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ACCURACY OF PUBLISHED RECORDS OF BAHAMIAN POLYCHAETES AND INCREMENTAL SAMPLING

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ABSTRACT

Teachers, researchers, and government policy makers involved in environmentally sensitive issues often make decisions based on information taken from scientific publications. In surveys of marine habitats, polychaetes are a major component. Thus, the accuracy of polychaete identifications can have a impact upon conclusions drawn not only during research studies but also upon future policies that use these studies as a source of data.

The contents of a recently compiled bibliography of publications on Bahamian polychaetes were analyzed to determine the level of accuracy of previously published reports. Comparison of reported Bahamian polychaete names to those in selected publications by experts in the field indicated that 9% of the 227 species had been misidentified. Extrapolation based on field work done on San Salvador Island, The Bahamas in 1996, revealed that the number of Bahamian polychaete species has been under reported by about 25%. As many of these specimens reported in the literature were not deposited at a major museum, reexamination and correction of the past records is not possible. On the other hand, at least 21 specimens collected from Bahamian waters and deposited in museums had been used the basis for new genus or species descriptions by experts. This data is used to suggest that sampling incrementally and, each time, comparing the species found with a previously made forecast (based on literature and previous sampling) until the forecast and sampling match, may provide a cost-effective way to determine when most species of polychaetes have been found at least once for the habitat under study.

INTRODUCTION

Polychaetes may constitute as much as 50-60% of the standing crop of marine macroinvertebrates (Uebelacker and Johnson, 1984). Therefore, by their presence and sheer numbers alone, they are an integral portion of the marine landscape around the Bahamian Islands. They impact commercial interests (as a part of the food chain for commercial fish and as models for underwater camera buffs), environmental stability (in forming reefs and aerating and turning over the sea bottom), and are used for applied research (indicators of pollution and other environmental changes) and basic research (e.g., parasitology, pharmacology, and toxicology). For instance, a polychaete typical of Bahamian coral reefs, *Eurythoe complanata* (Pallas, 1766), has been the subject for research on beta-adrenoceptors agonists (Suadicani, et al., 1993) and hemoglobin properties (Ilan, et al., 1990).

Because of their importance, data concerning polychaetes are used by teachers, researchers, and government policy makers involved in environmentally sensitive issues. As the data is often taken from scientific publications containing the names of specific species of polychaetes, the accuracy of polychaete identifications can impact decisions drawn during research studies and subsequently upon future policies that use these studies as a source of data.

Polychaetes are placed in the Phylum Annelida, Class Polychaeta. They are segmented worms with paired lateral body extensions (parapodia), which contain hair-like projections (setae). These two characters distinguish them from earthworms and leeches, which are lack parapodia and have few, if any, setae. This deceptively simple definition encompasses worms that are both marine and freshwater, with a few that are nearly terrestrial, and with an astonishing variety in body construction, feeding methods, and reproduction. It is a large group, divided into at least 75 families (Fauchald, 1977, p. 2), and again into over a 1000 genera and 11,000 species (Hartman, 1965, p. 1).

HISTORICAL PERSPECTIVE

The first polychaete referenced in recorded literature appeared at the dawn of the 18th century (Rumphius, 1705). Most of the nearly 50 papers in the 1700s were on Old World forms, but by mid-century, the American continent is mentioned, and, by the end of the century, the Caribbean (Abildgaard, 1789). Now, nearly three hundred years later, thousands of papers had been published, over 400 of them listing Caribbean species

Figure 1: List of Doubtful Bahamian Polychaete Records. Information from Long and Zottoli (1997).

CATEGORY	SPECIES
Identification Doubtful	*Antinoella angusta* (Verrill, 1874) *Eupanthalis kinbergi* McIntosh, 1876 *Leanira digitata*
Systematic Standing Changed	*Amphinome jamaicensis* Schmarda, 1861 *Clymenella zonalis* *Eunice longicirrata* Webster, 1884 *Lumbrinereis tetraura* (Schmarda, 1861) *Sabellastarte brunnea* (Treadwell, 1917)
Not In Caribbean Polychaete Checklists	*Drilonereis spiniferus* *Euclymene delineata* Moore, 1923 *Eumida (Pirakia)* sp. *Exogone verugera* (Claparéde, 1868) *Halodora oahuensis* (McIntosh, 1885) *Jasmineira bilobata* (Day) *Josephella* sp. *Leiocapitella glabra* Hartman, 1947 *Nereimyra punctata* (Müller, 1788) *Poecilochaetus johnsoni* Hartman, 1939 *Potamilla neglecta* (Sars,1851) *Sabellastarte longa* (Kinberg, 1867) *Tomopteris catharina* (Grosse, 1853)

Figure 2: Polychaetes, collected May 1966, from San Salvador Island, The Bahamas.

Family	Species
Amphinomidae Savigny, 1818	*Amphinome rostrata* (Pallas, 1776) *Eurythoe* sp.
Flabelligeridae Saint-Joseph, 1894	*Pherusa* sp.
Orbiniidae Hartman, 1942	*Naineris dendritica* (Kinberg, 1867) *Naineris* near *grubei* (Gravier, 1909) *Naineris setosa* (Verrill, 1900) *Protoaricia pigmentata* Solis-Weiss and Fauchald, 1989
Polynoidae Malmgren, 1867	*Harmothoe aculeata* Andrews, 1891
Syllidae Grube, 1850	*Exogone* sp. *Sphaerosyllis* sp.

(Perkins and Savage, 1975 and Salazar-Vallejo, 1992).

It was not until the early 1900s that a Bahamian polychaete was first mentioned (Treadwell, 1917). There was a thirty year gap before the next publication (Pearse, 1950), then an average of six publications a decade since then. To date, a total of 35 papers have been published on Bahamian polychaetes (Long and Zottoli, 1997). Of these, six were comprehensive surveys yielding at least 10 families and, at most, over 200 species. The rest covered one to five species each and most were part of systematic revisions by experts. A few included polychaetes as part of detailed studies of the biology of other animals, such as the feeding habits of octopus (Aronson, 1988 and 1989), or to test the work of others, such as the biogeographic

theory of MacArthur and Wilson (Schoener, 1974). In the latter case, the number of species was the datum of interest, not the species names; therefore, most of the polychaetes were identified first by family and then merely as species A or species B.

Long and Zottoli (1997) showed that 47 families had been reported from the Bahamas. Two hundred and twenty seven were given species names; the rest are listed as unidentified under the appropriate family. Unfortunately, few of the publications indicate where the Bahamian specimens are stored; thus, most are lost to posterity.

The small number of species thus far reported from the Bahamas belies their importance, for 5 were used as the basis of the description for a new genus and 16 for a new species.

EVALUATION OF PREVIOUS WORK ON BAHAMIAN POLYCHAETE SPECIES

In order to evaluate the likely accuracy and completeness of previously published records of Bahamian polychaetes, we took two approaches: (1) comparing them to family revisions by experts, and (2) doing our own identifications.

Comparing the list of Bahamian species to a sampling of family revisions by experts yielded two results of interest. First, 9% of the species recorded were used as the basis for describing a new genus (5) and a new species (16) or as part of the descriptive population (1). Second, the records of another 9% were doubtful, inaccurate, or misleading.

The doubtful Bahamian polychaete records can be divided into three categories (Figure 1).

1. Doubtful Record
   Three species were judged as doubtful by an expert in the families reported.
2. Reexamination Revealed Inaccurate Identification
   One specimen was examined and referred to a different species.
3. Geographic Locality Unlikely
   Thirteen of the species were not in either of the two checklists of polychaetes from the Caribbean and associated waters.
4. Systematic Revision
   Additionally, five species have undergone significant systematic revision and are no longer recognized under the name in the Bahamian literature.

As a check on the how well the published records represented the actual number of Bahamian species, we collected and preserved (specifically for systematic study) a few families, the species of which we identified using modern systematic approaches. Various aspects of that work are found in the rough draft of a field guide of polychaetes of San Salvador, currently being used by the Bahamian Field Station, of polychaetes from San Salvador, Bahamas and in another paper ("Morphological, Reproductive, and Behavioral Adaptation of Two Interstitial Polychaetes from Submerged Mangrove Roots in a Bahamian Land-locked Marine Lake") being delivered at this conference by Robert Zottoli. At least one voucher specimen of identified species has been given to the Bahamian Field Station; the rest of have been deposited at the National Museum of Natural History.

Based on the identified species from one collecting trip to various habitats we made in 1996 to San Salvador Island (Figure 2), six species (in four families) not previously recorded have been added to the list of Bahamian polychaetes. If this 6:4 ratio is representative for all habitats, then the eventual total of species from this island could be nearly 300. We feel, however, that this figure is too low, for, 42 families and nearly 1600 species have been reported from the Caribbean and associated waters (counts based on Perkins and Savage, 1975). Discounting species that may have been reported under more than one name, we can expect to find any of these in Bahamian waters.

To summarize, based on the literature, about 9% of the previously published records of Bahamian polychaete species were used as the basis for descriptions of new genera or species, another 9% are suspect and, based on our work, the literature studied represents an understatement of a minimum of 25% of the number likely to be found in the Bahamas, yielding a potential total of over 300 species.

We are using this 300 species figure as our first forecast of the potential number of polychaete species in the Bahamas. We intend to conduct an additional sampling trip and compare the results with this figure. If the potential total is still 300 species, then we will assume our initial forecast was correct. If not, we will derive another forecast, and, again, test it with additional collecting. This incremental approach to sampling, followed by comparison with the latest forecast, should allow us to arrive at the potential number of polychaete species in the Bahamas without exhaustive sampling (excluding exotics in unusual habitats, e.g., polychaete parasites in echinoderms) for a fraction of the cost of a

full-blown, environmental survey as typically envisioned for determining local fauna.

The approach used to analyze the literature to derive a forecast of expected numbers of species and then refining the forecast through incremental sampling could be used by government officials, researchers, and teachers to plan, assess, and evaluate the results of projects. For instance, prior to launching an effort to study populations at a site where there may be a potential environmental impact, a forecast could be made with regard to the number and names of species likely to be encountered in the habitat under study. With this forecast, an initial, small scale sampling would be done and the results compared to the forecast. If the results matched the forecast, then further costly sampling would not be necessary. If not, the new data would be used to issue a revised forecast and a second small scale sampling done. Again, the results would be compared with the revised forecast, and so on until the sampling data matched the forecast.

This allows incremental refinements and would will help build a model of Bahamian populations that could be used in other studies at other sites with similar habitats as well. Finally, a cost evaluation could be made of the standard approach to environmental studies--a few large scale samplings vs the one suggested here--incremental small scale samplings.

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