historical tide records, ensuring that future entries include all the relevant metadata required for planning, prioritising, and comparing digitisation efforts.

4.0 Past Approaches used for Data Digitisation and Inventory of Available Tools

In this section we review the approaches used by the past studies to digitise the sea-level datasets (Section 4.1) and then, considering other fields, we compile a comprehensive inventory of digitisation software tools applicable to the recovery of paper-based sea-level records (Section 4.2).

4.1 Past Recovery Methods

Across 47 studies digitising 241 historical sea-level records, three main recovery approaches have been used, namely: (1) manual digitisation; (2) citizen science, (3) semi-automated digital approaches. Several papers did not explicitly describe the approach they used to digitise data. The number of records recovered using each of these approaches is summarised in Table 4, while Figure 2 illustrates the frequency with which different recovery methods have been applied across published studies.

Manual digitisation, which was used to recover 187 records, involves the extraction of data directly from the original records by manually transcribing the observations from ledgers and marigrams into a digital database. It is a highly flexible and can accommodate variations in format, legibility, and physical condition that often limit the application of automated methods. However, accurate extraction frequently requires good understanding of sea-level characteristics and measurement methods (Latapy et al. 2023).

The continued reliance on manual digitisation reflects both the complexity of historical tide records and the limitations of automated techniques. The resolution of manually digitised data varies depending on research objectives, available resources, and the nature of the source material. For example, Gouriou et al. (2013) digitised ledgers at hourly resolution, whereas Talke et al. (2014) extracted both hourly and high- and low-water data, reflecting differences in both data availability and methodological choices.

While applicable to both ledgers and marigrams, manual digitisation is more commonly applied to ledgers due to the relative ease of transcribing numerical values compared to extracting graphical data. However, it remains time-consuming, labour-intensive, and costly, with individual records often requiring months or even years to complete depending on the length of the record (Wöppelmann et al. 2014; McLoughlin et al. 2024).

Citizen science offers considerable potential to enhance the efficiency and speed of digitisation processes. It involves public participation in scientific research, where volunteers help collect, submit, or analyse large datasets (Bonney et al. 2016). Citizen science has been widely applied in environmental research, including plastic pollution monitoring (Rambonnet et al., 2019), land management (Martin and Studer, 2022), habitat loss assessment (Boyle and Sigel, 2015), and conservation (Brightsmith et al., 2008), as well as in fields such as astronomy, archaeology, and biology (Brown and Williams, 2019).

Citizen science has also proven effective in the digitisation of historical meteorological records, including weather station logs (Hawkins et al. 2019), diaries or journals (Hawkins et al. 2023), and ship logbooks (Brohan, 2012). Despite this demonstrated potential, its application to historical sea-level record digitisation remains limited. To date, it has been used to recover only two sea-level records (Matthews et al. 2023), with volunteers recovering ~100 years of sea-level data from ledgers at two locations near Liverpool (UK), Hilbre Island and George's Pier.

The success of previous initiatives highlights the potential of citizen science for future sea-level record digitisation projects. However, its effectiveness depends on sustained public participation. Maintaining engagement requires user-friendly project design (Golumbic et al. 2019) and regular communication with volunteers to address their needs and provide feedback on progress and outcomes (Druschke and Seltzer, 2012).

Participation is also influenced by task complexity, as more intricate tasks require greater training, with simpler tasks tending to yield better results (Brown and Williams, 2019; Boone et al. 2024). In the context of historical sea-level records, marigrams are more difficult to digitise manually than ledgers owing to the need for interpretation of graphical data. Consequently, while citizen science represents a valuable and underutilised approach to the recovery of tidal records, initial efforts would potentially find greater benefit from focusing on the recovery of ledgers, despite the higher potential resolution offered by marigrams.

Manual digitisation and citizen-science approaches are often highly time-consuming, motivating the development of semi-automated digitisation approaches. Within the field of sea-level data archaeology, NUNIEAU (NUmérisation des NIveaux d'EAU), developed in 2004 (Ullmann et al. 2005), represents the first and most widely used semi-automated digitisation tool. The software operates by calibrating a digital grid over scanned images, redefining pixel coordinates relative to graph axes rather than image space and using colour-recognition techniques to extract data. Through targeted area selection and manual tracing, continuous analogue signals can be recovered efficiently (Ullmann et al. 2005).

To date, NUNIEAU has been used to recover 16 marigram records, totalling approximately 490 years of data, with records extending back to 1865 (Pirazzoli et al. 2007; Ullmann et al. 2007; Labbé et al. 2012; Wöppelmann et al. 2014; Ferret et al. 2016; Latapy et al. 2020; Khan et al. 2023; Yéo et al. 2023). Although developed over 20 years ago, it remains a valuable and actively used tool, as demonstrated by recent applications.

Other digitisation tools, such as Plot Digitizer and WebPlotDigitizer, employ similar underlying principles of grid calibration and colour-based data extraction. These tools have also been successfully applied to marigram digitisation by McInnes et al. (2024) and McLoughlin et al. (2024) to recover records from Williamstown, Australia, and Dún Laoghaire Harbour, Ireland, respectively. Together, these studies recovered 39 years of data, and both tools demonstrate strong potential for future application.

In addition to widely accessible tools, researchers have developed bespoke line finding algorithms (e.g. Araújo et al. 2013; Talke et al. 2014; Talke et al. 2020; Inayatillah et al. 2021). Collectively, these approaches have recovered ~206 years of sea-level data, from 5 records. Despite their effectiveness, these methods are rarely reused because they are tailored to specific formats. The considerable variability between marigram styles and layouts, therefore, limits the broader applicability of these highly specialised approaches (Latapy et al. 2023). Nevertheless, bespoke algorithms have proven highly effective for targeted recovery tasks and may offer valuable potential for recovering similar, yet unidentified, records.

Overall, both the use and development of semi-automated digitisation tools reflect a clear shift away from manual approaches. This trend is illustrated by the fact that six of the eight studies published since 2020 that recovered marigram data employed a dedicated digitisation tool. However, the continued use of such tools depends on their longevity and accessibility. For example, Ungraph, used by Murdy et al. (2015) to digitise marigrams from Belfast, showed potential for wider application but has since been discontinued. Although the software was not widely adopted, its loss highlights the importance of ensuring that digitisation tools remain accessible, enabling recovery methods to be refined, reapplied, and further developed without the loss of essential technical capabilities.

For 25 digitised records, spanning seven studies, the recovery methodology was not explicitly specified. Although the likely approach can sometimes be inferred from contextual information, it cannot be determined with certainty. This lack of transparency limits reproducibility and constrains methodological development, underscoring the need for improved reporting standards in sea-level data recovery. More comprehensive documentation would support future efforts by identifying the most effective approaches under different conditions and informing new digitisation tools and workflows.

4.2 Inventory of Digitisation Software Tools

Latapy et al. (2023) emphasised both the value and current lack of an inventory of digitisation tools to support future sea-level record recovery efforts. Similarly, Wojtyniak et al. (2020) highlighted the importance of documenting accessible and reliable digitisation tools in pharmacology, illustrating the broader interdisciplinary value that such inventories can provide. Across the 53 studies reviewed here, only a limited range of digitisation tools have been used. Therefore, we undertook a broader review of tools potentially applicable to marigram recovery, expanding beyond just sea-level recovery. Candidate tools were identified through expert consultation and targeted searches of Web of Science and Google Scholar.

Our resulting inventory of tools, summarised in Table 5, includes 20 software packages. For each tool, we recorded its name, website link, the number of published studies that have applied it in a sea-level context, and context of their application to other fields, Table S3 contains the individual studies identified. Although optical character recognition tools have been successfully applied to other historical records (e.g., Blanke et al. 2012; Singh et al. 2012; Gupta et al. 2015; Askarov et al. 2025; Bhaskar et al. 2025) they have not yet been applied to sea-level digitisation and were therefore excluded from this review. Instead, we focused on tools capable of digitising marigrams, as these records provide higher-frequency sea-level datasets. Of the 20 tools identified, only three have previously been applied to digitise marigrams in published papers. Nevertheless, our initial assessment suggests that the remaining 17 tools may also have considerable potential for marigram recovery.

Despite the variety of available tools, the underlying approaches are relatively limited, with most employing variations of two primary methods. The first relies on colour-recognition techniques to extract pixels within a user-defined colour range. Prior to extraction, the image is calibrated by assigning coordinates to selected axis limits, thereby transforming pixel positions from image space into quantitative data values. Additional functions commonly allow users to include or exclude specific regions, enabling more precise extraction of continuous signals. The second approach is simpler and relies on manual point selection. Following calibration, users directly digitise the graph by selecting points at chosen intervals.

Although the underlying principles are broadly similar, the implementation and user interaction vary between software packages. Colour-recognition approaches are available in 14 tools, while manual point-and-click functionality is present in 19. However, without systematic evaluation, it remains unclear which tools are best suited to different marigram formats and recovery objectives.

5. Conclusions

In this paper we conducted a detailed review of 53 published data archaeology studies focused on the recovery or compilation of historic sea-level datasets. From these studies, we have compiled a consistent and flexible global catalogue of historical sea-level records that have either been digitised or identified but not yet digitised. Across the published literature, 241 sea-level high-frequency sea-level records have been digitised, representing ~7,823 years of data, while a further 631 sea-level records remain undigitised, equating to ~7,441 years of additional data. Although records were identified across all continents, their spatial distribution remains uneven, with notably high concentrations in Europe and North America.

To maintain a manageable scope, this review focused exclusively on published or near-published sea-level data archaeology studies. We recognise that many unpublished efforts also exist. The catalogue is designed to be easily extended so new data can be incorporated in future work. We hope that this review will encourage organisations and researchers holding historical sea-level data not currently listed in this catalogue to contribute and participate, thereby improving the completeness of the catalogue in future updates.

Our review demonstrates that historical sea-level recovery efforts have been dominated by manual digitisation approaches. Despite successful applications in other disciplines, citizen science remains underutilised in historical tide-record recovery, with only a single identified application within sea-level research to date. Nevertheless, other fields demonstrate strong potential for efficient ledger digitisation when projects are designed to sustain engagement and support effective volunteer training. Semi-automated digitisation tools offer additional opportunities to accelerate marigram recovery and improve the temporal resolution of extracted datasets. NUNIEAU remains the most widely applied semi-automated recovery tool, in contrast, Plot Digitizer and WebPlotDigitizer have each been used in only a single published study. Despite the broader availability of graphical digitisation tools successfully applied in other disciplines, relatively few digitisation tools have been used for sea-level record recovery.

To support future recovery efforts, we compiled an inventory of 20 software tools with potential applicability to marigram digitisation. We are currently undertaking a companion assessment of these methods in which volunteers use these tools to digitise a common sea-level marigram dataset. Participants record both the time required and perceived ease of use, while the recovered datasets are compared against a control record to assess digitisation accuracy and methodological performance. This will be submitted shortly.

Both the global data catalogue and inventory of digitisation tools are available online (https://ckenw77.github.io/TideVault/). Continued development and maintenance of these databases would improve consistency in the reporting of record characteristics and digitisation methodologies, enabling more effective method development and better prioritisation of scientifically valuable or at-risk records.

In addition, advances in artificial intelligence and machine learning offer significant potential to accelerate and fully automate the digitisation of both ledgers and marigrams, particularly through improved pattern recognition and image-based data extraction. The development of fully automated methods for digitisation of both ledgers and marigrams should be prioritised to enhance the preservation of historical tide records. Advancing these priorities will improve access to paper-based tidal time series, strengthening long-term sea-level analysis and supporting more robust scientific understanding, as well as hazard assessment and adaptation planning.

Author Contributions

Christian Kenwright: Conceptualization; Investigation; Software; Writing - Original Draft; Visualization; Resources; Data Curation

Ivan D. Haigh: Conceptualization; Writing - Review & Editing; Visualization; Resources; Obtained funding

Joanne Williams: Conceptualization; Writing - Review & Editing; Visualization; Resources

Robert Nicholls: Conceptualization; Writing - Review & Editing; Visualization; Resources

Duo Chan: Conceptualization; Writing - Review & Editing; Visualization; Resources

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Conflict of Interest

The authors declare no conflicts of interest regarding this paper.

Data Availability Statement

The catalogue and digitisation tool inventory generated in this study are publicly available at: https://ckenw77.github.io/TideVault/ and https://zenodo.org/records/20510039

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Tables

Table 1. *The consistent fields of metadata for digitised records with an example record.*

Location	Country	Latitude	Longitude	Record Start	Record End	No. Recorded years	No. Missing Years	Missing Years	Data Type	Method of Recovery	Resolution	Link
Courttown	Ireland	52.64	-6.22	1842	1979	1.83	136.17	January - June 1842, August 1842 - August 1978, August 1979- December 1979	Ledger	Manual Digitisation	Hourly	comparison of recent and historical tides and mean sea-levels off Ireland | Geophysical Journal International | Oxford Academic

Table 2. *The consistent fields of metadata for undigitised records with an example record.*

Location	Country	Latitude	Longitude	Record Start	Record End	No. Recorded years	No. Missing Years	Missing Years	Data Type	Link
Trieste	Italy	45.65	13.76	1859	1874	16	0	NA	Ledger	A Study of Early Trieste Sea Level Data (1875-1914) on JSTOR

Table 3. *The distribution of the different data formats from the 872 identified historical sea-level records, sorted into number of records, the percentage and the number of studies that dealt with that format. Studies that recovered multiple data formats are counted in each relevant category.*

Data Format	No. Records	Relative Percentage	No. Studies
Ledger (Digitised)	181	20.8%	31
Ledger (Undigitised)	348	39.9%	6
Marigram (Digitised)	53	6.1%	26
Marigram (Undigitised)	104	11.9%	11
Unspecified (Digitised)	7	0.8%	4
Unspecified (Undigitised)	179	20.5%	4

Table 4. *The distribution of different digitisation methods used to recover data from 241 historical sea-level records. Sorted by the number of records recovered, the percentage of recovered records and the number of studies which used that method.*

Method of Recovery	No. Records Recovered	Relative Percentage	No. Studies
Manual Digitisation	187	77.6%	30
Citizen Science	2	0.8%	1
Digital Methods	27	11.2%	14
Unspecified	25	10.4%	7

Table 5. *A complete list of the 20 identified digitisation tools, showing the name, the number of published studies where it was used to recover historical sea-level data and their usage for data recovery in different research fields*

Tool	No. published historical sea-level studies	Usage in other research fields (No. published studies)
NUNIEAU	8	Environmental Sciences – 2
Plot Digitizer	1	Medicine, Biomedical and Health Sciences - 1 Environmental Biotechnology – 1
WebPlotDigitizer	1	Medicine, Biomedical and Health Sciences – 11 Environmental Science – 3 Astronomy and Astrophysics – 1 Computer Science – 1 Physics and Instrumentation – 1 Electrical and Power Engineering - 1
Engauge Digitizer	None	Medicine, Biomedical and Health Sciences – 12 Environmental Sciences – 1
Graph Grabber	None	Medicine, Biomedical and Health Sciences – 7 Engineering and Applied Sciences – 4 Environmental Science – 4 Physical Sciences – 2 Engineering and Applied Sciences – 1
OriginPro	None	Engineering and Applied Sciences – 5 Environmental Science – 2 Medicine, Biomedical and Health Sciences – 1 Physics and Instrumentation – 1
GetData Graph Digitizer	None	Medicine, Biomedical and Health Sciences – 11 Environmental Science – 5 Engineering and Applied Sciences – 2
GRABIT	None	Medicine, Biomedical and Health Sciences – 5 Environmental Science – 2
DigitGraph	None	None
DigitizeIt	None	Medicine, Biomedical and Health Sciences – 12 Social and Educational Sciences – 1 Engineering and Applied Sciences – 1 Environmental Science – 1
Dagra	None	Medicine, Biomedical and Health Sciences – 4 Environmental Science – 4 Engineering and Applied Sciences – 1

UN-SCAN-IT	None	Medicine, Biomedical and Health Sciences – 11 Environmental Science – 2 Engineering and Applied Sciences – 1
DataThief III	None	Ecology and Environmental Science – 11 Medicine, Biomedical and Health Sciences – 2
xyExtract Graph Digitizer	None	Environmental Science – 4 Engineering and Applied Sciences – 4 Medicine, Biomedical and Health Sciences – 3
Log Evolve	None	Environmental Sciences – 1
G3data	None	Environmental Sciences – 3 Engineering and Applied Sciences – 3 Physical Sciences – 1 Medicine, Biomedical and Health Sciences – 1
Im2graph	None	Medicine, Biomedical and Health Sciences – 5 Environmental Sciences – 2 Engineering and Applied Sciences – 1 Physical Sciences – 1
WinDig	None	Medicine, Biomedical and Health Sciences – 5 Environmental Sciences – 2 Engineering and Applied Sciences – 2
Graphreader	None	Medicine, Biomedical and Health Sciences – 3 Engineering and Applied Sciences – 1
GraphClick	None	Medicine, Biomedical and Health Sciences – 3 Environmental Sciences – 2 Behavioural and Biological Sciences – 1

Figures

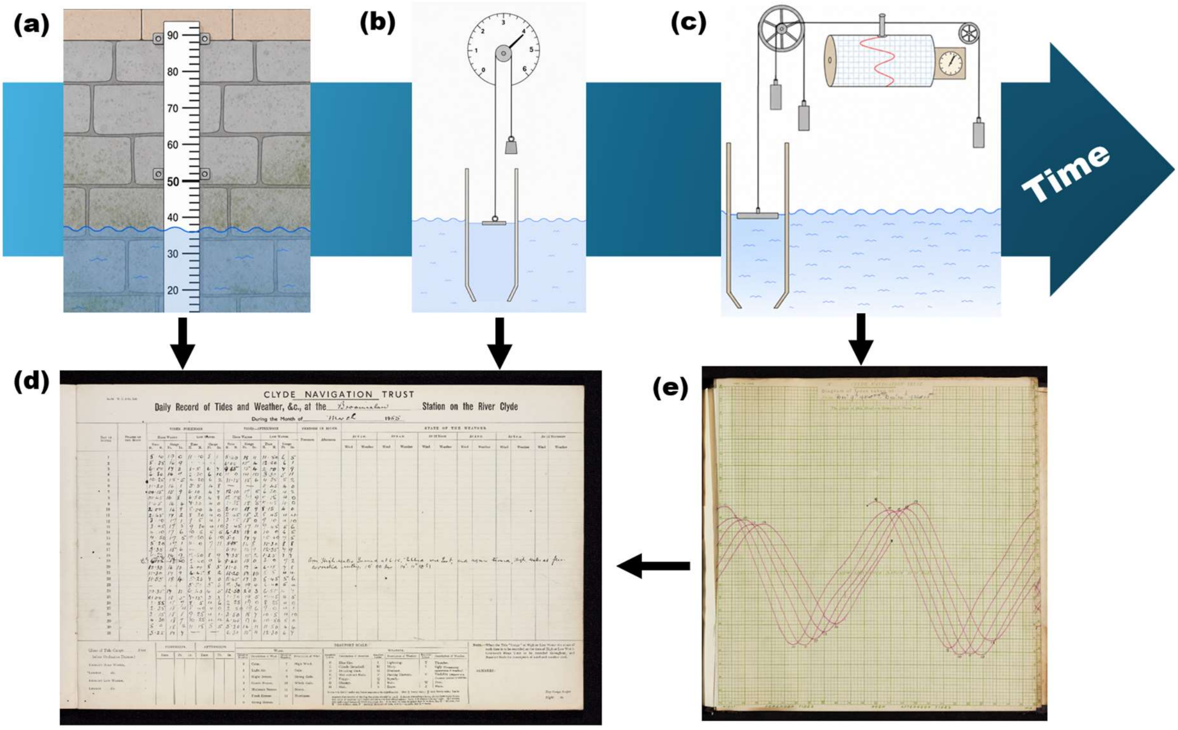

Figure 1. *Progression of tidal measurement techniques over time and their associated data products.* **(a)** *Schematic of a tide pole/staff gauge attached to a dockside wall.* **(b)** *Schematic of a float tide gauge.* **(c)** *Schematic of a self-recording float tide gauge. Schematics were made with the help of AI.* **(d)** *Example of a tidal ledger from Broomielaw in the Clyde Estuary.* **(e)** *Example of a marigram from Gourock in the Clyde Estuary, from which tidal observations can be transcribed into ledger records.*

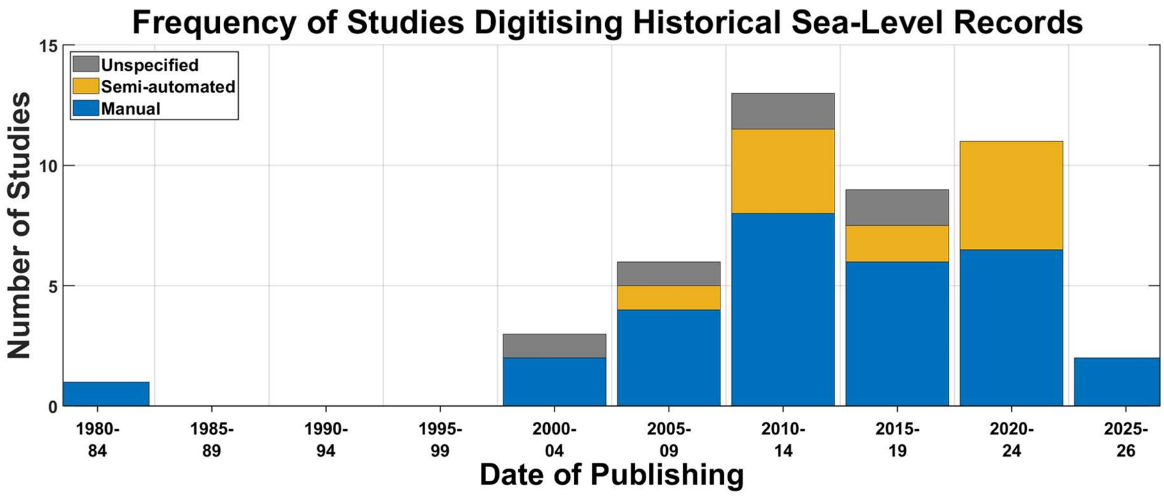

Figure 2. *Frequency of published historical sea-level data recovery studies grouped into 5-year publication intervals. Colours indicate the primary data recovery method used in each study. Studies identified in this review currently in review have not been included on this figure.*

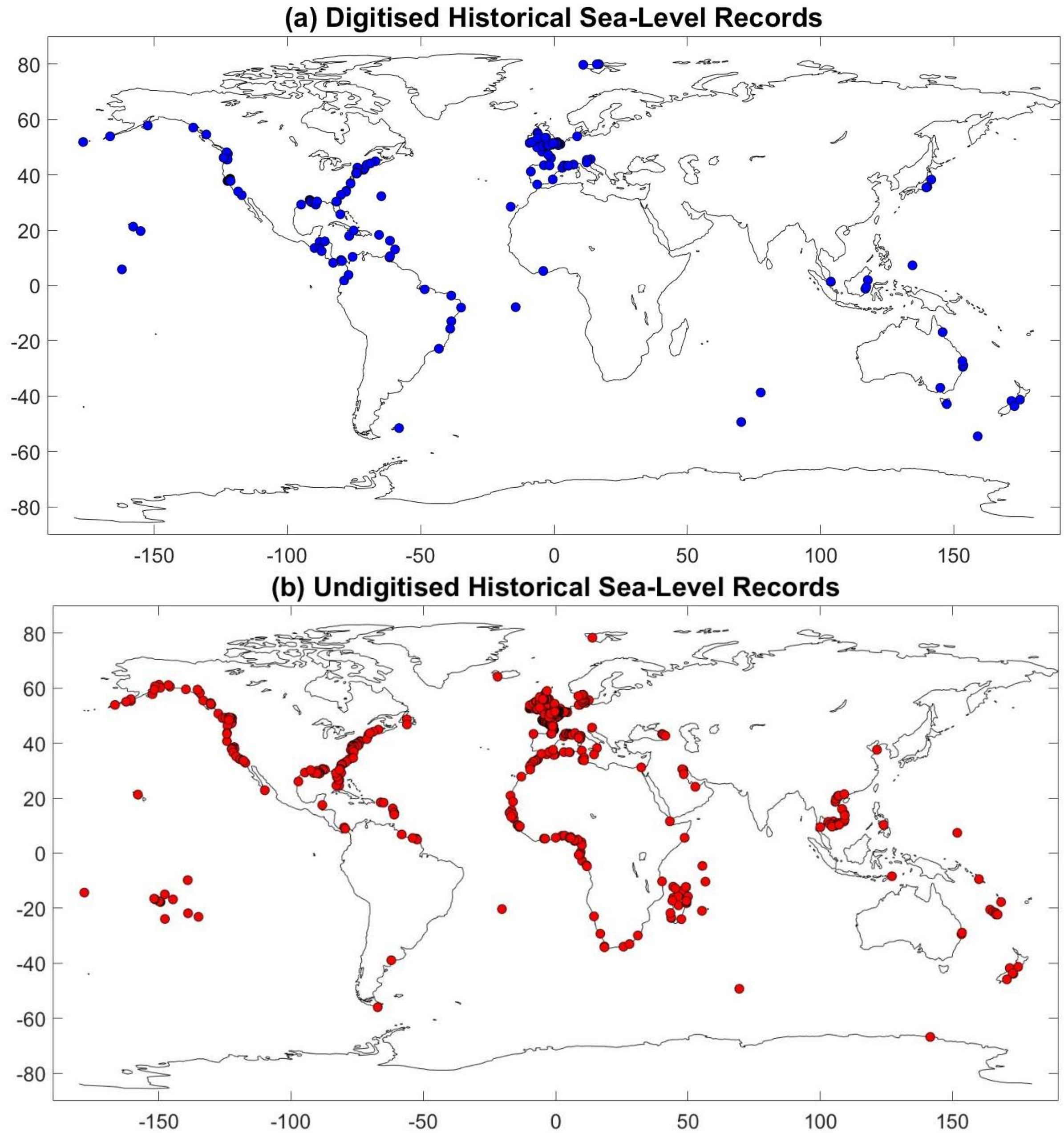

Figure 3. *A global map showing the locations of the known historical sea-level records on a world map, with* **(a)** *Showing the digitised records and* **(b)** *showing the identified but undigitised records.*

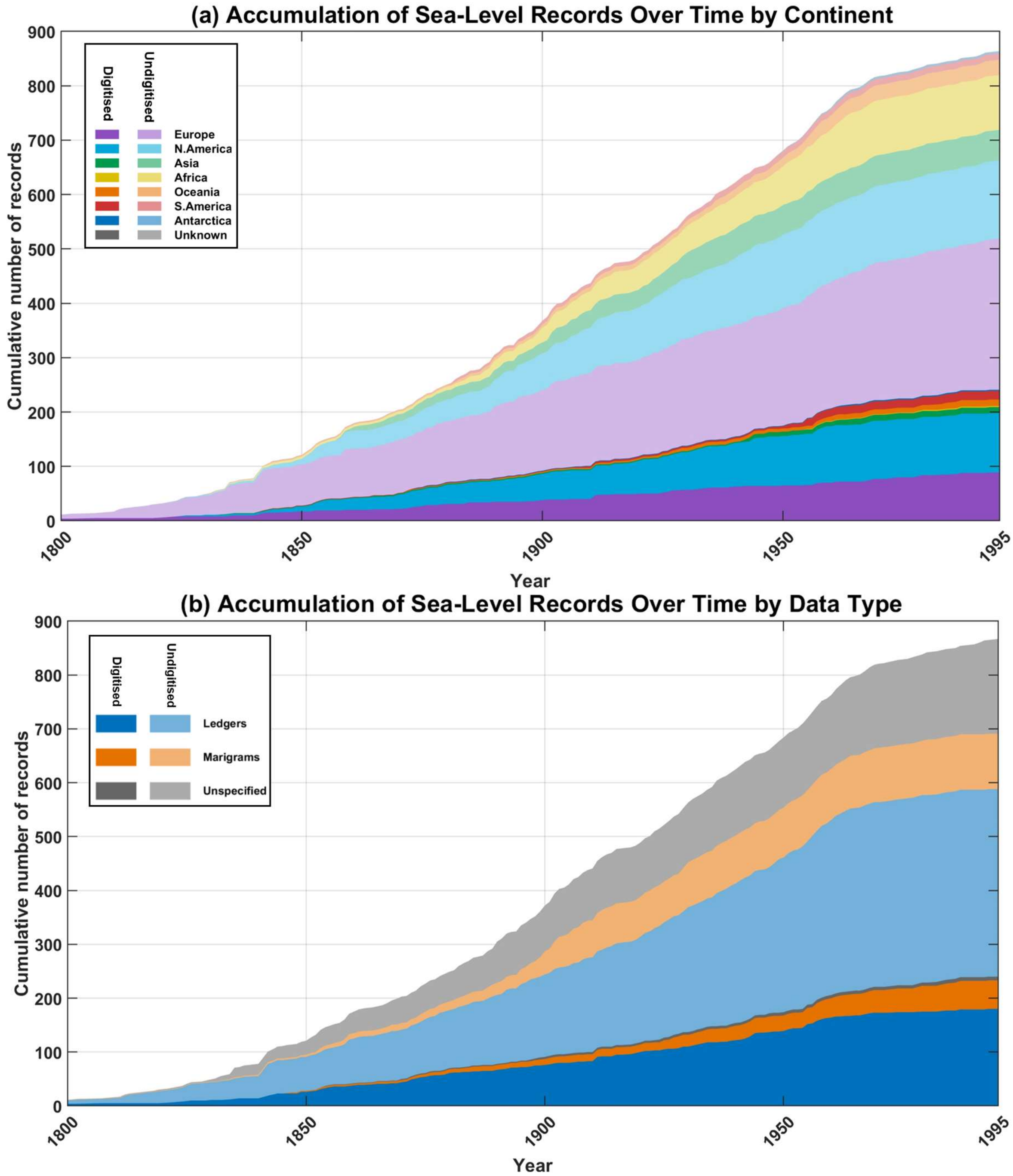

Figure 4. (a) *Accumulation of paper-based sea-level records through time, categorised by continent of origin. The colours indicate the continent of origin for each record. Darker colours depict digitised records while lighter colours represent undigitised records.* **(b)** *Accumulation of paper-based tide records through time, categorised by the data type of the record. The colours indicate the data type. Darker colours depict digitised records while lighter colours represent undigitised record.*

Supplementary Material 1

Table S1. *Details the studies that recovered/ compiled historical tide data. HLW refers to high and low water measurements. A more detailed list can be found in the online catalogue at: https://ckenw77.github.io/TideVault/*

Location	Country	Record start	Record finish	No. Recorded yrs	No. Missing yrs	Data Type	Method	Resolution	Link
Macquarie Island	Australia	1912	1913	1.38	0.63	Marigram	Unspecified	Unspecified	https://academic.oup.com/gji/article/182/2/781/571033
Yamba	Australia	1984	2013	30.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Hobart	Australia	1960	2013	54.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Ballina	Australia	1986	2013	28.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Brisbane	Australia	1957	2013	57.00	0.00	Ledger	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Cairns	Australia	1960	2013	45.00	9.00	Ledger	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacif

									ic_Tidal_Data_Lost_or_Just_Forgotten
Williamstown	Australia	1927	1965	35.00	4.00	Marigram	Plot Digitizer	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024JC020908
Williamstown	Australia	1872	1966	91.00	4.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024JC020908
Bridgetown	Barbados	1968	1970	3.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Palau	Belau	1929	1936	8.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Lungsurannaga	Borneo	1942	1943	2.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Balikpapan	Borneo	1942	1943	2.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Samarinda	Borneo	1943	1944	2.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Pantuan	Borneo	1943	1944	2.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Bayor	Borneo	1943	1944	2.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Belem	Brazil	1955	1968	14.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Fortaleza	Brazil	1955	1968	14.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Recife	Brazil	1955	1967	13.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf

Salvador	Brazil	1955	1964	10.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Canavierias	Brazil	1956	1961	6.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Rio de Janeiro	Brazil	1955	1968	14.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Bermuda	British overseas territory	1933	1949	17.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Port Louis	British overseas territory	1842	1842	0.60	0.40	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2010JC006113
Ascension Island	British overseas territory	1955	1955	0.08	0.92	Ledger	Manual	Hourly	https://www.tandfonline.com/doi/abs/10.2989/1814232X.2012.689623?casa_token=zBny8ik3tAMAAAAA:D-WLZrlhXskUGl1Xag8khGwd83rNrPI2GZ94RlKOsCvfW4t4DDubKDq8PhmhPgZCerNLRIoGbCBZ
Cartagena	Colombia	1951	1994	44.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Tumaco	Colombia	1951	1979	29.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Buenaventura	Colombia	1951	1979	29.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Guantanamo	Cuba	1937	1948	12.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Acajutla	El Salvador	1963	1991	15.00	14.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf

La Union	El Salvador	1954	1966	13.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Pointe-a-Pitre	France	1993	1998	6.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Jardions du Roy	France	1679	1679	0.02	0.98	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s10236-005-0044-z
Pointe de la Rose	France	1692	1716	7.00	18.00	Ledger	Manual	HLW	https://link.springer.com/article/10.1007/s10236-005-0044-z
Bassin du Brest	France	1757	1832	44.00	32.00	Ledger	Manual	HLW	https://link.springer.com/article/10.1007/s10236-005-0044-z
la Mâture	France	1846	2008	119.00	44.00	Marigram	Manual	Hourly	https://link.springer.com/article/10.1007/s10236-005-0044-z
la Mâture	France	1807	1812	6.00	0	Ledger	Manual	HLW	https://link.springer.com/article/10.1007/s10236-005-0044-z
Port-Vendres	France	1983	1997	13.70	1.06	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3
Sete	France	1986	1999	13.60	0.35	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3
Grau-de-la-Dent	France	1979	1995	14.00	3.00	Marigram	NUNIEAU	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434306003888#sec2
Saint Paul Island	France	1874	1874	1.00	0.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2010JC006404
Nice	France	1979	1979	0.00	1.00	Marigram	NUNIEAU	1-minute	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JF001964
Villefranche	France	1979	1979	0.00	1.00	Marigram	NUNIEAU	1-minute	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JF001964
La Rochelle, Vieux Port	France	1824	1892	30.00	39.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434313001283#s0010
La Pallice	France	1890	1997	24.00	84.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434313001283#s0010

Ile d'Aix	France	1824	1974	3.00	148.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434313001283#s0010
Fort Enet	France	1859	1873	15.00	0.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434313001283#s0010
Fort Boyard	France	1873	1909	37.00	0.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434313001283#s0010
Brest (Chazallon)	France	1849	1851	3.00	0.00	Ledger	Manual	Hourly	https://link.springer.com/article/10.1007/s00190-014-0728-6
Brest (Totalisateur)	France	1885	1988	100.00	4.00	Marigram	NUNIEAU	Hourly	https://link.springer.com/article/10.1007/s00190-014-0728-6
Brest (Totalisateur)	France	1885	1988	100.00	4.00	Ledger	Manual	Hourly	https://link.springer.com/article/10.1007/s00190-014-0728-6
Saint Nazaire (Lighthouse)	France	1821	1925	63.00	42.00	Ledger	Manual	Hourly, 15min	https://refmar.shom.fr/sites/default/files/2024-07/Reconstruction%20serie%20maregraphique%20Saint-Nazaire%20par%20Yann%20Ferret%202016.pdf
Saint Nazaire (Lighthouse)	France	1932	1964	23.00	10.00	Marigram	NUNIEAU	5min	https://refmar.shom.fr/sites/default/files/2024-07/Reconstruction%20serie%20maregraphique%20Saint-Nazaire%20par%20Yann%20Ferret%202016.pdf
Port Elizabeth	France	1979	1982	4.00	0.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Dunkerque	France	1701	1836	5.00	131.00	Ledger	Manual	Unspecified	https://theses.hal.science/tel-02899411/
Dunkerque	France	1865	1944	24.00	56.00	Marigram	NUNIEAU	Continuous	https://theses.hal.science/tel-02899411/
Calais	France	1836	1836	1.00	0.00	Ledger	Manual	Unspecified	https://theses.hal.science/tel-02899411/
Calais	France	1879	1943	8.00	57.00	Marigram	NUNIEAU	Continuous	https://theses.hal.science/tel-02899411/
Boulogne	France	1835	1855	2.00	19.00	Ledger	Manual	Unspecified	https://theses.hal.science/tel-02899411/

Boulogne	France	1876	1944	11.00	58.00	Marigram	NUNIEAU	Continuous	https://theses.hal.science/tel-02899411/
Socoa	France	1942	2004	54.50	8.50	Marigram	NUNIEAU	Hourly, 5min	https://hal.science/hal-04555208v1/file/Khan2023.pdf
Socoa	France	1875	1920	46.00	0.00	Ledger	Manual	Hourly	https://hal.science/hal-04555208v1/file/Khan2023.pdf
Port-aux-Français	French Southern and Antartic Lands	1962	1972	1.26	9.74	Marigram	Manual	Hourly	https://link.springer.com/article/10.1007/s10236-005-0056-8
Cuxhaven	Germany	1899	1995	97.00	0.00	Marigram	Manual	Hourly	https://link.springer.com/article/10.1007/s10236-013-0598-0
Cuxhaven	Germany	1843	1898	56.00	0.00	Ledger	Manual	Hourly	https://link.springer.com/article/10.1007/s10236-013-0598-0
Puerto Cortes	Honduras	1948	1968	21.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Puerto Castilla	Honduras	1955	1968	14.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Courttown	Ireland	1842	1979	1.83	136.17	Ledger	Manual	Hourly	https://academic.oup.com/gji/article/71/3/809/656230?login=true
Ballycastle	Ireland	1842	1980	1.86	137.14	Ledger	Manual	Hourly	https://academic.oup.com/gji/article/71/3/809/656230?login=true
Castletownsend	Ireland	1842	1978	1.33	135.67	Ledger	Manual	Hourly	https://academic.oup.com/gji/article/71/3/809/656230?login=true
Cork (Passage West)	Ireland	1842	1842	0.25	0.75	Ledger	Manual	Hourly	https://os.copernicus.org/articles/17/1623/2021/#section2
Cobh	Ireland	1906	1906	1.00	0.00	Ledger	Manual	Hourly	https://os.copernicus.org/articles/17/1623/2021/#section2
Dún Laoghaire Harbour	Ireland	1925	1931	4.35	2.65	Marigram	WebPlotDigitizer	Hourly	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.256
Trieste	Italy	1939	2005	67.00	0.00	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3
Oceanographic Platform	Italy	1974	2005	27.20	4.80	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3
Diga Sud Lido	Italy	1968	2005	36.50	1.48	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3

Punta delta Salute	Italy	1940	2005	64.50	1.51	Marigram	NUNIEAU	Hourly	https://journals.openedition.org/mediterranee/170#tocto1n3
Canale Candio (Tide gauge 1)	Italy	1873	1934	50.00	12.00	Ledger	Manual	HLW	https://link.springer.com/article/10.1007/s00190-019-01238-w#Sec2
Canale Candio (Tide gauge 2)	Italy	1934	1957	21.00	3.00	Marigram	Unspecified	HLW	https://link.springer.com/article/10.1007/s00190-019-01238-w#Sec2
Canale Candio (Tide gauge 3)	Italy	1957	1986	30.00	0.00	Marigram	Unspecified	HLW	https://link.springer.com/article/10.1007/s00190-019-01238-w#Sec2
Quai Nord	Ivory Coast	1979	2011	33.00	0.00	Marigram	NUNIEAU	Hourly	https://www.scirp.org/journal/paperinformation?paperid=128406
Port Royal	Jamaica	1965	1968	4.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Ayukawa	Japan	1962	2013	52.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Hanasaki	Japan	1964	2013	50.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Yokohama	Japan	1961	2013	53.00	0.00	Marigram	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Wellington	New Zealand	1891	1893	3.00	0.00	Ledger	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2003GL019166
Westport	New Zealand	1982	2013	32.00	0.00	Unspecified	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Lyttleton	New Zealand	1924	2013	90.00	0.00	Unspecified	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacif

									ic_Tidal_Data_Lost_or_Just_Forgotten
Corinto	Nicaragua	1967	1967	1.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Sorgfjord	Norway	1900	1900	0.29	0.71	Ledger	Manual	Hourly	https://hgss.copernicus.org/articles/17/1/2026/
Mossel Bay	Norway	1872	1873	0.29	1.71	Ledger	Manual	30min and hourly	https://hgss.copernicus.org/articles/17/1/2026/
Port Vigo	Norway	1897	1897	0.10	0.90	Ledger	Manual	Hourly	https://hgss.copernicus.org/articles/17/1/2026/
Puerto Armuelles	Panama	1983	1998	16.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Cristobal	Panama	1907	1974	68.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Isle de Naos	Panama	1909	2013	105.00	0.00	Ledger	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
Leixões Port	Portugal	1884	2004	87.00	34.00	Marigram	Specalised Algorithm	Hourly	https://www.sciencedirect.com/science/article/pii/S002216941201092X#s0010
Singapore Town	Singapore	1834	1841	1.50	6.50	Ledger	Unspecified	HLW	In Review
Victoria Dock	Singapore	1865	1865	1.00	0.00	Ledger	Unspecified	HLW	In Review
Sembawang	Singapore	1947	1947	0.09	0.91	Unspecified	Unspecified	Hourly	In Review
Cadiz	Spain	1880	1924	45.00	0.00	Ledger	Manual	Daily Average	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JC007558
Santa Cruz harbour (Southern Pier)	Spain	1927	1956	30.00	0.00	Marigram	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrc.20377

Santa Cruz harbour (Northern Pier)	Spain	1958	1990	32.00	1.00	Marigram	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrc.20377
Santa Cruz harbour (secondary)	Spain	1955	1957	3.00	0.00	Marigram	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrc.20377
Alicante (Tidal Pole, Outer harbour)	Spain	1870	1874	5.00	0.00	Ledger	Manual	6hr	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Alicante (Adie, Outer harbour)	Spain	1874	1924	47.92	3.08	Ledger	Manual	Daily average	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Alicante (Thomson floating gauge, Outer harbour)	Spain	1927	1989	51.92	11.08	Marigram	Manual	Hourly	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Alicante (OTT, mechanical recorder)	Spain	1969	1971	3.00	0.00	Marigram	Manual	15 min	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Alicante II (Inner harbour)	Spain	1957	1996	40.00	0.00	Marigram	Manual	Hourly	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Santander (Adie)	Spain	1876	1924	44.00	5.00	Ledger	Manual	Daily average	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Santander (Mier)	Spain	1920	1925	6.00	0.00	Ledger	Manual	Daily average	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Santander (Iglesias)	Spain	1925	1928	4.00	0.00	Ledger	Manual	Daily average	https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.112
Point Fortin	Trinidad and Tobago	1987	1996	10.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Port- O- Spain	Trinidad and Tobago	1984	1992	9.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf

St Marys	UK	1987	1989	3.00	0.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434309002313
Devonport	UK	1961	1990	29.00	1.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434309002313
Weymouth	UK	1926	2006	81.00	0.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434309002313
Southampton	UK	1935	1989	37.00	18.00	Marigram	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434309002313
Portsmouth	UK	1961	1990	30.00	0.00	Ledger	Manual	Hourly	https://www.sciencedirect.com/science/article/pii/S0278434309002313
Belfast (Tide gauge 1)	UK	1901	1957	57.00	0.00	Marigram	UnGraph	Continuous	https://www.researchgate.net/publication/273705568_Maintaining_legacy_data_Saving_Belfast_Harbour_UK_tide-gauge_data_1901-2010
Belfast (Tide gauge 2)	UK	1957	1972	16.00	0.00	Marigram	UnGraph	Continuous	https://www.researchgate.net/publication/273705568_Maintaining_legacy_data_Saving_Belfast_Harbour_UK_tide-gauge_data_1901-2010
Belfast (Tide gauge 3)	UK	1972	1986	15.00	0.00	Marigram	UnGraph	Continuous	https://www.researchgate.net/publication/273705568_Maintaining_legacy_data_Saving_Belfast_Harbour_UK_tide-gauge_data_1901-2010
Belfast (Tide gauge 4)	UK	1987	2001	15.00	0.00	Marigram and Digital	UnGraph	Hourly	https://www.researchgate.net/publication/273705568_Maintaining_legacy_data_Saving_Belfast_Harbour_UK_tide-gauge_data_1901-2010
Poole Bridge	UK	1927	1979	4.00	49.00	Marigram	Specalised Algorithm	Continuous, weekly max	https://southerncoastalgroup-scopac.org.uk/wp-content/uploads/2022/01/Digitisation-and-Analysis-of-Poole-

									Harbour-Tide-Gauge-Record-September-2021.pdf
Walton-on-Naze	UK	1968	1995	27.00	1.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Margate Harbour	UK	1967	1995	28.00	1.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Shivering Sand	UK	1974	1974	1.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Southend	UK	1911	1995	85.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Coryton	UK	1969	1983	15.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Tilbury	UK	1912	1995	84.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Gallions Pier (Albert Dock)	UK	1915	1990	36.00	40.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals

Silvertown (North Woolwich)	UK	1950	1975	26.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Cherry Garden Pier	UK	1911	1934	24.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Tower Pier	UK	1929	1995	67.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Old Swan Pier	UK	1911	1929	19.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
All Hallows Pier	UK	1911	1911	0.08	0.92	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Temple Pier	UK	1911	1918	8.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Strand-on-Green	UK	1911	1924	14.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Richmond	UK	1911	1995	85.00	0.00	Ledger	Manual	HLW	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-

									origsite=gscholar&sourcetype=Scholarly%20Journals
Georges and Princes Pier	UK	1853	1904	52.00	0.00	Ledger	Citizen Science	15min	https://www.zooniverse.org/projects/psmsl/uk-tides
Hilbre Island	UK	1853	1904	52.00	0.00	Ledger	Citizen Science	15min	https://www.zooniverse.org/projects/psmsl/uk-tides
Fajado	USA	1921	1923	3.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Palmyra	USA	1947	1950	4.00	0.00	Ledger	Manual	Hourly	https://www.nodc.noaa.gov/media/pdf/esm/ESM_SEP2003vol14no1.pdf
Fort Point	USA	1854	1877	23.50	0.50	Unspecified	Unspecified	Hourly	https://journals.ametsoc.org/view/journals/clim/16/6/1520-0442_2003_016_0982_svatcc_2.0.co_2.xml
Presidio	USA	1897	2000	103.50	0.50	Unspecified	Unspecified	Hourly	https://journals.ametsoc.org/view/journals/clim/16/6/1520-0442_2003_016_0982_svatcc_2.0.co_2.xml
Honolulu	USA	1905	2000	83.00	13.00	Marigram	Unspecified	Hourly	https://journals.ametsoc.org/view/journals/phoc/36/6/jpo2876.1.xml
Hilo	USA	1947	2000	54.00	0.00	Marigram	Unspecified	Hourly	https://journals.ametsoc.org/view/journals/phoc/36/6/jpo2876.1.xml
Seattle	USA	1899	2013	113.00	2.00	Unspecified	Unspecified	Hourly	https://www.researchgate.net/publication/261063515_Nineteenth_Century_North_American_and_Pacific_Tidal_Data_Lost_or_Just_Forgotten
New York (Governors Island)	USA	1852	1885	29.00	5.00	Marigram	Specalised Algorithm	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059574
New York (Governors Island)	USA	1844	1852	9.00	0.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059574
Brooklyn (Hamilton ferry dock)	USA	1856	1862	7.00	0.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059574

Sandy Hook	USA	1873	1893	17.00	4.00	Marigram	Specalised Algorithm	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059574
Fort Hamilton	USA	1893	1926	34.00	0.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059574
Southport	USA	1923	1988	37.00	29.00	Ledger	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GL069494
Wilmington	USA	1887	2015	90.00	39.00	Ledger and Digital	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GL069494
Eastport	USA	1861	1864	4.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Pulpit Harbour	USA	1870	1946	19.00	58.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Providence	USA	1872	1892	21.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Fort Schulyer	USA	1921	1932	12.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Willets point	USA	1892	2000	71.00	38.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Battery	USA	1843	2017	170.00	5.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Perth Amboy	USA	1933	1943	11.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Old Point Comfort	USA	1844	1974	60.00	71.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Norfolk	USA	1826	1894	10.00	59.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Southport	USA	1851	1954	31.00	73.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Charlston	USA	1849	1904	36.00	20.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Miami Beach	USA	1931	1985	53.00	2.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Red River Landing	USA	1871	1924	54.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Bayou Sara	USA	1898	1933	36.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Baton rouge	USA	1883	1890	8.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Plaquemines	USA	1880	1933	54.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Donaldsville	USA	1890	1933	44.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
College Point	USA	1881	1908	28.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Fort Jackson	USA	1898	1933	36.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Carrollton	USA	1872	1933	62.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Algiers	USA	1903	1921	19.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
East Bay	USA	1895	1924	30.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Biloxi	USA	1855	1928	37.00	37.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Galvston	USA	1852	1890	5.00	34.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sacramento	USA	1849	1946	79.00	19.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sausalito	USA	1877	1953	23.00	54.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
San Francisco	USA	1854	1877	24.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
San Diego	USA	1853	1872	20.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Santa Monica	USA	1932	1965	34.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Townsend	USA	1855	1952	11.00	87.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Vancouver	USA	1902	2017	91.00	25.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Portland	USA	1876	2017	142.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Kelly Point	USA	1901	1914	14.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sitka	USA	1893	1928	6.00	30.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Kodiak	USA	1880	1973	43.00	51.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Unalaska	USA	1934	1979	40.00	6.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Adak	USA	1943	1949	7.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Simpson	USA	1911	1919	9.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Columbia River	USA	1941	1943	3.00	0.00	Ledger	Manual	HLW, Hourly	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Boston tide gauge	USA	1921	2018	98.00	0.00	Marigram	Manual	HLW, Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017JC013645
Boston (Baldwin data)	USA	1825	1827	3.00	0.00	Ledger	Manual	HLW, Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017JC013645
Boston (US Navy data)	USA	1902	1911	10.00	0.00	Ledger	Manual	HLW, Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017JC013645
Boston (US coast survey)	USA	1847	1877	31.00	0.00	Marigram	Manual	HLW, Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017JC013645
Boston (Dry dock construction)	USA	1830	1833	4.00	0.00	Ledger	Manual	HLW, Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2017JC013645
Albany	USA	1868	2018	151.00	0.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018JC014313
Port Newark	USA	1919	1952	2.00	32.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Gregory Avenue	USA	1939	1958	2.00	18.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Montclair Bridge	USA	1932	1932	1.00	0.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Constable Hook	USA	1952	1952	1.00	0.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6

Staten Island Ferry Dock	USA	1918	1918	1.00	0.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Fort Hamilton	USA	1952	1952	1.00	0.00	Ledger	Manual	Unspecified	https://link.springer.com/article/10.1007/s12237-018-0379-6
Eastport	USA	1860	1890	7.00	24.00	Ledger	Unspecified	HLW, 30min	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015277
Portland	USA	1864	1866	1.42	1.58	Ledger	Unspecified	HLW, hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015277
Pulpit Harbour	USA	1870	1946	8.90	68.10	Unspecified	Unspecified	Hourly, 30min	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015277
Astoria	USA	1853	1876	24.00	0.00	Marigram	Specalised Algorithm	6min, hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015656
Astoria	USA	1854	1876	20.00	3.00	Ledger	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015656
Astoria tongue point	USA	1925	1957	33.00	0.00	Marigram	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015656
Fort Stevens	USA	1940	1942	3.00	0.00	Ledger	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015656
Astoria Youngs Bay	USA	1931	1943	13.00	0.00	Ledger	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015656
Mayport	USA	1895	1897	3.00	0.00	Marigram	Manual	Hourly	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JC016328
Acosta Bridge	USA	1959	1959	1.00	0.00	Marigram	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JC016328
Longbranch	USA	1928	1968	24.00	17.00	Marigram	Manual	HLW	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JC016328

Saint Johns River Estuary, Florida (US Army engineers)	USA	1879	1892	2.00	12.00	Ledger	Manual	Unspecified	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JC016328
Sacramento River, I Street	USA	1919	2024	74.00	31.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Sacramento River, Snodgrass	USA	1944	2024	78.00	2.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Mokelumne River, Thornton	USA	1959	2024	62.10	2.90	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Sacramento River, Walnut Grove	USA	1929	2024	74.90	20.10	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Mokelumne River, New Hope	USA	1925	2024	98.00	1.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Sacramento River, Rio Vista	USA	1915	2024	78.70	30.30	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Georgiana Slough, Mokelumne River	USA	1944	2024	63.20	16.80	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Three Mile Slough, Sacramento River	USA	1944	1984	25.90	14.10	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Sacramento River, Collinsville	USA	1915	2024	65.80	43.20	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Suisun Bay, Benicia (East Bay, Martinez)	USA	1944	2024	55.80	24.20	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018

San Joaquin River (Antioch)	USA	1934	2024	74.60	15.40	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (San Andreas Landing)	USA	1957	2021	56.30	7.70	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (Three Mile Slough)	USA	1944	2024	67.00	13.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (Venice Island)	USA	1928	2024	78.80	17.20	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Middle River (Bacon Island)	USA	1957	2024	59.20	7.80	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (Rindge Pump)	USA	1939	2024	70.60	14.40	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Old River, Rock Slough (Old River, Bacon Island)	USA	1945	2024	55.50	23.50	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River, Burns Cutoff (Stockton)	USA	1959	2024	61.00	4.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Middle River, Borden (Union Pt)	USA	1944	2024	69.40	10.60	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (Brandt Bridge)	USA	1958	2024	59.00	7.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Middle River (Mowry Bridge)	USA	1958	2024	60.00	6.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Old River (Clifton Court Ferry)	USA	1957	2024	61.00	6.00	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018

Grantline Canal (Tracy)	USA	1958	2024	52.80	13.20	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
Old River (Tracy Blvd Bridge)	USA	1957	2024	61.50	5.50	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018
San Joaquin River (Mossdale Bridge)	USA	1920	2024	45.80	58.20	Ledger	Manual	HLW	https://rmets.onlinelibrary.wiley.com/doi/10.1002/gdj3.70018

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Supplementary Material 2

Table S2. *A list of the studies which identified but did not recover historical tide data. A more detailed list can be found in the online catalogue at: https://ckenw77.github.io/TideVault/*

Location	Country	Record Start	Record Finish	No. Recorded years	No. Missing years	Data Type	Link
Unspecified	Algeria	1922	1953	2.00	30.00	Ledger	https://theses.hal.science/tel-00353660/
Arzew	Algeria	1958	1958	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Oran	Algeria	1931	1931	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Alger	Algeria	1843	1850	5.00	3.00	Unspecified	https://theses.hal.science/tel-00353660/
Alger	Algeria	1921	1921	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Bejaia	Algeria	1958	1958	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Puerto Belgrano	Argentina	Unspecified	Unspecified	10.00	Unspecified	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Austral Islands	Austral Islands	1956	1958	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Yamba	Australia	1900	1984	19.00	66.00	Marigram	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Ballina	Australia	1897	1986	21.00	69.00	Ledger	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Anvers	Belgium	1799	1803	2.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Nieuwpoort	Belgium	1801	1808	8.00	0.00	Ledger	https://theses.hal.science/tel-00353660/

Zeebrugge	Belgium	1940	1973	6.00	28.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Belize City	Belize	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Cotonou	Benin	1951	1952	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Kompong	Cambodia	1937	1938	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Phnom Penh	Cambodia	1860	1868	5.00	4.00	Unspecified	https://theses.hal.science/tel-00353660/
Ilot Cone	Cambodia	1930	1930	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ream	Cambodia	1927	1928	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Cameroon	1948	1955	2.00	6.00	Ledger	https://theses.hal.science/tel-00353660/
Douala	Cameroon	1938	1955	3.00	15.00	Ledger	https://theses.hal.science/tel-00353660/
Kribi	Cameroon	1915	1915	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Newfoundland	Canada	1851	1862	3.00	9.00	Ledger	https://theses.hal.science/tel-00353660/
Port Hardy	Canada	1905	1909	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Tofino	Canada	1905	1948	29.00	15.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Simpson	Canada	1903	1926	15.00	9.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Alberni	Canada	1909	1950	6.00	36.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Haney	Canada	1899	1900	2.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Sumas	Canada	1898	1911	4.00	10.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Coquitlan Townsite (Pitt River)	Canada	1912	1914	3.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
New Westminster (Fraser River)	Canada	1895	1926	32.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Garry Point (Fraser River)	Canada	1895	1926	32.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Atkinson	Canada	1897	1960	38.00	26.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sand Heads	Canada	1895	1930	36.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Claxton	Canada	1907	1914	8.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Prince Rupert	Canada	1906	1942	19.00	18.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Vancouver	Canada	1901	1940	25.00	15.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Victoria/ Esquimalt	Canada	1893	1908	16.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Jersey	Channel Islands	1832	1950	3.00	116.00	Ledger	https://theses.hal.science/tel-00353660/
Guernesey	Channel Islands	1832	1950	5.00	114.00	Ledger	https://theses.hal.science/tel-00353660/
Minquiers	Channel Islands	1888	1888	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
St Peter Port	Channel Islands	1989	1995	7.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Cape Horn	Chile	1882	1883	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Beihai	China	1901	1901	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Tché-Fou	China	1860	1860	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Rodbyhavn	Denmark	1955	1980	26.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Kobehavn	Denmark	1890	1974	85.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Korsor	Denmark	1890	1972	83.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Slipshavn	Denmark	1890	1971	82.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Flynshavn/Mommark	Denmark	1923	1969	47.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fredericia	Denmark	1890	1972	83.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Aarhus	Denmark	1890	1970	81.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Frederikshavn	Denmark	1890	1970	81.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Hirtshals	Denmark	1890	1891	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Hanstholm	Denmark	1950	1952	3.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Djibouti (GLOSS n°2)	Djibouti	1897	1928	3.00	29.00	Ledger	https://theses.hal.science/tel-00353660/

Djibouti (GLOSS n°2)	Djibouti	1899	1899	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Etablissements Français de l'Océanie?	Etablissements Français de l'Océanie	1953	1956	4.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Suez Canal	Eygpt	1891	1951	61.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Truk, Caroline Island	Federation States of Micronesia	1948	1949	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Grau-de-la-Dent	France	1905	1978	74.00	0.00	Marigram	https://www.sciencedirect.com/science/article/pii/S0278434306003888#sec2
Bancs des Flandres (SHOM 7JJ3354)	France	1932	1954	3.00	20.00	Ledger	https://theses.hal.science/tel-00353660/
Dunkerque	France	1802	1985	49.00	135.00	Ledger	https://theses.hal.science/tel-00353660/
Merville	France	1834	1834	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Boulogne	France	1876	1936	7.00	54.00	Ledger	https://theses.hal.science/tel-00353660/
Calais	France	1911	1954	2.00	42.00	Ledger	https://theses.hal.science/tel-00353660/
Le Touquet	France	1878	1878	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Dieppe	France	1937	1937	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Dieppe	France	1834	1978	35.00	110.00	Ledger	https://theses.hal.science/tel-00353660/
Le Tréport	France	1839	1896	8.00	50.00	Ledger	https://theses.hal.science/tel-00353660/
Pointe du Hoc	France	1869	1869	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Saint-Valery-en-Caux	France	1837	1878	5.00	37.00	Ledger	https://theses.hal.science/tel-00353660/
Fecamp	France	1834	1850	11.00	6.00	Marigram	https://theses.hal.science/tel-00353660/

Fecamp	France	1908	1950	3.00	40.00	Ledger	https://theses.hal.science/tel-00353660/
Cap de la Heve	France	1856	1869	14.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Le Havre	France	1701	1962	73.00	189.00	Ledger	https://theses.hal.science/tel-00353660/
Le Havre	France	1900	1920	21.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Le Havre (Sémaphore)	France	1956	1976	21.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Le Havre (Dragages)	France	1974	1982	9.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Octeville	France	1913	1913	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Quillebeuf	France	1852	1860	8.00	1.00	Unspecified	https://theses.hal.science/tel-00353660/
Honfleur	France	1869	1869	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Honfleur	France	1875	1960	3.00	83.00	Ledger	https://theses.hal.science/tel-00353660/
Arromanches	France	1949	1951	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Barfleur	France	1876	1876	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Barfleur	France	1933	1933	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Saint Vaast la Hougue	France	1949	1951	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Cotentin	France	1936	1950	6.00	9.00	Ledger	https://theses.hal.science/tel-00353660/
Cherbourg	France	1789	1979	89.00	102.00	Ledger	https://theses.hal.science/tel-00353660/
Cherbourg	France	1900	1914	15.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Jobourg	France	1921	1922	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Les Huquets de Jobourg	France	1952	1952	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/

Goury	France	1921	1922	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Barneville-Carteret	France	1902	1902	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Barneville-Carteret	France	1902	1902	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Ile Chausey	France	1831	1832	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Ile Chausey	France	1923	1924	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Granville	France	1829	1922	4.00	90.00	Ledger	https://theses.hal.science/tel-00353660/
Granville	France	1832	1840	7.00	2.00	Unspecified	https://theses.hal.science/tel-00353660/
Cancale	France	1835	1840	6.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Cancale	France	1923	1924	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Rochebonne	France	1960	1960	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
St. Marlo (St. Servan)	France	1829	1841	8.00	5.00	Unspecified	https://theses.hal.science/tel-00353660/
St. Marlo (St. Servan)	France	1835	1950	65.00	51.00	Ledger	https://theses.hal.science/tel-00353660/
St. Marlo (St. Servan)	France	1850	1917	68.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Cap Fréhel	France	1925	1925	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Lanros	France	1902	1902	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Baie de Saint Brieuc	France	1926	1929	4.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Paimpol	France	1835	1902	65.00	3.00	Unspecified	https://theses.hal.science/tel-00353660/
Paimpol	France	1902	1902	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Heaux de Brehat	France	1889	1932	9.00	35.00	Ledger	https://theses.hal.science/tel-00353660/

Abords de Brehat	France	1930	1935	3.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Perros-guirec	France	1955	1956	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Trégier	France	1954	1956	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Morlaix	France	1837	1931	4.00	91.00	Ledger	https://theses.hal.science/tel-00353660/
Roscoff	France	1954	1954	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Aberwrach	France	1835	1932	7.00	91.00	Ledger	https://theses.hal.science/tel-00353660/
Cote Ouest de France?	France	1964	1966	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ouessant	France	1816	1818	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ouessant	France	1835	1840	5.00	1.00	Unspecified	https://theses.hal.science/tel-00353660/
Sein	France	1816	1932	5.00	112.00	Ledger	https://theses.hal.science/tel-00353660/
Molène	France	1818	1818	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Roscanvel	France	1948	1948	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Camaret-sur-Mer	France	1816	1816	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Douarnenez	France	1817	1954	25.00	113.00	Ledger	https://theses.hal.science/tel-00353660/
Douarnenez	France	1835	1840	6.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Audierne	France	1835	1840	6.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Audierne	France	1902	1960	5.00	54.00	Ledger	https://theses.hal.science/tel-00353660/
Ile Longue	France	1954	1967	5.00	9.00	Ledger	https://theses.hal.science/tel-00353660/
Penmarch	France	1902	1904	2.00	1.00	Unspecified	https://theses.hal.science/tel-00353660/

Penmarch	France	1902	1902	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Ile Tudy	France	1835	1840	6.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Benodet	France	1903	1903	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Concarneau	France	1819	1905	3.00	84.00	Ledger	https://theses.hal.science/tel-00353660/
Hennebont	France	1902	1902	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Penfret	France	1903	1903	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Lorient	France	1716	1951	15.00	221.00	Ledger	https://theses.hal.science/tel-00353660/
Lorient	France	1839	1858	20.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Port Louis	France	1819	1819	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Groix	France	1938	1939	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Quiberon	France	1923	1927	5.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Belle-ile-en-mer	France	1908	1939	4.00	28.00	Ledger	https://theses.hal.science/tel-00353660/
Point Joinville	France	1967	1967	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Le Croisic	France	1906	1967	6.00	56.00	Ledger	https://theses.hal.science/tel-00353660/
Paimboeuf	France	1835	1893	3.00	56.00	Unspecified	https://theses.hal.science/tel-00353660/
Fromentine	France	1866	1956	3.00	88.00	Ledger	https://theses.hal.science/tel-00353660/
Saint Gilles Croix de Vie	France	1967	1967	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Les sables d'Olonne	France	1824	1967	3.00	141.00	Ledger	https://theses.hal.science/tel-00353660/
Les sables d'Olonne	France	1891	1891	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/

Ile de Ré	France	1963	1963	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Brest (La Pallice)	France	1885	1889	5.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ile d'Aix	France	1960	1964	2.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Fort Enet	France	1867	1867	0.00	1.00	Marigram	https://theses.hal.science/tel-00353660/
Fort Boyard	France	1876	1908	13.00	20.00	Marigram	https://theses.hal.science/tel-00353660/
Rochefort	France	1811	1858	28.00	20.00	Unspecified	https://theses.hal.science/tel-00353660/
Rochefort	France	1859	1918	60.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Rochefort	France	1859	1918	44.00	16.00	Marigram	https://theses.hal.science/tel-00353660/
Port des Barques	France	1859	1860	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Vergeroux	France	1824	1824	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Pointe de Chapus	France	1878	1878	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
La Cayenne	France	1878	1878	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
La Coubre	France	1874	1924	3.00	48.00	Ledger	https://theses.hal.science/tel-00353660/
Ile d'Oléron	France	1878	1964	3.00	84.00	Ledger	https://theses.hal.science/tel-00353660/
Saint Dennis d'Oléron	France	1882	1882	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
La Perrotine	France	1882	1882	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Château d'Oléron	France	1878	1882	2.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
La Perroche	France	1882	1882	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Coureaux d'Oléron	France	1946	1946	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/

Au Brie Maumusson	France	1813	1813	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Royan	France	1812	1924	9.00	104.00	Ledger	https://theses.hal.science/tel-00353660/
Talmont	France	1878	1892	2.00	13.00	Ledger	https://theses.hal.science/tel-00353660/
Mortagne	France	1868	1892	3.00	22.00	Ledger	https://theses.hal.science/tel-00353660/
Gironde	France	1949	1950	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Port de Beychevelle	France	1892	1892	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Blaye	France	1825	1892	2.00	66.00	Ledger	https://theses.hal.science/tel-00353660/
Blaye	France	1874	1874	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
La Grave	France	1874	1892	2.00	17.00	Marigram	https://theses.hal.science/tel-00353660/
Bordeaux	France	1825	1874	2.00	48.00	Ledger	https://theses.hal.science/tel-00353660/
Bec d'Ambez	France	1813	1825	2.00	11.00	Ledger	https://theses.hal.science/tel-00353660/
Pauillac	France	1867	1892	4.00	22.00	Ledger	https://theses.hal.science/tel-00353660/
Port de la Maréchale	France	1812	1892	5.00	76.00	Ledger	https://theses.hal.science/tel-00353660/
Port de By	France	1874	1892	2.00	17.00	Ledger	https://theses.hal.science/tel-00353660/
Pointe Grave	France	1868	1961	5.00	89.00	Ledger	https://theses.hal.science/tel-00353660/
Cordouan	France	1812	1924	9.00	104.00	Ledger	https://theses.hal.science/tel-00353660/
Cordouan	France	1912	1917	6.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Bassin d'Arcachon	France	1825	1931	5.00	102.00	Ledger	https://theses.hal.science/tel-00353660/
Arcachon-Eyrac	France	1892	1967	2.00	74.00	Ledger	https://theses.hal.science/tel-00353660/

Le Pilat-Plage	France	1964	1964	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Boucau-Bayonne	France	1919	1919	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Boucau-Bayonne	France	1899	1904	6.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Saint-Jean-De-Luz	France	1826	1979	26.00	128.00	Ledger	https://theses.hal.science/tel-00353660/
Socoa-Saint-Jean-De-Luz	France	1900	1917	18.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Bayonne	France	1826	1963	3.00	135.00	Ledger	https://theses.hal.science/tel-00353660/
Cotes Sud de France?	France	1958	1960	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Golfe du Lion	France	1937	1937	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Banyuls-Sur-Mer	France	1963	1963	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Port-Vendres	France	1895	1951	3.00	54.00	Ledger	https://theses.hal.science/tel-00353660/
Port-Vendres	France	1888	1932	45.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Sète	France	1975	1979	5.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Le Grau du Roi	France	1961	1961	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Port-de-Bouc	France	1956	1975	20.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Martigues	France	1895	1983	30.00	59.00	Ledger	https://theses.hal.science/tel-00353660/
Etang de Berre	France	1966	1966	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ile du Planier	France	1964	1980	17.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Toulon	France	1777	1975	49.00	150.00	Ledger	https://theses.hal.science/tel-00353660/
Toulon	France	1832	1836	5.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/

Port Pothuau	France	1954	1954	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Porquerolles	France	1896	1898	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Nice	France	1896	1990	38.00	57.00	Ledger	https://theses.hal.science/tel-00353660/
Porto-Vecchio	France	1884	1890	4.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Bastia	France	1957	1957	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Saint-Florent	France	1888	1891	2.00	2.00	Ledger	https://theses.hal.science/tel-00353660/
Calvi	France	1977	1977	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ajaccio	France	1821	1978	2.00	156.00	Ledger	https://theses.hal.science/tel-00353660/
La Rochelle, Vieux Port	France	1775	1776	1.00	0.00	Marigram	https://www.sciencedirect.com/science/article/pii/S0278434313001283#f0010
Kerguelen	French Southern and Antartic Lands	1949	1956	3.00	5.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Gabon	1889	1964	12.00	64.00	Ledger	https://theses.hal.science/tel-00353660/
Libreville	Gabon	1949	1963	3.00	12.00	Ledger	https://theses.hal.science/tel-00353660/
Sangatanga	Gabon	1963	1963	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Cap-Lopez	Gabon	1910	1912	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Gambia	1964	1965	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Gagra	Georgia	1926	1985	60.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Gudauta	Georgia	1928	1960	33.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Ochamchira	Georgia	1928	1960	33.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Elbe Estuary?	Germany	1811	1811	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Cuxhaven	Germany	1812	1812	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Tema	Ghana	1963	1964	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Gibraltar	Gibralta	1854	1855	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Gibraltar	Gibraltar	1961	1999	39.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	Guadeloupe	1867	1869	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Guinea	1947	1959	6.00	7.00	Ledger	https://theses.hal.science/tel-00353660/
Boffa	Guinea	1942	1943	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Conakry	Guinea	1900	1938	2.00	37.00	Marigram	https://theses.hal.science/tel-00353660/
Conakry	Guinea	1937	1950	3.00	11.00	Ledger	https://theses.hal.science/tel-00353660/
Dubréka	Guinea	1942	1943	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Guyana	1929	1948	6.00	14.00	Ledger	https://theses.hal.science/tel-00353660/
Salvation Islands	Guyana	1896	1897	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Salvation Islands	Guyana	1896	1937	3.00	39.00	Marigram	https://theses.hal.science/tel-00353660/
Cayenne	Guyana	1830	1830	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Cayenne	Guyana	1936	1937	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Cayenne	Guyana	1931	1937	5.00	2.00	Marigram	https://theses.hal.science/tel-00353660/

Saint-Laurent Du-Maroni	Guyana	1935	1937	3.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Saint-Laurent Du-Maroni	Guyana	1936	1937	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Honolulu	Hawaii	1851	1851	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Reykjavik	Iceland	1956	1963	8.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	Indochina	1904	1956	20.00	33.00	Ledger	https://theses.hal.science/tel-00353660/
Abadan	Iran	1931	1936	6.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Al Basrah	Iraq	1923	1932	9.00	1.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Kilbaha	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Kilrush	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Foynes Island	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi

								=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Limerick	Ireland		1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Casleh Bay	Ireland		1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Galway	Ireland		1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false

Old Head	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Mullaghmore	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Buncrana	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Port Rush	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-

							nZJlvx3WtW7G_29I#v=onepage&q&f=false
Carrow Keel	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Glenarm	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Donnaghadee	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Ardglass	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig

							=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Clogher Head	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Kingstown	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Dunmore East	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
New Ross	Ireland	1842	1842	0.25	0.75	Ledger	https://books.google.co.uk/books?hl=en&lr=&id=3IY_AAAAcAAJ&oi=fnd&pg=PA1&dq=Airy,+G.+B.,+1845.+On+the+laws+of+the+tides+on+the+coasts+of+Ireland,+as+inferred+from+an+extensive+series+of++

							observation&ots=MzTk0tsKU6&sig=pxngOFTngG-nZJlvx3WtW7G_29I#v=onepage&q&f=false
Wicklow	Ireland	1968	1969	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Trieste	Italy	1859	1874	16.00	0.00	Ledger	https://www.jstor.org/stable/4496116?seq=3
Messina	Italy	1858	1858	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Unspecified	Ivory Coast	1961	1965	5.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Vridi	Ivory Coast	1951	1952	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Vridi	Ivory Coast	1953	1953	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Quai Nord	Ivory Coast	1912	1965	8.14	45.86	Marirgams	https://www.scirp.org/pdf/jwarp_2023101914441059.pdf
Mina Az Zawr	Kuwait	1966	1967	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	La Réunion	1840	1948	9.00	100.00	Marigram	https://theses.hal.science/tel-00353660/
Unspecified	Les Comores	1962	1964	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Madagascar	1888	1960	28.00	45.00	Ledger	https://theses.hal.science/tel-00353660/
Antongil	Madagascar	1936	1937	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Toamasina	Madagascar	1900	1962	5.00	58.00	Ledger	https://theses.hal.science/tel-00353660/
Toamasina	Madagascar	1901	1907	7.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Nosy-bé	Madagascar	1900	1908	4.00	5.00	Ledger	https://theses.hal.science/tel-00353660/
Fort-Dauphin	Madagascar	1936	1937	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/

Fort-Dauphin	Madagascar	1951	1952	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Soalara	Madagascar	1948	1949	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Tulear	Madagascar	1951	1952	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Morombé	Madagascar	1960	1962	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Milamatsaha	Madagascar	1899	1899	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Majunga	Madagascar	1900	1900	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Majunga	Madagascar	1900	1962	11.00	52.00	Ledger	https://theses.hal.science/tel-00353660/
Diego-Suarez	Madagascar	1888	1909	5.00	17.00	Marigram	https://theses.hal.science/tel-00353660/
Diego-Suarez	Madagascar	1888	1962	12.00	63.00	Ledger	https://theses.hal.science/tel-00353660/
Beravina	Madagascar	1901	1901	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Beravina	Madagascar	1903	1903	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Morondava	Madagascar	1948	1955	6.00	2.00	Ledger	https://theses.hal.science/tel-00353660/
Mosoala?	Madagascar	1960	1962	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Baie du Courrier	Madagascar	1907	1907	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Foulpointe	Madagascar	1948	1949	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Fénérive	Madagascar	1951	1952	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Valletta	Malta	1870	1926	26.00	31.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	Martinique	1824	1825	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Fort de France	Martinique	1912	1939	3.00	25.00	Marigram	https://theses.hal.science/tel-00353660/

Fort de France	Martinique	1938	1939	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Saint Pierre	Martinique	1939	1942	4.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Baie du Levrier	Mauritania	1905	1906	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Unspecified	Mauritania	1954	1965	6.00	6.00	Ledger	https://theses.hal.science/tel-00353660/
Agalega Islands	Mauritius Group	1962	1962	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	Mayotte	1900	1900	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Unspecified	Mayotte	1913	1963	3.00	48.00	Ledger	https://theses.hal.science/tel-00353660/
Cabo San Lucas	Mexico	1859	1861	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Unspecified	Morocco	1905	1955	6.00	45.00	Ledger	https://theses.hal.science/tel-00353660/
Rabat	Morocco	1913	1939	8.00	19.00	Unspecified	https://theses.hal.science/tel-00353660/
Mehdia	Morocco	1913	1954	3.00	39.00	Ledger	https://theses.hal.science/tel-00353660/
Mehdia	Morocco	1953	1953	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Pont Blondin	Morocco	1954	1954	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Casablanca	Morocco	1920	1954	4.00	31.00	Ledger	https://theses.hal.science/tel-00353660/
El Jadida	Morocco	1952	1952	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Safi	Morocco	1950	1954	2.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Essaouira	Morocco	1920	1920	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Agadir	Morocco	1920	1956	6.00	31.00	Ledger	https://theses.hal.science/tel-00353660/

Agadir	Morocco	1942	1942	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Walvis Bay	Namibia	1932	1957	26.00	0.00	Unspecified	In review
Escaut occidental	Netherlands	1811	1811	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Vlissingen	Netherlands	1799	1808	5.00	5.00	Ledger	https://theses.hal.science/tel-00353660/
Paagoumene	New Caledonia	1936	1936	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	New Caledonia	1872	1965	6.00	88.00	Ledger	https://theses.hal.science/tel-00353660/
Thio	New Caledonia	1906	1907	2.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Nouméa	New Caledonia	1930	1937	8.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Goro	New Caledonia	1938	1938	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Akaroa	New Zealand	1844	1844	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Akaroa	New Zealand	1843	1844	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Wellington	New Zealand	1887	1890	4.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Lyttleton	New Zealand	1883	1923	41.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Dunedin	New Zealand	1883	1899	17.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
West Port	New Zealand	1901	1981	81.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Wellington	New Zealand	1894	1894	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Lyttleton	New Zealand	1886	1900	15.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Dunedin	New Zealand	1898	1898	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Bonny Town	Nigeria	1963	1967	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Calabar	Nigeria	1961	1970	10.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Lagos Bar	Nigeria	1940	1970	17.00	14.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Ogidigbe	Nigeria	1961	1962	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Port Harcourt	Nigeria	1963	1967	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Sapele	Nigeria	1962	1969	8.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Warri	Nigeria	1915	1926	12.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Spitzberg	Norway	1892	1892	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Colón	Panama	1882	1882	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Naos	Panama	1882	1882	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Isle de Naos	Panama	1881	1888	8.00	0.00	Marigram	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Cebu	Phillippines	1935	1938	4.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Unspecified	Polynésie Française	1958	1968	8.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Iles Gambier	Polynésie Française	1956	1968	6.00	7.00	Ledger	https://theses.hal.science/tel-00353660/
Mururoa	Polynésie Française	1962	1968	4.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Iles Marquises	Polynésie Française	1956	1958	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Tuamotu	Polynésie Française	1949	1968	10.00	10.00	Ledger	https://theses.hal.science/tel-00353660/
Tahiti	Polynésie Française	1936	1968	7.00	26.00	Ledger	https://theses.hal.science/tel-00353660/
Papeete	Polynésie Française	1911	1924	2.00	12.00	Marigram	https://theses.hal.science/tel-00353660/
Moorea	Polynésie Française	1956	1957	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Raiatea	Polynésie Française	1956	1969	3.00	11.00	Ledger	https://theses.hal.science/tel-00353660/
Tahaa	Polynésie Française	1956	1957	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Bora-Bora	Polynésie Française	1956	1967	4.00	8.00	Ledger	https://theses.hal.science/tel-00353660/
Ile Wallis	Polynésie Française	1936	1936	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Unspecified	Republic of Congo	1960	1960	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Pointe-Noire	Republic of Congo	1911	1918	2.00	6.00	Marigram	https://theses.hal.science/tel-00353660/
Port Saint Pierre	Saint Pierre et Miquelon	1940	1940	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Senegal	1958	1965	5.00	3.00	Ledger	https://theses.hal.science/tel-00353660/
Casamance?	Senegal	1963	1964	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Mbour	Senegal	1948	1948	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Dakar	Senegal	1889	1932	21.00	23.00	Marigram	https://theses.hal.science/tel-00353660/

Dakar	Senegal	1936	1937	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Rufisque	Senegal	1930	1931	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Kaolack	Senegal	1930	1931	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Port Victoria	Seychelles	1962	1968	7.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Honiara	Solomon Islands	1957	1968	9.00	3.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Unspecified	Somalia	1934	1935	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Port Nolloth	South Africa	1907	1908	2.00	0.00	Unspecified	In review
Table Bay Harbour	South Africa	1835	1958	70.00	54.00	Unspecified	In review
Simons Bay	South Africa	1831	1956	75.00	51.00	Unspecified	In review
Port Elizabeth	South Africa	1879	1972	68.00	26.00	Unspecified	In review
East London	South Africa	1867	1959	56.00	37.00	Unspecified	In review
Durban	South Africa	1885	1969	41.00	44.00	Unspecified	In review
Almeria	Spain	1977	1998	22.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Cartagena	Spain	1927	1989	15.00	48.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
A Coruna	Spain	1950	1983	34.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Mtwara Bay	Tanzania	1954	1962	9.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Pointe Geolgie	Terre Adélie	1957	1957	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Unspecified	Terre Adélie	1961	1962	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/

Gulf of Thailand?	Thailand	1902	1952	8.00	43.00	Ledger	https://theses.hal.science/tel-00353660/
Salara	Timor-Leste	1903	1903	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Unspecified	Tunisia	1881	1952	12.00	60.00	Ledger	https://theses.hal.science/tel-00353660/
Bizerte	Tunisia	1890	1955	24.00	42.00	Ledger	https://theses.hal.science/tel-00353660/
Gabes	Tunisia	1885	1885	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Sfax	Tunisia	1884	1949	3.00	63.00	Ledger	https://theses.hal.science/tel-00353660/
Sfax	Tunisia	1884	1886	3.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Sfax	Tunisia	1946	1947	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Adjim Canal	Tunisia	1933	1933	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Barrow (Ramsden Dock)	UK	1849	1891	29.00	14.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Barrow (Halfway Shoal)	UK	1992	1996	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Barrow (Roa Island)	UK	1992	1996	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Blacktoft	UK	1991	1992	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Bournemouth	UK	1974	1990	17.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Burnham-on-Crouch	UK	1987	1988	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Chatham	UK	1968	1987	19.00	1.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Dunbar	UK	1969	1979	11.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fleetwood	UK	1992	1992	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Goole	UK	1994	1996	3.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Gorleston-On-Sea	UK	1991	1993	3.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Greenock	UK	1972	1989	17.00	1.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Haws Point	UK	1982	1982	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Humber Bridge	UK	1991	1992	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Ilfracombe	UK	1970	1971	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Invergordon	UK	1915	1918	4.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Inverness	UK	1995	1995	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Larne	UK	1968	1969	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Leith	UK	1980	1988	9.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Milford Haven	UK	1980	1984	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Nab Tower	UK	1934	1935	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
North Woolwich	UK	1989	1996	8.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Oban	UK	1910	1972	7.00	56.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Plymouth (Devonport)	UK	1953	1961	9.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Portland	UK	1923	1987	22.00	43.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Portsmouth	UK	1936	1958	22.00	1.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Ramsgate	UK	1990	1991	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Rosyth	UK	1912	1964	29.00	24.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Scarborough	UK	1958	1967	10.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Scrabster	UK	1966	1976	11.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Shoreham	UK	1965	1997	16.00	17.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Stromness	UK	1910	1912	3.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Tobermory	UK	1977	1978	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Dorset Lake	UK	1980	1981	1.33	0.67	Marigram	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JC016328
Unspecified	UK	1947	1956	4.31	5.69	Marigram	https://southerncoastalgroup-scopac.org.uk/wp-content/uploads/2022/01/Digitisation-and-Analysis-of-Poole-Harbour-Tide-Gauge-Record-September-2021.pdf
Holes Bay	UK	1980	1981	1.33	0.67	Marigram	https://southerncoastalgroup-scopac.org.uk/wp-content/uploads/2022/01/Digitisation-and-Analysis-of-Poole-Harbour-Tide-Gauge-Record-September-2021.pdf
Walton-on-Naze	UK	1967	1996	30.00	0.00	Marigram	https://southerncoastalgroup-scopac.org.uk/wp-content/uploads/2022/01/Digitisation-and-Analysis-of-Poole-Harbour-Tide-Gauge-Record-September-2021.pdf
Margate Harbour	UK	1970	1997	28.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Shivering Sand	UK	1964	1988	25.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Southend	UK	1929	1997	69.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Coryton	UK	1969	1983	15.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-

							origsite=gscholar&sourcetype=Scholarly%20Journals
Tilbury	UK	1929	1989	61.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Gallions Pier (Albert Dock)	UK	1950	1990	41.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Silvertown (North Woolwich)	UK	1950	1990	41.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Tower Pier	UK	1929	1997	69.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Old Swan Pier	UK	1929	1997	69.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Richmond	UK	1962	1997	36.00	0.00	Marigram	https://www.proquest.com/docview/2649433831?fromopenview=true&pq-origsite=gscholar&sourcetype=Scholarly%20Journals
Broomielaw*	UK	1890	1972	79.40	3.60	Marigram	In review
Bowling*	UK	1888	1952	43.30	21.70	Marigram	In review
Rothesay Dock*	UK	1908	1972	62.30	2.70	Marigram	In review
Gourock*	UK	1922	1966	45.00	0.00	Marigram	In review
Queens Dock*	UK	1883	1890	8.00	0.00	Marigram	In review

Govan Wharf*	UK	1906	1966	55.80	5.20	Marigram	In review
Pointhouse*	UK	1903	1906	4.00	0.00	Marigram	In review
Patrick Wharf*	UK	1891	1910	13.00	7.00	Marigram	In review
Dalmuir*	UK	1899	1907	9.00	0.00	Marigram	In review
Princes Pier*	UK	1906	1921	16.00	0.00	Marigram	In review
Broomielaw*	UK	1895	1982	54.40	33.60	Ledger	In review
Govan Wharf*	UK	1906	1966	56.20	4.80	Ledger	In review
Pointhouse*	UK	1895	1906	7.00	5.00	Ledger	In review
Rothesay Dock*	UK	1859	1982	31.80	92.20	Ledger	In review
Dalmuir*	UK	1866	1906	10.00	31.00	Ledger	In review
Bowling*	UK	1895	1971	63.00	14.00	Ledger	In review
Dumbuck*	UK	1859	1881	20.00	3.00	Ledger	In review
Garmoyle*	UK	1859	1881	21.00	2.00	Ledger	In review
Cardoss*	UK	1859	1881	21.00	2.00	Ledger	In review
Princes Pier*	UK	1908	1980	15.00	58.00	Ledger	In review
Port Glasgow*	UK	1895	1906	6.00	6.00	Ledger	In review
Gourock*	UK	1922	1974	53.00	0.00	Ledger	In review
Glasgow Harbour*	UK	1859	1878	19.00	1.00	Ledger	In review
Jabal Az Zannah	United Arab Emirates	1968	1980	13.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Mer d'Alboran	Unspecified	1961	1962	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Old Point Comfort	USA	1853	1853	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Fort Constitution	USA	1853	1853	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Easport	USA	1860	1918	2.00	57.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Pulpit Harbour	USA	1888	1888	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Newport, RI	USA	1992	1995	4.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fort Hamilton	USA	1927	1936	10.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
New York (Governor's Island)	USA	1837	1886	31.00	19.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Willet's Point	USA	1885	1896	7.00	5.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Sandy Hook	USA	1835	1839	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Atlantic City	USA	1911	1939	29.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Philadelphia	USA	1890	1937	48.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Baltimore	USA	1845	1899	11.00	44.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Annapolis	USA	1853	1870	2.00	16.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Old Point Comfort	USA	1906	1910	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Wilmington	USA	1882	1882	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Charleston	USA	1850	1913	41.00	23.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Fort Pulaski	USA	1851	1852	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fernandina	USA	1855	1879	6.00	19.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Mayport	USA	1899	1939	41.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Pensacola	USA	1890	1939	50.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fort Morgan	USA	1846	1920	3.00	72.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Galveston	USA	1852	1939	88.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
La Jolla	USA	1924	1939	16.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Los Angeles	USA	1852	1937	86.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
San Francisco	USA	1853	1853	1.00	0.00	Marigram	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Sausalito	USA	1851	1870	20.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Port Townsend	USA	1941	1941	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Seattle	USA	1891	1892	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Fort Sumter	USA	1882	1913	28.00	4.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

Presidio	USA	1858	1925	29.00	39.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
St Paul, Kodiak	USA	1880	1891	12.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
San Juan	USA	1892	1899	7.00	1.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Santa Barbara	USA	1931	1935	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Friday Harbor	USA	1934	1938	5.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Toke point (Willapa Bay)	USA	1935	1938	4.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
San Francisco	USA	1853	1853	1.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Seattle	USA	1891	1892	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Portsmouth	USA	1926	1957	32.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Salem	USA	1828	1829	2.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Newport	USA	1844	1912	10.00	59.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Marcus Hook	USA	1915	1916	2.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cape May	USA	1909	1928	8.00	12.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Fort Carroll (Baltimore)	USA	1897	1901	5.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Annapolis	USA	1844	1847	4.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Washington DC	USA	1858	1902	13.00	32.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Alexandria	USA	1913	1915	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cambridge	USA	1942	1951	10.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Colonial Beach	USA	1902	1910	9.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Richmond	USA	1892	1972	81.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
West Point (York River)	USA	1971	1974	4.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Portsmouth	USA	1908	1915	8.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Morehead City	USA	1952	1963	12.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cape Lookout Bight	USA	1914	1916	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Winyah Bay	USA	1899	1934	27.00	9.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Royal	USA	1892	1897	2.00	4.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Fort Jackson/ Savannah	USA	1903	1957	55.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Fort Pulaski/ Tybee Light (Savannah River)	USA	1889	1892	4.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Fort Clinch/ Fernandina	USA	1856	1878	8.00	15.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Mayport/ Jacksonville	USA	1892	1898	4.00	3.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
St Augustine	USA	1892	1918	17.00	10.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Daytona Beach	USA	1925	1950	21.00	5.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Key West	USA	1851	1858	4.00	4.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Dry Tortugas	USA	1857	1861	5.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Punta Rassa	USA	1927	1966	5.00	35.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Egmont Key	USA	1924	1926	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
St Petersburg	USA	1924	1926	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cedar Keys	USA	1857	1893	4.00	33.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Pensacola	USA	1858	1859	2.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Mobile	USA	1934	1937	4.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Fort Morgan	USA	1848	1919	8.00	64.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
New Orleans	USA	1936	1954	19.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Head of Passes	USA	1875	1947	73.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Eads	USA	1875	1943	69.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
North Pass	USA	1941	1953	13.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Pass a Loutre	USA	1941	1943	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Burrwood Bayou	USA	1941	1953	13.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cubits Gap	USA	1944	1952	9.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Burrwood SW Pass	USA	1909	1960	52.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Bayou Rigaud	USA	1949	1979	31.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Eugene Island	USA	1939	1974	36.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Humble Oil Platform	USA	1949	1969	15.00	6.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Mermentau R.	USA	1941	1947	7.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Isabel	USA	1944	1976	33.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Humboldt	USA	1911	1923	5.00	8.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sacramento	USA	1969	1985	17.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Stockton	USA	1908	1956	26.00	23.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Benicia	USA	1976	1981	6.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Hunter's Point	USA	1941	1956	12.00	4.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Monterrey	USA	1854	1957	8.00	96.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Honolulu	USA	1877	1904	22.00	6.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port San Louis	USA	1933	1935	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Hueneme	USA	1940	1962	23.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Long Beach	USA	1924	1985	62.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Newport Beach	USA	1959	1994	36.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Bellingham	USA	1914	1935	3.00	19.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Anacortes	USA	1921	1923	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Seattle	USA	1875	1875	1.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Bremerton	USA	1897	1952	24.00	32.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Olympia	USA	1916	1953	11.00	27.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Tacoma	USA	1950	1954	5.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
USACE	USA	1883	1907	25.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Umpqua	USA	1920	1934	3.00	12.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Coos Bay	USA	1922	1924	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Craig	USA	1914	1920	7.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Juneau	USA	1911	1980	50.00	20.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Skagway	USA	1908	1970	33.00	30.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Yakutat	USA	1945	1954	10.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Cordova	USA	1929	1931	3.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Valdez	USA	1923	1968	11.00	35.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Anchorage	USA	1918	1974	16.00	41.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Seward	USA	1926	1929	4.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Nikiski	USA	1961	1976	9.00	7.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Seldovia	USA	1906	1979	22.00	52.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Sand Point	USA	1953	1964	4.00	8.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Port Moller	USA	1939	1960	10.00	12.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
King Cove	USA	1923	1943	11.00	10.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Unalaska	USA	1889	1889	1.00	0.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Portland	USA	1852	1852	0.42	0.58	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Acosta Bridge	USA	1945	1970	26.00	0.00	Marigram	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac

Port Vila	Vanuatu	1967	1968	2.00	0.00	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf
Cac Ba	Vietnam	1902	1908	3.00	4.00	Marigram	https://theses.hal.science/tel-00353660/
Tonkin Province?	Vietnam	1874	1885	2.00	10.00	Unspecified	https://theses.hal.science/tel-00353660/
Tonkin Province?	Vietnam	1886	1950	9.00	56.00	Ledger	https://theses.hal.science/tel-00353660/
Red River?	Vietnam	1929	1929	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ha Long Bay	Vietnam	1929	1938	6.00	4.00	Ledger	https://theses.hal.science/tel-00353660/
Ha tien	Vietnam	1868	1868	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Ha tien	Vietnam	1904	1905	2.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Vinh	Vietnam	1936	1937	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Can Tho	Vietnam	1869	1869	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Cua-Hoi	Vietnam	1926	1943	17.00	1.00	Unspecified	https://theses.hal.science/tel-00353660/
Cua-Hoi	Vietnam	1930	1944	15.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Than Hoa Province?	Vietnam	1930	1930	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
My Thon	Vietnam	1862	1866	2.00	3.00	Unspecified	https://theses.hal.science/tel-00353660/
Ho Chi Minh	Vietnam	1861	1863	3.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Ho Chi Minh	Vietnam	1864	1898	6.00	29.00	Unspecified	https://theses.hal.science/tel-00353660/
Ho Chi Minh	Vietnam	1921	1925	5.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Bien Hoa	Vietnam	1861	1862	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Can Gio	Vietnam	1861	1867	6.00	1.00	Ledger	https://theses.hal.science/tel-00353660/

Can Gio	Vietnam	1896	1898	2.00	1.00	Unspecified	https://theses.hal.science/tel-00353660/
Can Gio	Vietnam	1868	1868	1.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Hon Dau	Vietnam	1931	1937	7.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Haiphong	Vietnam	1874	1936	12.00	51.00	Unspecified	https://theses.hal.science/tel-00353660/
Haiphong	Vietnam	1928	1929	2.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
Cua Cam	Vietnam	1873	1874	2.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Vung Tau	Vietnam	1862	1950	11.00	78.00	Ledger	https://theses.hal.science/tel-00353660/
Vung Tau	Vietnam	1908	1933	11.00	15.00	Marigram	https://theses.hal.science/tel-00353660/
Hong Gai	Vietnam	1925	1925	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Hong Gai	Vietnam	1903	1937	9.00	26.00	Marigram	https://theses.hal.science/tel-00353660/
Cam Ranh	Vietnam	1906	1950	9.00	36.00	Ledger	https://theses.hal.science/tel-00353660/
Cam Ranh	Vietnam	1909	1909	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Long Chau Island	Vietnam	1930	1930	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Annam?	Vietnam	1935	1936	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Da Nang	Vietnam	1858	1944	18.00	69.00	Unspecified	https://theses.hal.science/tel-00353660/
Da Nang	Vietnam	1858	1908	4.00	47.00	Ledger	https://theses.hal.science/tel-00353660/
Da Nang	Vietnam	1902	1949	21.00	27.00	Marigram	https://theses.hal.science/tel-00353660/
Phan Rang	Vietnam	1930	1930	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Nha Trang	Vietnam	1898	1902	3.00	2.00	Marigram	https://theses.hal.science/tel-00353660/

Nha Trang	Vietnam	1912	1913	2.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Qui Nhon	Vietnam	1902	1902	1.00	0.00	Unspecified	https://theses.hal.science/tel-00353660/
Qui Nhon	Vietnam	1879	1938	11.00	49.00	Marigram	https://theses.hal.science/tel-00353660/
Qui Nhon	Vietnam	1926	1926	1.00	0.00	Ledger	https://theses.hal.science/tel-00353660/
Cau-Da	Vietnam	1930	1944	15.00	0.00	Marigram	https://theses.hal.science/tel-00353660/
St Thomas	Virgin Islands	1872	1926	8.00	47.00	Ledger	https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1426&context=cengin_fac
Castries	Windward Islands	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	https://sonel.univ-lr.fr/IMG/pdf/caldwell_2012unesco.pdf

* Recently scanned and held at the National Oceanography Centre, Liverpool, on behalf of Scottish Environment Protection Agency.

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Supplementary Material 3

Table S3. *A complete list of the 20 identified digitisation tools, showing the name, link to access the tool, a list of the studies where it was used to recover historical tide data and a list of some of the studies where the tool was used to digitise other forms of data.*

Tool	Link	Historical tide record study	Used in other studies
NUNIEAU	NUNIEAU: Software for digitizing the graphic recordings of WATER LEVELS - Expertises Territoires	Pirazzoli et al. 2007; Ullmann et al. 2007; Labbé et al. 2012; Wöppelmann et al. 2014; Ferret et al. 2015; Latapy et al. 2020; Khan et al. 2023; Yéo et al. 2023	Fuentes et al. 2018; Paturel et al. 2024
Plot Digitizer	PlotDigitizer PRO App	McInnes et al. 2024	Bae et al. 2013; Iliodromiti et al. 2014; Xu and Boeing, 2014; Han et al. 2014; Bell et al. 2015; Sarfaty et al. 2018; Kokkinou et al. 2018; Menshawy et al. 2018; Moscarelli et al. 2020; Fundaun et al. 2022; Miatke et al. 2023; Wilding et al. 2024
WebPlotDigitizer	WebPlotDigitizer - Copyright 2010-2024 Ankit Rohatgi	McLoughlin et al. 2024	Drevon et al. 2017; Marin et al. 2017; Burda et al. 2017; Mani et al. 2018; Raseli et al. 2019; Ashok et al. 2020; Riaz, 2020; Zhao, 2020; Laffon et al. 2020; Veitia, 2021; Daniel et al. 2022;

				Purushothaman et al. 2023; Cicala et al. 2023; González-Barrios et al. 2023; Gouveia et al. 2024; Yu et al. 2025; Molina-Hernández and Álvarez-Filip, 2024; Ullah et al. 2025
Engauge Digitizer	Engauge Digitizer	None		Zhang et al. 2012; Chen et al. 2013; Wu et al. 2016; Cao et al. 2017; No et al. 2017; Kim et al. 2018; Xu et al. 2018; Shi et al. 2019; Molina et al. 2023; Sanders et al. 2023; Yu and Kim, 2023; Pak et al. 2023; Ma et al. 2025; Ye et al. 2025
Graph Grabber	Graph Grabber 2.0.2 | Downloads And Demos | Software | Quintessa Limited | Scientific and Mathematical Consultancy	None		Ngaba et al. 2014; Myneedu et al. 2019; Gaudino et al. 2019; Niether et al. 2020; Comino-Suárez et al. 2021; Ganguly et al. 2021; Khairallah et al. 2023; Kingsberg et al. 2023; Bernemann et al. 2024; Pereira et al. 2025
OriginPro	Origin: Data Analysis and Graphing Software	None		Fedorov et al. 2010; Yanshina et al. 2020; Peng et al. 2020; Adshead et al. 2023; Sibirev et al. 2023; Oberlander et al. 2024; Han et al. 2025; Sutariya and Mer, 2025
GetData Graph Digitizer	Digitize graphs and plots - GetData Graph Digitizer - graph digitizing software	None		Shen et al. 2016; Park et al. 2018; Moreira et al. 2021; Shi and Lin, 2021; Kim et al. 2023; Zhou et al. 2023; Gikaro et al. 2023; Lee et al. 2023; Ren et al. 2023; Park et al. 2023;

			Wang et al. 2023; Zhang et al. 2023; Ma et al. 2023; Zhu et al. 2023; Fang et al. 2023; Kong et al. 2024; Lu et al. 2024; Liu et al. 2025
GRABIT	GRABIT - File Exchange - MATLAB Central	None	Stepien et al. 2015; Kashkynbayev et al. 2020; Burke et al. 2024; Faulder et al. 2024; Chattopadhyay et al. 2024; Chattopadhyay et al. 2025; Kench et al. 2025
DigitGraph	DigitGraph | Newton Excel Bach, not (just) an Excel Blog	None	None
Digitizeit	DigitizeIt - Plot Digitizer Software. Digitize graphs, charts and math data.	None	Wiermann et al. 2008; Sun et al. 2015; Bhowmick, 2017; Sofi et al. 2017; Zoder-Martell et al. 2019; Cho et al. 2019; Ball and Tarride, 2019; Pitman et al. 2020; Hoondert et al. 2020; Teres et al. 2021; Pitman et al. 2022; Rios Olais et al. 2023; Noack et al. 2024; Choe et al. 2025
Dagra	Homepage - Dagra Data Digitizer	None	Lung et al. 2013; Milas et al. 2014; Koehler et al. 2014; Koehler and Tranvik, 2015; Koehler et al. 2016; Rahmati and Behzadipour, 2019; Cedro III et al. 2019; Olsen et al. 2021; Pulido et al. 2023
UN-SCAN-IT	UN-SCAN-IT Graph Digitizer Software	None	Jemnitz et al. 2002; Zerbe et al. 2004; Saleem et al. 2006; Jeong et al. 2007; Magnani et al. 2007; Leonardi et al. 2012; Yamada et al. 2013;

			Li et al. 2014; Kong et al. 2016; Cho et al. 2017; Rasheed et al. 2019; Akkanapalli et al. 2020; Ho et al. 2021; Greiner et al. 2025
DataThief III	DataThief	None	Gallagher and Dick, 2010; Braissant et al. 2013; Richard et al. 2014; Mach et al. 2014; Shantz and Burkepile, 2014; Monaco et al. 2014; Gittman et al. 2016; Meiners et al. 2018; Hollweg et al. 2020; Reddin et al. 2020; Ardyna et al. 2020; Lukić et al. 2022
xyExtract Graph Digitizer	xyExtract Graph Digitizer	None	Hoffmann et al. 2009; Simion et al. 2009; de Oliveira Ferreira et al. 2011; McNicol et al. 2011; Kozlowsky-Suzuki et al. 2012; Lawes et al. 2013; Simion et al. 2015; Augusto and Miano, 2017; Hariri Tabrizi et al. 2020; Laccio et al. 2021; Deshoux et al. 2023
Log Evolve	Log Evolve Type Log Digitizing Software - Gray Technical	None	Arts et al. 2024
G3data	GitHub - pn2200/g3data: Grab graph data, a program for extracting data from graphs	None	Mendyk et al. 2012; Mancinelli et al. 2013; Ludlow and Lee, 2015; Wang et al. 2016; Cheng et al. 2017; Sarangi and Baas, 2021; Fell et al. 2023; Mattera et al. 2025
Im2graph	im2graph	None	Shoffner and Schnell, 2016; Afrin et al. 2018; Burrow et al. 2018; Arabi et al. 2019; Lassila et al. 2020; Dimitri et al. 2021; Mak and Elkady, 2021; Sampaio et al. 2021;

			Santos et al. 2021; Scott and Freckleton, 2022
WinDig	WinDig 2.5 – Image Data Digitizer – My Biosoftware – Bioinformatics Softwares Blog	None	Ostenfeld et al. 1998; Guerrero and Li, 2004; Papaioannou et al. 2005; Dueker, 2006; O'Connor et al. 2006; Caccamese et al. 2007; Tan and Fok, 2010; Xiao, et al. 2013; Xu and Yuan, 2017
Graphreader	graphreader.com - Online tool for reading graph image values and save as CSV / JSON	None	Sahin et al. 2020; Dostbil et al. 2024; Banolia et al. 2025; Meyerson et al. 2025
GraphClick	GraphClick - Macintosh Repository	None	Kimbro et al. 2013; Liu et al. 2014; Hussain et al. 2017; Hussain et al. 2021; Gorman et al. 2022; Islam et al. 2023

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