

LifeWatch Data Grant 2014

Filling the gaps in the World Register of Marine species (WoRMS)

Turritellidae

Final Report

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1. Data grant background

Late 2009, a first tentative list of potentially accepted names of Turritellidae was uploaded into WoRMS based on such provisional list provided by the present editor, with the aim to deliver a first rough idea of extant species and to provide a basis to continue constructive work across editors. At the time, the data load only contained the epithet, author and a single bibliographic source for each record.

A number of doubtful names were not uploaded nor were any names of fossil species. Some have since been added and some have been updated according to the background research progress and – if and when occurred – following specific requirements.

Furthermore, valid contributions to the initial list were made by many editors in many genera, sometimes based on dubious records from very general bibliography; sometimes from extensive recent works on specific groups of Turritellidae. A large number of photographs has meanwhile kindly been provided by NRM, Rotterdam, and checked by the present editor.

However, with somewhat 1500+ names attributed to both fossil as well as recent species throughout history, and with uncertainty surrounding the earliest species names, pre-occupation, synonymies and misinterpretations are all over. Very early misinterpretations of Linnaean species and even the evolution of Linnaeus' own *perception of turritellid species*, have caused that most of the recent generic and specific names are in drastic need of systematic type-based research, analysis of infra-specific variation, analysis of protoconch- and operculum development and extensive documentation – by preference supported by molecular research - in order to enable proper further examinations, generic definitions and taxonomic placement, species identity, validity, further replacements if and when needed and as a bottom line solid-based future worldwide biodiversity and possibly even climate research.

2. Agreed deliverables (as specified in the Data Grant contract)

The data grant project was started April 1st, 2014 and ran until June 30th, 2014. [Actual on-site research: 22/04 to 02/05 (9 workdays), excl. April 26 and 27]

The following results were expected by the end of the contract [copied from the contract]:

- Addition to the World Register of Marine Species of the results on the examined samples. (Initial estimation: 28 to 30 samples)
- By the end of the contract, the consultant shall submit a final report, listing the work done and the problems encountered. This report will be made available online.
- If any of the tasks has not been completely finished, the report should clearly mention this, including a short explanation on why some taxa could

not be evaluated. If this were the case, the consultant shall give a truthful assessment of the estimated time needed to complete the remaining work.

Besides the contractual deliverables, a win-win was agreed with NHMUK consisting of assistance with the treatment of a number of type samples, historical- and bibliography research, detailed sample documentation and detailed photography using high magnification.

3. Results of the project:

a. Summary:

The present type-based research as performed under the WoRMS LifeWatch Data Grant aimed to establish species identities and synonymies, and document those as a basis for future research(ers), through filling data gaps in WoRMS.

From a qualitative point of view, the present project illustrates how little is known on Turritellidae as a taxonomic group on a global scale, how diverse the sometimes lucrative misinterpretations in the past have been, and that Turritellidae apparently are a less homogeneous group than currently perceived – even requiring the support of molecular study.

Furthermore, quantitative results illustrate how a small project against limited investment can lead to a large output and the filling of many gaps - in part through indirectly impacted Aphia - leaving opportunity for the host institution to now organise and curate the General Collection (Turritellidae) based on the nearly stable nomenclature in WoRMS.

b. Number of Aphia impacted:

Where an initial 28 to 30 samples were foreseen to be examined, an ambitious agenda and solid preparation resulted in on-site examination of 44 samples (including those not found by the end of the on-site period), and totalling in 88 impacted Aphia in WoRMS. All updates possible according to the editor's access rights were performed within the WoRMS portal before the project deadline.

Quantitative results on impacted Aphia level:

- Availability of type material:

Material available for research	35
Material not available for research	8
Aphia impacted by research (*)	44
Additional material examined	1
	88

- Examination of samples:

Samples examined	37
Samples not examined (not avail.)	8
Aphia impacted by research (*)	43
	88

- WoRMS entry possibility:

WoRMS updates possible	77
WoRMS updates not possible (**)	10
No entry needed (***)	1
	88

(*) Due to entry or changes following examination of type samples, other Aphia were newly created or existing Aphia were altered. Most of these are considered synonymous or alternate representations.

(**) Updates could not be entered by the present editor due to access restrictions.

(***) During examination of *Turritella sanguinea* Reeve, 1849, link was made to material of *Turritella lentiginosa* Reeve, 1849, of which the type material was subsequently also examined. When this type sample was retrieved from the type collection, a second sample was joined, without name on the recto of the wooden tablet, and with "*leucostoma* ?" in pencil on the verso. In order to clear any doubt as to its relevance to the present project, this sample was examined briefly, and considered to be conspecific with *Turritella leucostoma* Valenciennes, 1832. The origin of the specimen however ("R. B. Hinds, Esq." and locality "Conchagua") leaves to think that this is the sample mentioned by Reeve in the original description of *Turritella cumingii* Reeve, 1849 as Reeve states: "*It was also collected by Sir E. Belcher at Conchagua during the voyage of the Sulphur*". Whether or not Mr. Hinds was indeed the surgeon on that vessel during that voyage is currently being examined by the curators at NHMUK. Whatever the result of this examination, the sample would not be available for any update within the framework of the current project. As such, no WoRMS entry is required at this point in time.

b. Number of WoRMS updates performed:

A total of 393 updates have been performed within the WoRMS portal with regards to those Aphia for which access was available. (°)

Update	Number	Of which
AphiaID's edited	47	
New created		34 (°°)
Tax. status adapted		4 (°°°)
Synonymies edited	39	
New synonymies		34
Corrected synonymies		4
Vernacular added	2	
Notes added	57	
Sources added	125	
New sources created		10
Distributions added	23	
Type locality		11
Specimens added	43	
Online database links	23	

to NHMUK online (°°°°)		22
to MZC online		1
Contexts added	34	
Total:	393	

(°) Results of examined samples for which data cannot be entered at present due to access restrictions are not yet included, with the exception of the results of 1 examined and meanwhile entered sample. Further entry of those updates would result in an additional 18 updates, bringing the end total to 411.

(°°) including one new Genus-Subgenus combination

(°°°) Change of placement of *fastigiata* from *Archimediella* to *Turritella* following early teleoconch examinations; Three species (*ferruginea*, *fultoni* and *sanguinea* isolated as *incertae sedis* through status change to *taxon inquirendum* until agreement on how to list these, or until genetic research provides more insight.

(°°°°) An additional 9 links were added related to a 2012 privately funded project, and are here not considered a part of the results of the WoRMS LifeWatch Grant Project.

c. Qualitative results:

- A limited project, aimed at an initial agenda of 28 to 30 samples to be examined has at present resulted in 393 updates, filling gaps for 88 impacted Aphia. The on-site period was limited to 9 working days, with 7 weeks of result elaboration [on a non-permanent basis] at home location.

These figures show that large impact can be created against limited investment, provided thorough preparation and dedication. In that respect, the WoRMS LifeWatch Data Grant program can be assessed as having been a great success, and eligible for repeat.

Furthermore, it has enabled a type preserving institution to start the organisation of a part of its collection using accepted recent nomenclature via WoRMS, as such not causing extra cost nor resources for preliminary research.

- Recent Turritellidae carry a long and diverse history, with a majority of historical type samples preserved at NHMUK following the known historical events. Very few researchers in the past have attempted to do exhaustive work on type material, resulting in the type collection as being partially curated. The present project results include full curation of all examined samples for as far as not yet performed, full sample documentation and detailed photography.

As such, 44 research documents, 61 plates (composed from the detailed photographs taken during the on-site research time), 43 factsheets (PDF extracts of the present editor's OneNote dataset containing all information

known on a species) and an additional 71 photographs (full samples showing labels; type cards, details showing numbers on specimens, ...) were forwarded to NHMUK.

As more records are becoming available in the NHMUK online Zoology Collection Database (ZCD), specific analysis was performed, enabling addition to WoRMS of 9 links related to a previous, privately funded research project (2012) and 22 links related to the WoRMS LifeWatch Grant Project.

For 23 examined samples, no online record was found at present. These will be subject to further follow-up on a regular basis.

d. Case-specific results:

- Morphological relations between the genus *Eglisia* Gray, 1847 (initially in Turritellidae; today in Epitoniidae) and Turritellidae in general show the main morphological characteristics are the finely cancellated microsculpture and aperture shape of the former – the protoconch mostly not being available. This sculpture appears to be composed of spiral cords crossed by labial thickening at the end of a growth period rather than growth lines in the strict sense.

Examination of some types of Turritellidae show a finely cancellated microsculpture (under high magnification), and also a peculiar aperture (i. e. *T. ferruginea*, *T. sanguinea*, *T. puncticulata*, *T. fultoni*, *T. illustris* and ultimately also *T. cochlea*). This fine micro-sculpture however, is much finer than that observed in the genus *Eglisia* Gray, 1847 yet appears to result from a similar origin.

In that respect, some species have at present been isolated awaiting further examination and input from specialised sources.

- Examination of some types (e. g. *Turritella fastigiata* Adams & Reeve in Reeve, 1849) show a peculiar “early teleoconch” which is developed in a post-larval stage – possibly during the planktotropic stage -, and consists of a large amount of nearly equal-sized whorls over a short length, seemingly before the actual build of the shell is commenced. This also being a feature observed with *Turritella terebra* (Linnaeus, 1758), the taxonomical placement of those species was altered to that genus.
- Examination of the holotype and paratype of *Vermicularia maoriana* Powell, 1937 revealed a strange looking creature, looking more like the larvae of a terrestrial gastropod than a Turritellidae. Subsequent interaction with specialists in the field of New Zealand mollusca and “worm snails” as a group has revealed this species belongs in Annelida. As it is not clear as yet where exactly this species belongs within that group, its

status *incertae sedis* as proposed by Bieler & Petit (2011:46) is at present maintained within WoRMS.

- Examination of a sample marked “type” of *Serpula lumbricalis* Linnaeus, 1758 in comparison to a figure in Lister (1688) to which Linnaeus refers has not brought any further clarity as to the identity of the nominal species. This species is also the type species for the genus *Vermicularia* Lamarck, 1799, yet its identity remains unsure at present.

e. Open issues:

- Samples not available at present:
A number of samples initially foreseen for examination were not found in the type collection or general collection at the time of the on-site visit. It is however very likely that these specimens are present at NHMUK, yet would require further extensive search. All have been listed on a provisional agenda for future visits.
- Issues resulting from subsequent research:
 - For some – currently accepted – names, an older – less known – name is known (e. g. *nivea* Anton, 1838 for *gemmata* Reeve, 1849). In order to examine the provisions of Art. 23.9.1. (Reversal of Precedence), both nominal species remain as “accepted” in WoRMS until the issues are sufficiently documented.
Foreseen timeframe: end of 2014.
 - References and specimens referred to by subsequent authors: Considered out of scope of the present project, yet listed on a provisional agenda for potential future research projects.
- Historical issues:
 - Numbers and markings on specific specimens or some specimens which potentially link to important historical collections remain to be examined further if and when a research opportunity occurs. The placement of these specimens in a historical context is estimated as having limited impact on the nomenclature as presently entered in WoRMS.

4. (Brief) description of the work/methodology

Due to the vast amount of Turritellidae type material preserved at NHMUK, a selection was required, and was focussed on specific output sources.

a. Preparatory:

- Selection of samples to examine:
Prior to the research visit, a day-to-day agenda of samples to examine was composed, based on:
 - history:

- When viewed chronologically in comparison to species described and confusion in nomenclature, Reeve's monograph (including the "Samarang" species) is a key work in Turritellidae – as it is in many groups of molluscs. Unravelling Reeve's *perception of species* and his *methodology of species definition* separating one species from another are as such crucial elements to take into consideration when revising nomenclature. As such, the majority of the examined species included many of Reeve's descriptions, and all of the "Samarang" species.
- following future output sources:
 - Nominal species related to a revision of the genus *Vermicularia* Lamarck, 1799 (in support of the taxonomical editor for that group)
 - Nominal species related to examination of expedition material, property of MNHN, Paris and currently on loan by the present editor, in view of a publication within the Tropical Deep Sea Benthos framework, including a specific case on the historical use of the specific epithet "excavata" [-um] in a Turritellidae context.
 - Nominal species related to a revision of European and western African (incl. South African in part) species of Turritellidae.
 - Nominal species related to a distribution article within the "Red Sea Mollusca" framework.
 - Additional nominal species, indirectly related to any of the above.
- Documentation preparation:

For each taxon, documents were prepared in detail to avoid loss of on-site research time, including a partially filled-in template containing the necessary boxes to host all information which should be collected in view of time-efficient WoRMS entry.
- WoRMS preparation:

During the confection of the above mentioned documents, some basic updates – mostly the original descriptions and some additional sources – were already entered in WoRMS for the species foreseen on the agenda. These entries were not included in the project results.

b. on-site work:

Every sample was treated in 5 stages:

- Upon retrieval from the type collection: curation check
 - Availability of a type card and of the information in the Registration Books (Ledgers)
 - Origin of the sample as compared to the original description, the given measurements (when applicable), type locality, and other relevant data.
- General photography:

- Whole-view photographs of the entire sample including all labels and additional notes contained in the sample.
- Detailed description
 - For the purpose of sample assessment and species assessment, detailed information was recorded with regards to registration number, acc. number (if any), sample status, number of specimens, type locality, sample origin (collector), sample label(s) (or wooden tablet) texts, measurements of each individual specimen, detailed description of each individual specimen, bibliography sources, other notes and additions.
 - Assessment of the sample and proposal for sample status or confirmation of the current status. Proposals for type status updates following these assessments and curation actions were forwarded and discussed with the local curators, and adapted where required.
- Macro-photography
 - Using a DinoLite Pro USB Microscope, global as well as detailed photographs were taken of each individual specimen. Most magnifications are in the near of x50, except those of the protoconch (if available), early teleoconch (if available) or remaining apical whorls, which were magnified between x200 and x225. The latter magnification has the disadvantage of a very small focal area, yet has proven quite adequate in documenting protoconchs of less than 1 mm diameter, or the very finely cancellated micro-sculpture of species of *Eglisia* Gray, 1847 and some Turritellidae.

c. Post-research elaboration and distribution:

- For every documented sample, all information was entered in WoRMS for as much as access rights permitted to do so, and all documents and composed photographic plates were forwarded to NHMUK (cf. supra).

5. Problems encountered and how it was solved (or expected solutions).
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a. Current state of research of Turritellidae type material

Recent Turritellidae have apparently never been a popular group amongst researchers nor amateur collectors/malacologists, and relatively little in-depth type material research has been done in the past from a global point of view. Whilst a few specific regions are meanwhile reasonably documented, the global picture – and distribution – is mostly discarded, also due to the current state of fossil and recent taxonomy and nomenclature and the sheer amount of – assumed costly – elementary type material research remaining to be done.

A previous documentation project, together with the present LifeWatch project has brought much clarity in the type collection at NHMUK as well as in taxonomy and nomenclature for Turritellidae as a group. It is estimated that a second period of 2 weeks would bring the mass of type material at NHMUK to a

controlled status, with the exception of the *Vermicularia*-group for which a time estimate is not possible at present.

Similar projects at MHNG, Geneva, MfN, Berlin, MNHN, Paris and other type-preserving institutions would be desirable in order to tackle further historical milestones.

b. Specific issues

- Use of the photographs:
Agreement was made during the research visit not to use the detailed photographs within the WoRMS portal as such. The detailed photographs will be used for internal collection documentation and curator support in the future.
Meanwhile, links to the online Zoological Collection Database have been entered in WoRMS where available at present, and currently missing links will be monitored by the present editor on a regular basis.

c. WoRMS Entry issues

- Subsequent history:
Resulting from the initial upload and subsequent updating, most recent nominal species have already been created in WoRMS and have been foreseen of their initial description and a minimum of additional data ever since.
The aim of the present project is to fill the gaps with regards to the species identity, partially documenting subsequent listings – synonymous, homonymous, or in alternate representations – for as much as the *perception of species* of such subsequent authors is sufficiently clear.

It would however be impossible within the present project to list all possible subsequent listings from the original descriptions to date, in their respective *perceptions*, as such listing would require extensive worldwide examination of the material upon which these *perceptions* were established.

Therefore, a limited amount of subsequent bibliography was consulted and considered "in scope". Where references to other material than the type material was detected (e. g. Martens & Thiele, Deut. Tiefsee Exp. for *Turritella excavata* and *T. punctulata* [sic]), the actual examination of the expedition material was not considered an integral part of the present project.

- Updates requiring supportive bibliography:
As the updates were entered following the actual research, supportive bibliography was not always available at the moment of entry. Some entries however (e.g. move of the species *fastigiata* Adams & Reeve *in*

Reeve, 1849 from the genus *Archimediella* to the genus *Turritella*) would require such supporting documentation.

Moreover, the future output sources benefiting from the present research project also depend on external factors (other editors' availability for entry, publication time, and other types to examine ...) and can as such not be placed within a timeframe with reasonable timing estimate.

This issue was temporarily solved adding reference to the project research in an explanatory note.

- Access restrictions:

However correct and logically explainable, restriction of access to the initial genera has proven counter-productive, as 9 AphiaID's could not be treated, and the operational work had to be forwarded to third parties.

On the other hand, it would only be logical that such updates – if access had been possible – would only be done after constructive interaction and discussion with, and consent from the designated editor for such genera.

Following the access limitations, the following actions have been taken:

- Updates to worm-snail genera (*Serpula*; *Vermetus*; *Vermiculus*; *Vermicularia*):
Framed in the supporting research to the editor of this group, all results have been forwarded to that editor including proposals for WoRMS updates.
Resulting from the examination of the holotype and paratype of *Vermicularia maoriana* Powell, 1937, interaction has been started with the editor of the worm-snail taxa-group and a New Zealand expert in an attempt to re-assess the taxonomical placement of this most peculiar species, and eventually to determine the synonymy.
- Updates to *Cerithium*:
Framed within the use of the specific epithet *excavata* [-um] in a Turritellidae context, results of the present research are forwarded to the relevant researcher, as well as to a taxonomical editor requesting (a. o.) creation of *Cerithium excavatum* G. B. Sowerby II, 1865, duly adding it as synonym to *Colpospira australis* (Lamarck, 1822), and including relevant bibliography and notes.
- Updates to *Eglisia*:
At present, no specific editor for Epitoniidae is allocated within WoRMS, and results have been forwarded to a principal taxonomical editor for further treatment. As for the *Vermicularia*-group and the *Cerithium*-issue, the *Eglisia*-issues will be followed up over a period of 2 months after which the initiated interactions will be re-visited.
- Species *incertae sedis*:

3 nominal species [+ indirectly one of the synonymous species] have at present been isolated as *taxon inquirendum* whilst awaiting agreement on how these should be listed within WoRMS or awaiting results of genetic research. At present, a solution – permanent or temporary – is foreseen by the end of 2014.

6. Other: remarks, suggestions, other information, bibliography, ...
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Bibliographical sources added in WoRMS:

Turritellidae have been subject in many publications of all sorts throughout history, yet only rarely subject to exhaustive monographs. As such, the sources added under the present project were limited to the original descriptions, the major historical monographs of Reeve (1849); Tryon (1886) and Kobelt (1897), where needed accompanied by (a. o.) Adams & Reeve (1850), Watson (1886), Marche-Marchad (1960), Garrard (1972), Tomlin (1925) and where possible set to modern standards by more recent publications such as (a. o.) Bieler & Petit (2011); Petit (2007; 2009) and Herbert (2013).

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Bibliography added to WoRMS (as existing in WoRMS today), or used for background research:

[Anonymous] [1771] Conchology, or Natural History of Shells: containing The Figures of Shells correctly and finely engraved, and accompanied with Their Description in English and French. The Whole exhibited in a Systematic Manner. By a Collector. ii + 26 pp.; 12 pls. (parts I-VI) London. ["collector" sometimes thought to be E. Mendes Da Costa, sometimes G. Humphrey. Front page of NHMUK copy with pencil addition "[i. e. E. M. Da Costa]"]

Adams A. & Reeve L. A. (1850) Mollusca [in] Adams A. (ed.) The zoology of the voyage of H. M. S. Samarang under the command of Captain Sir Edward Belcher, C. B., F. R. A. S., F. G. S., during the years 1843-1846. Reeve, Benham & Reeve: London. Parts I-III.

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