

# Biodiversity of Tanaidacea (Crustacea: Peracarida) in the Northern Gulf of Mexico

BITMAB 2018

Adelaide Rhodes<sup>1</sup>, Kate Lavelle<sup>2</sup>, Jill Bourque<sup>3</sup>, Melissa Rohal<sup>2</sup>, Elani Morgan<sup>2</sup>, Paul Montagna<sup>2</sup>

<sup>1</sup>Larner College of Medicine, Microbiology and Molecular Genetics, University of Vermont

<sup>2</sup>Ecosystems and Modeling Group, Harte Research Institute for Gulf of Mexico Studies, TAMUCC

<sup>3</sup> Cherokee Nation Technology Solutions, Contracted to the U.S. Geological Survey

# Why study tanaids in the GOM?



Deepwater Horizon Oil Spill had an unprecedented impact on the Gulf of Mexico ecosystem

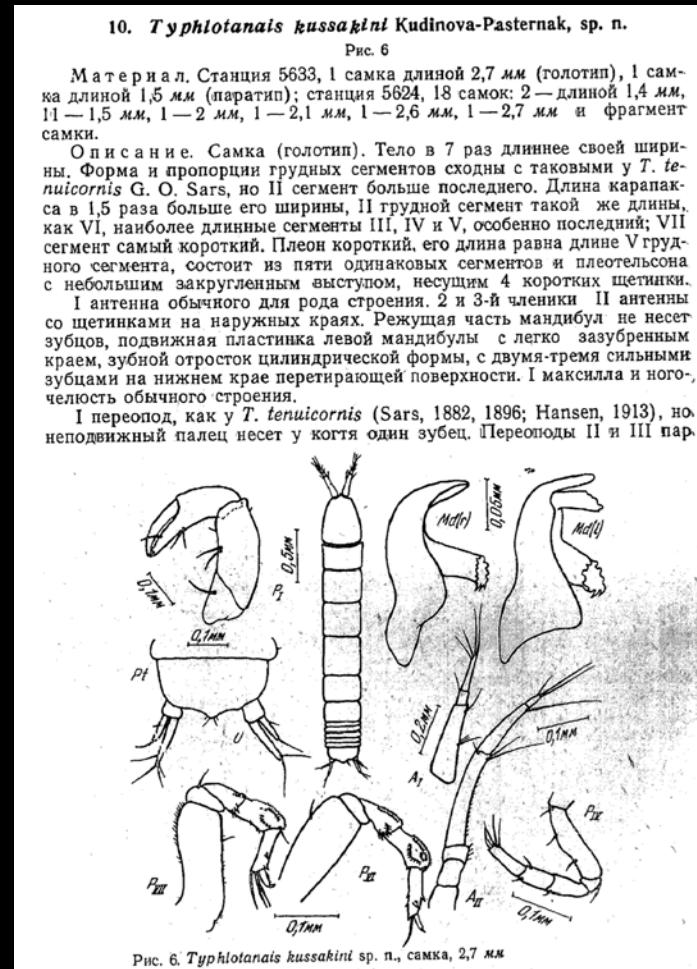
As we counted, it became clear that tanaids are the most abundant and the most diverse crustaceans below 200m in the Northern Gul of Mexico.

Difficulties – no organized data collection effort on the baseline diversity and abundance of tanaids below 200m

Lack of good descriptions for multiple taxa in the deep sea.

# Primary literature difficult to locate or behind paywalls

Example: Blazewicz paper



Tanaidacea  
Bluhm/UAF/CoML

Larsen, Kim. "Proposed new standardized anatomical terminology for the Tanaidacea (Peracarida)." *Journal of Crustacean Biology* 23.3 (2003): 644-661.

**Journal Title:** Trudy Instituta okeanologii im. P.P. Shirshova

**Volume:** 86

**Issue:**

**Month/Year:** 1970 **Pages:** 341-381

**Article Author:** Kudinova-Pasternak, R.K.

**Article Title:** Tanaidacea of the Kurile-Kamchatka Trench

# Conflicting descriptions



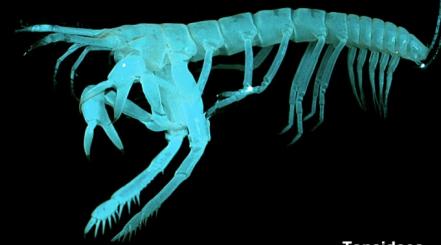
## Example: Terminology

Table 1. Different terminologies and nomenclatures for tanaidacean appendages.

	Bate, 1856	G. O. Sars, 1896	Whitelegge, 1901	Hansen, 1913	Tattersall, 1925	Sieg, 1977
First cephalic appendage	First or anterior antennae	Superior antennae	Upper antenna	Antennule	Antennule	Antenna 1
Second cephalic appendage	Second or external antennae	Inferior antennae	Lower antenna	Antenna	Antenna	Antenna 2
Fourth cephalic appendage	First maxilla	Anterior maxillae	First maxilla	Maxillule	(not mentioned)	Maxilla 1
Fifth cephalic appendage	Second maxilla	Posterior maxillae	Second maxilla	Maxilla	(not mentioned)	Maxilla 2
First thoracopod	Maxilliped	Maxilliped	(not mentioned)	Maxilliped	(not mentioned)	Maxilliped

Larsen, Kim. "Proposed new standardized anatomical terminology for the Tanaidacea (Peracarida)." *Journal of Crustacean Biology* 23.3 (2003): 644-661.

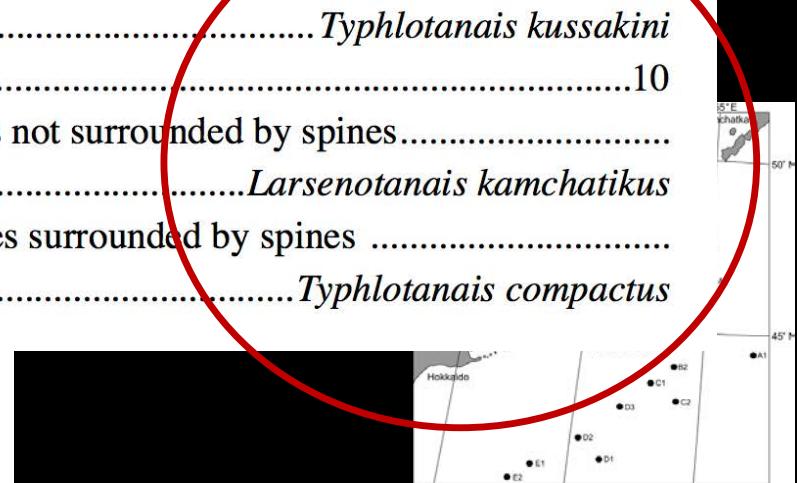
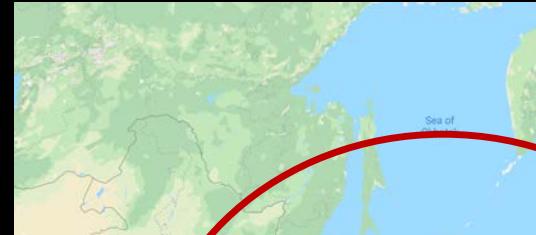
# Keys based on regionally specific information



Tanaidacea  
Bluhm/UAF/CoML

## Key to females of nototanaids and typhlotanaids of Kamchatka's abyssal

- 1 Antennule shorter than carapace ..... *Meromonakantha setosa*  
Antennule longer than carapace ..... 2
- 2 Uropods rami subequal ..... 3  
Uropod exopod shorter than endopod ..... 4
- 3 Pereonites 2–4 longer than wide; pereopod 6 propodus distal setae subequal ..... *Peraeospinosus magnificus*  
Pereonite 2–4 as long as wide; pereopod 6 propodus with one long and two short setae distally ..... 9
- 9 Pereopod 6 propodus distal setae reach beyond end of unguis ..... *Typhlotanais kussakini*  
Pereopod 6 propodus distal setae shorter than dactylus ..... 10
- 10 Uropod rami with one article; pereopods 4–6 prickly tubercles not surrounded by spines .....  
..... *Larsenotanais kamchatikus*  
Uropod rami with two articles; pereopods 4–6 prickly tubercles surrounded by spines .....  
..... *Typhlotanais compactus*
  
- 7 Pereopod 1 carpus with six simple setae of similar length ..... *Torquella elegans*  
Pereopod 1 carpus with rod setae ..... 8
- 8 Pereopods 2 and 3 propodus with long dorsal seta reaches beyond unguis ..... *T. angularis*  
Pereopods 2 and 3 propodus with dorsal seta shorter than dactylus ..... *T. grandis*
- 9 Pereopod 6 propodus distal setae reach beyond end of unguis ..... *Typhlotanais kussakini*  
Pereopod 6 propodus distal setae shorter than dactylus ..... 10
- 10 Uropod rami with one article; pereopods 4–6 prickly tubercles not surrounded by spines .....  
..... *Larsenotanais kamchatikus*  
Uropod rami with two articles; pereopods 4–6 prickly tubercles surrounded by spines ..... *Typhlotanais compactus*



BŁAŻEWICZ-PASZKOWYCZ, M. "Family Nototanaidae Sieg, 1976 and Typhlotanaidae Sieg, 1984." *Zootaxa* 1599 (2007): 101-120.

Błażewicz-Paszkowycz, Magdalena, Krzysztof Pabis, and Piotr Józwiak. "Tanaidacean fauna of the Kuril-Kamchatka Trench and adjacent abyssal plain—Abundance, diversity and rare species." *Deep Sea Research Part II: Topical Studies in Oceanography* 111 (2015): 325-332.

# Exponentially growing taxa list

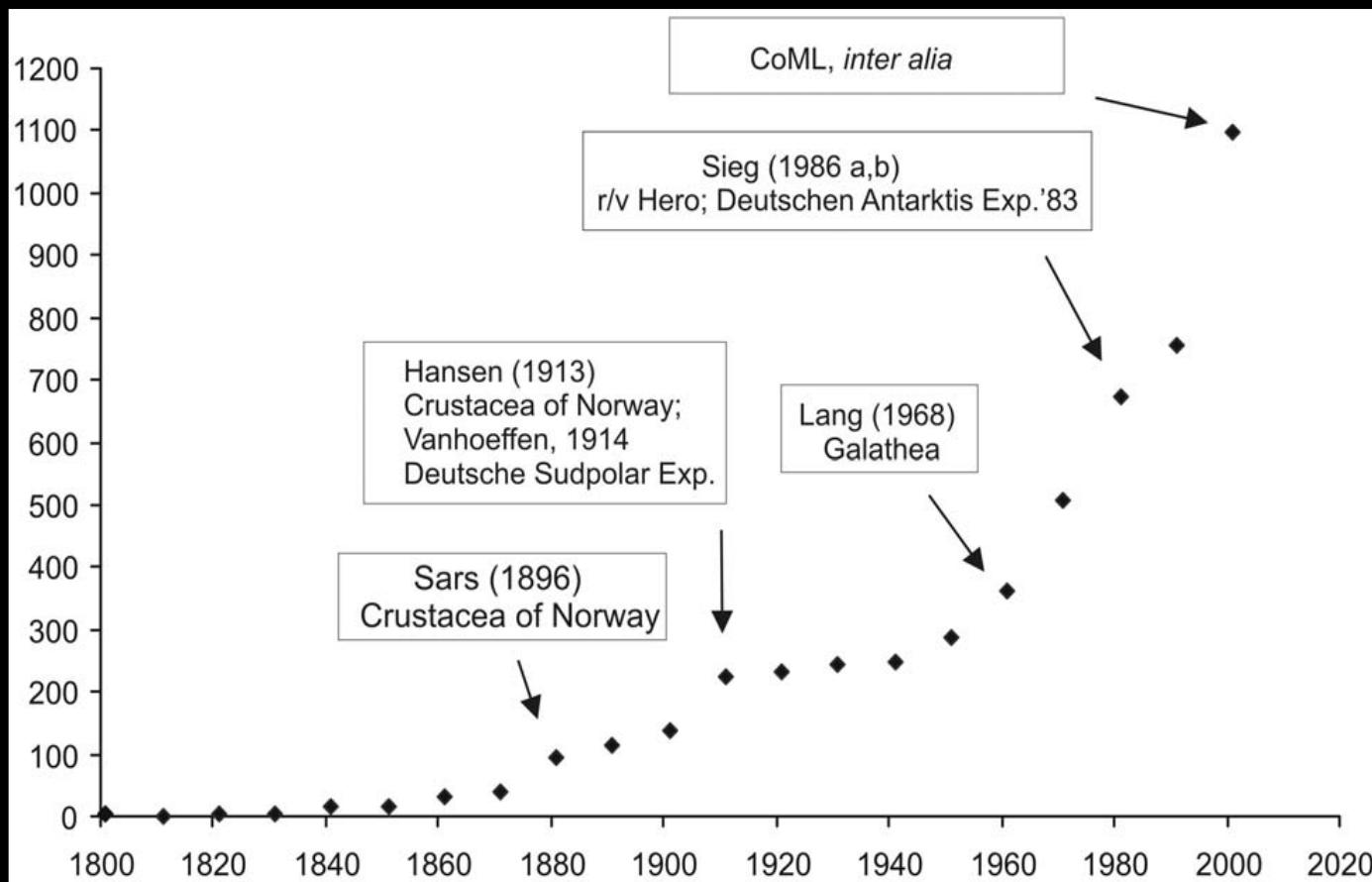
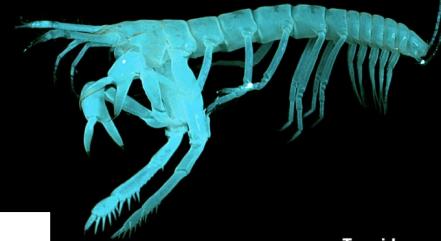
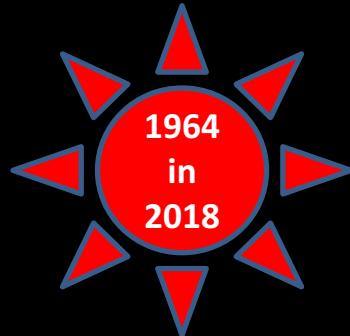


Figure 1. Cumulative number of tanaidacean species described in each decade since 1800.



[https://aquila.usm.edu/cgi/  
viewcontent.cgi?article=100  
3&context=tanaids30](https://aquila.usm.edu/cgi/viewcontent.cgi?article=1003&context=tanaids30)

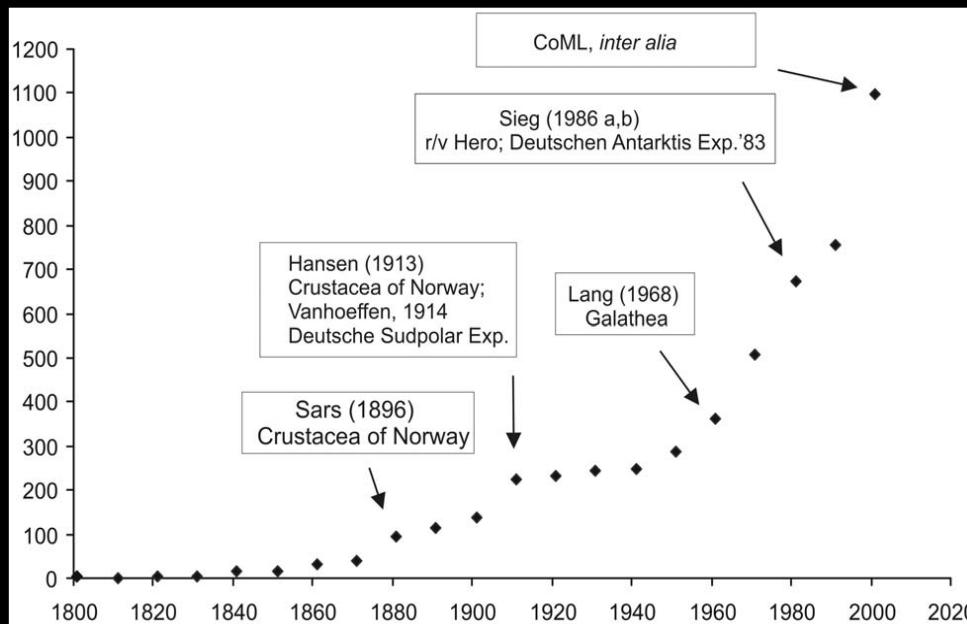


Figure 1. Cumulative number of tanaidacean species described in each decade since 1800.

Blazewicz-Paszkowycz, Magdalena, Roger Bamber, and Gary Anderson.  
"Diversity of Tanaidacea (Crustacea: Peracarida) in the world's oceans—how far have we come?." *PLoS One* 7.4 (2012): e33068.

Majority of Tanaidacea not described (Appeltans et al. 2012)



~1200 described species with global observations steadily increasing over last decade  
(Appeltans et al. 2012, Blazewicz-Paskowycz et al. 2012)

[https://aquila.usm.edu/cgi/  
viewcontent.cgi?article=100  
3&context=tanaids30](https://aquila.usm.edu/cgi/viewcontent.cgi?article=1003&context=tanaids30)

36% of Gulf of Mexico tanaidomorphs undescribed  
(Blazewicz-Paskowycz et al. 2012)

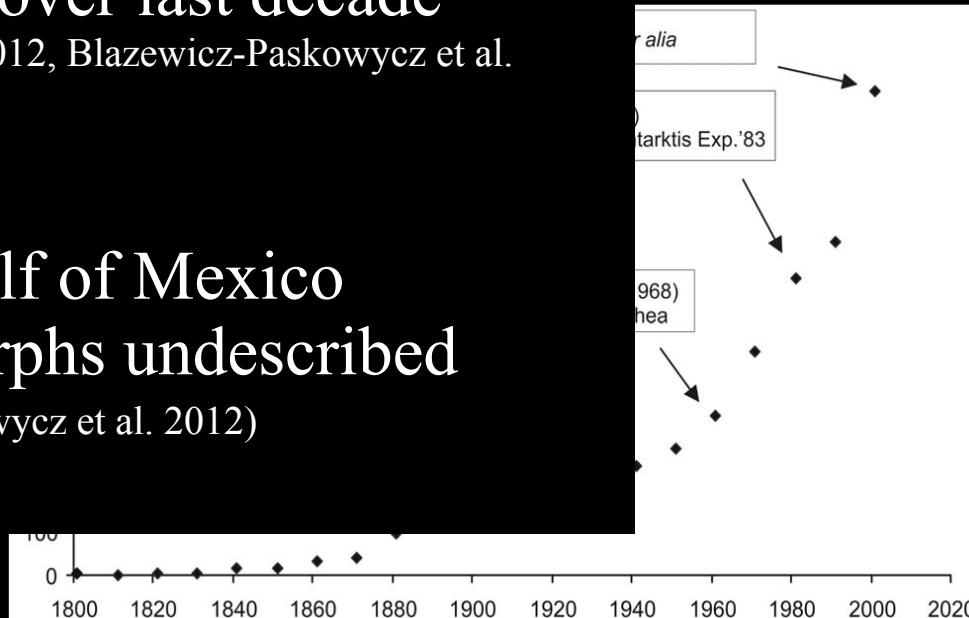


Figure 1. Cumulative number of tanaidacean species described in each decade since 1800.

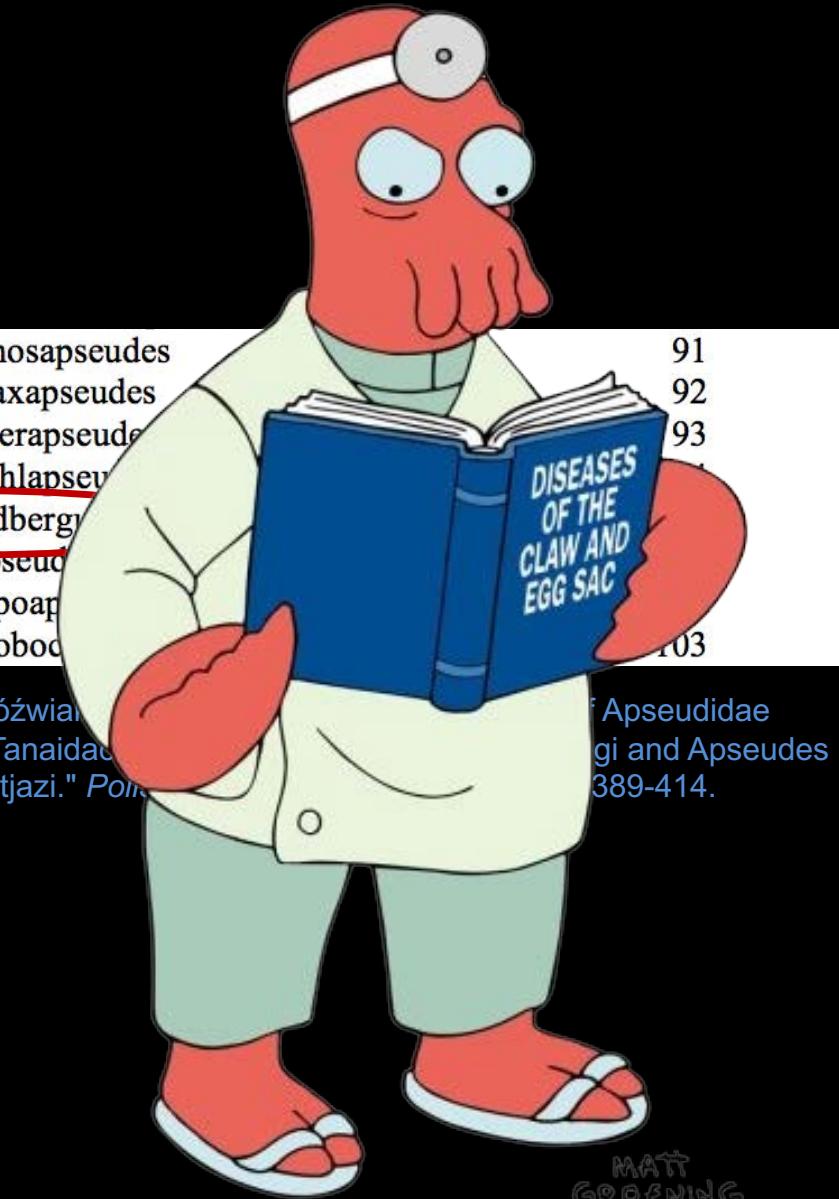
Blazewicz-Paszkowycz, Magdalena, Roger Bamber, and Gary Anderson.  
"Diversity of Tanaidacea (Crustacea: Peracarida) in the world's oceans—how far have we come?." *PLoS One* 7.4 (2012): e33068.

# Exponentially growing taxa list

Family Apseudidae	38
Subfamily Apseudinae	41
Genus Apseudes	42
Genus Apseudopsis	67
Genus Atlantapseudes	60
Genus Bilobatus	72
Genus Bunakenia	73
Genus Dactylopriion	75
Genus Falsapseudes	78
Genus Glabroapseudes	79
Genus Langapseudes	80
Genus Mendamanus	
Genus Obscurapseudes	
Genus Paradoxapseudes	
Genus Pectinapseudes	
Subgenus Impectinatus	
Subgenus Pectinapseudes	
Genus Spinosapseudes	
Genus Taraxapseudes	
Genus Tuberapseudes	
Genus Typhlapseudes	
Genus Zoidbergus	
Subfamily Leviapseudinae	98
Genus Carpoapseudes	103
Genus Colobocladus	103
Genus Eliomosa	103
Genus Fageapseudes	104
Genus Leviapseudes	107
Subfamily Pugiodactylinae	118
Genus Pugiodactylus	118
Family Gigantapseudidae	121
Genus Gigantapseudes	121

Genus Spinosapseudes	91
Genus Taraxapseudes	92
Genus Tuberapseude	93
Genus Typhlapseu	
Genus Zoidbergu	
Subfamily Leviapseud	
Genus Carpoape	
Genus Colobocla	
98	103

Józwiai  
(Tanaidac  
vitjazi." Pol.



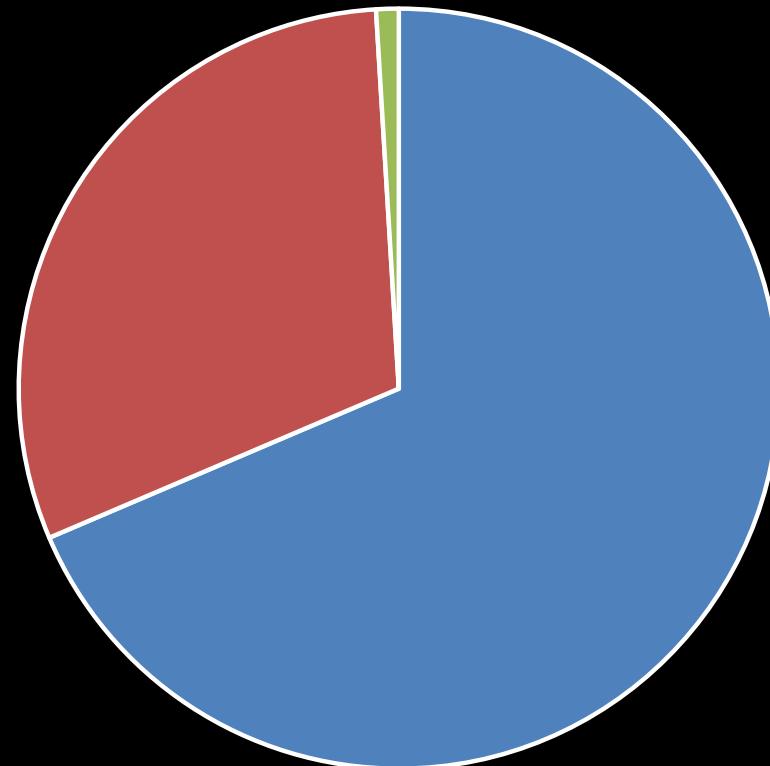
<https://aquila.usm.edu/cgi/viewcontent.cgi?article=1003&context=tanaids30>

of Apseudidae  
gi and Apseudes  
389-414.

# Large proportion of taxa in uncertain nomenclature *incertae sedis*

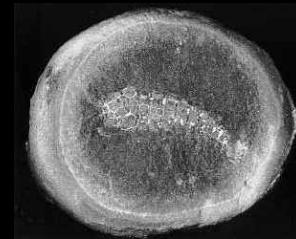
## Paratanaoidea Family *incertae sedis*

Genus Andrognathia  
Genus Androtanais  
Genus Arcantitanais  
Genus Armadillopsis  
Genus Armatognathia  
Genus Armaturatanais  
Genus Bifidia  
Genus Coalecerotanais  
Genus Cristatotanais  
Genus Exspina  
Genus Gejavis  
Genus Insociabilitanais  
Genus Kanikipa  
Genus Leptognathioides  
Genus Monstrotanais  
Genus Parafilitanais  
Genus Paranarthrurella  
Genus Portaratrum  
Genus Proleptocheilia  
Genus Pseudoarthrura  
Genus Pseudomacrinella  
Genus Pseudoparatanais  
Genus Robustochelia  
Genus Safaritanais  
Genus Salemia  
Genus Selvagentanais  
Genus Singula  
Genus Tanabnormia  
Genus Tangalooma  
Genus Tythhotanais

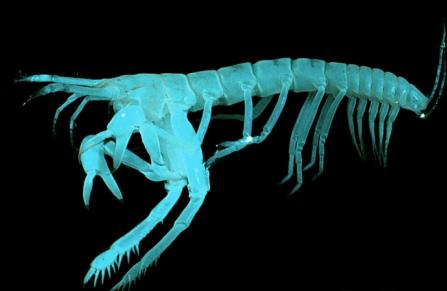


■ Tanaid Species ■ Incertae sedis at sp. Level ■ Extinct

# Order Tanaidacea



Anthracocaridomorpha: fossils, 2 families, 4 species

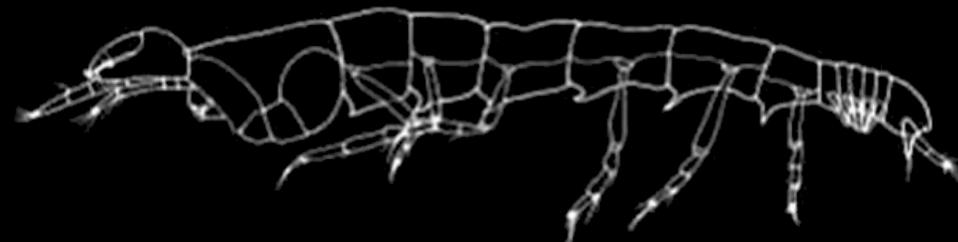


Tanaidcea  
Bluhm/UAF/CoML

Apseudomorpha: ~15 families ~530 species;  
coral reefs, estuaries, mangroves, few deep sea



Tanaidomorpha: ~20 families, ~834 species;  
tubiculous lifestyle evident in body shape



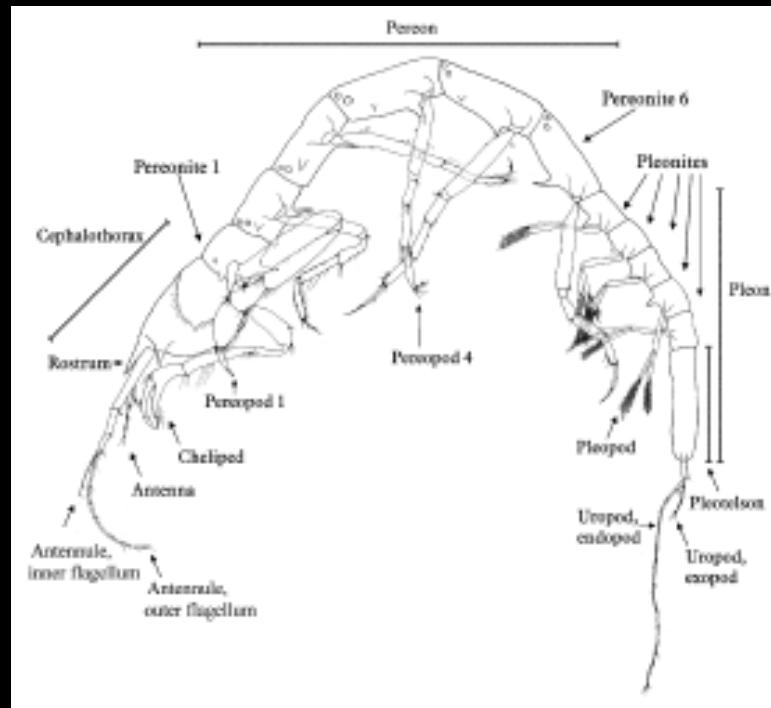
*Incertae sedis* ~ 545 species

# Ecological Significance

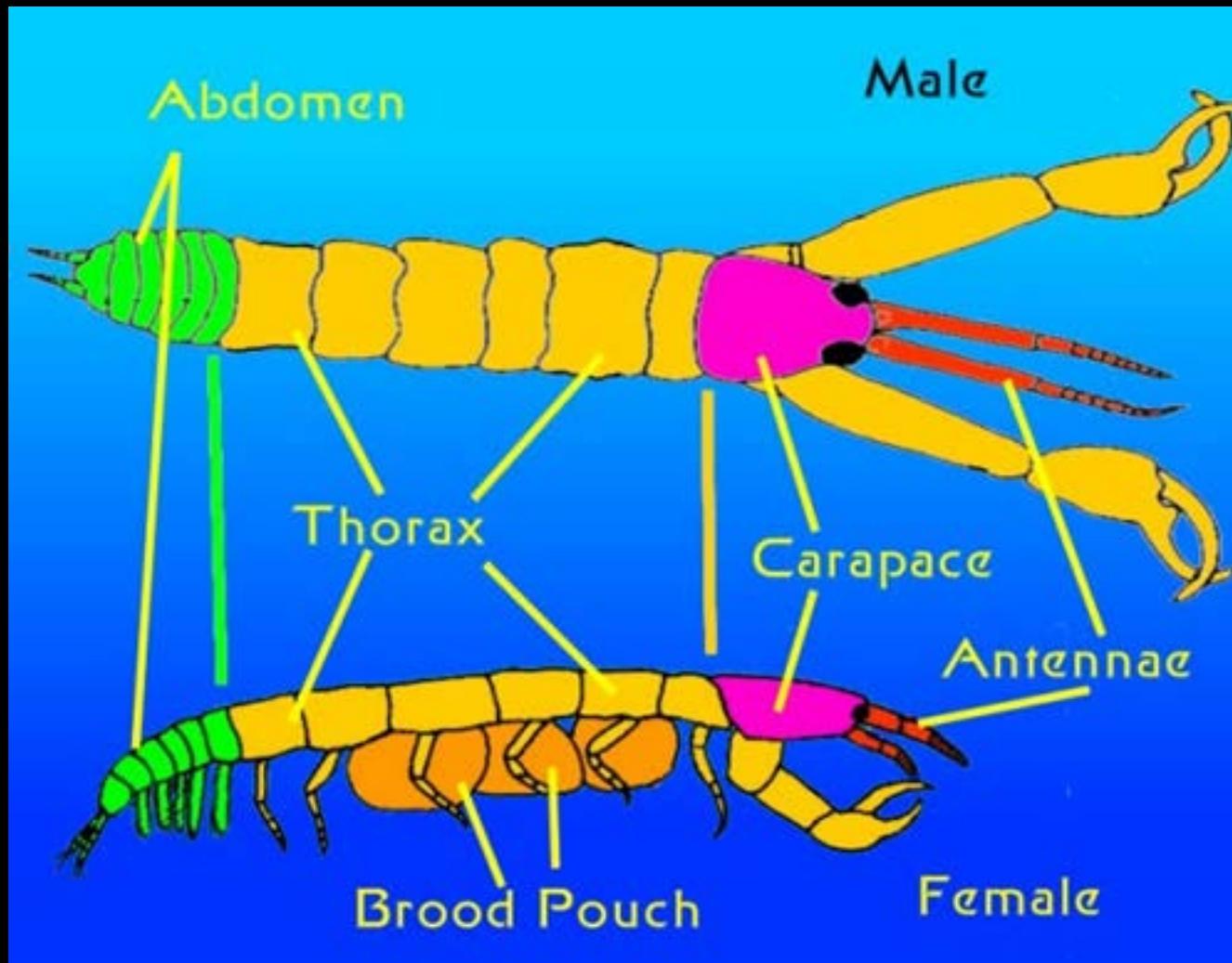
- Benthic macroinvertebrates that live in tubes or burrows
- Represent some of smallest peracarids
- Ecosystem engineers and bioturbators
- Important prey item to upper trophic levels
- Recorded from mostly marine habitats
- Abundant on continental shelf and abyssal plains



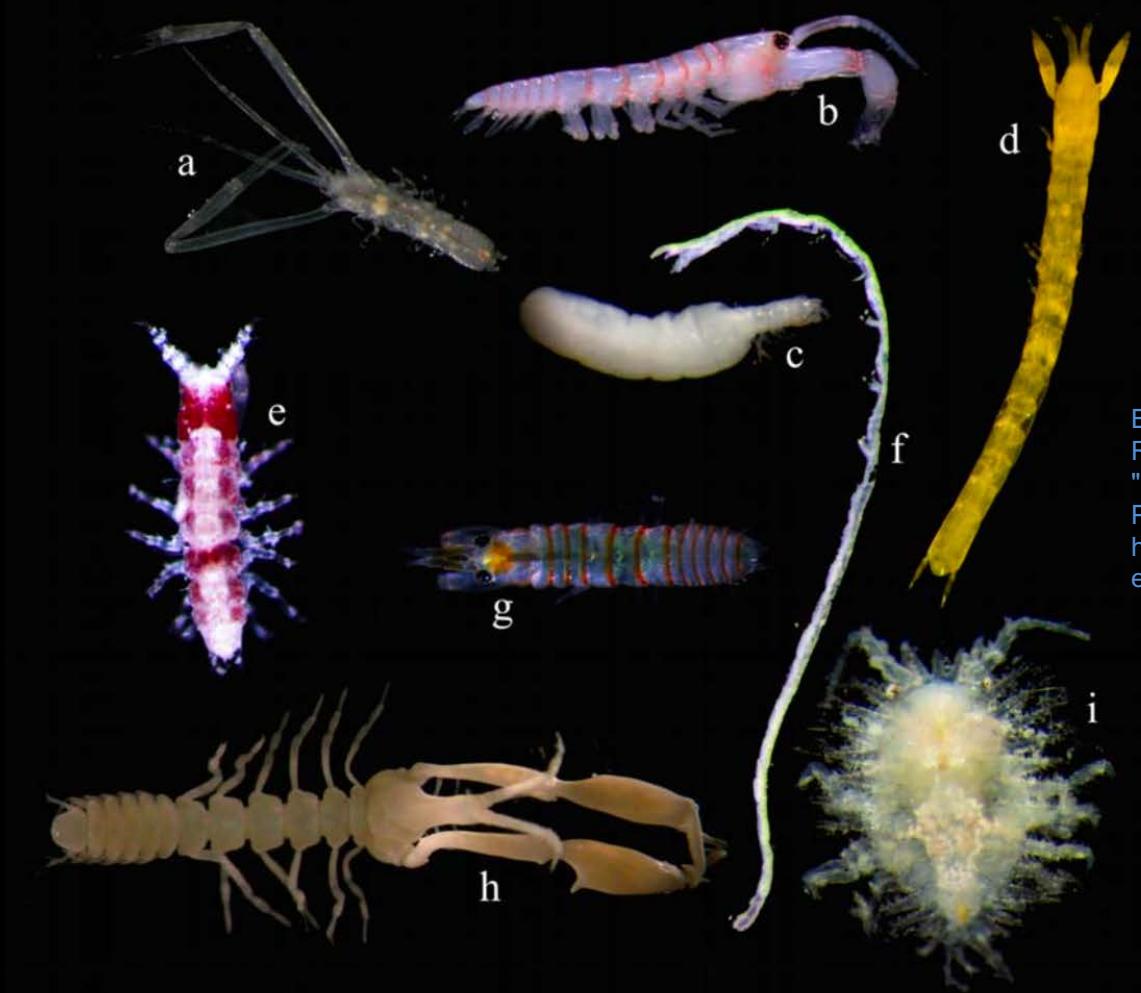
Tanaidacea  
Bluhm/UAF/CoML



# General body plan



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans



Blazewicz-Paszkowycz, Magdalena,  
Roger Bamber, and Gary Anderson.  
"Diversity of Tanaidacea (Crustacea:  
Peracarida) in the world's oceans—how far  
have we come?." *PLoS One* 7.4 (2012):  
e33068.

**Figure 3. Diversity of forms in the Tanaidacea. a-b, g, various forms of males in the Leptocheiliidae; c, female of *Pooreotanais* sp.; d, *Arhaphuroides* sp.; e, *Sinelobus* sp.; f, *Anarthruridae* indet.; h, *Neotanais* sp.; i, *Metatanais* sp.; j, *Tanzanapseudes* sp.**  
doi:10.1371/journal.pone.0033068.g003

# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

## Step 2: Which Suborder?



Apseudomorpha  
242 (16%)



Tanaidomorpha  
1261 (84%)

# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Step 2: How many antennal segments?



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Step 3: Does the uropod have an exopod?



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Step 4: How are the chelipeds attached?



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Step 5: What do the chelipeds look like?



Open?

Closed?

Crossed?

# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Step 6: How are the pereonites attached?



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

## Step 7: Is it weird?



# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Weird example 1 – what is happening here?

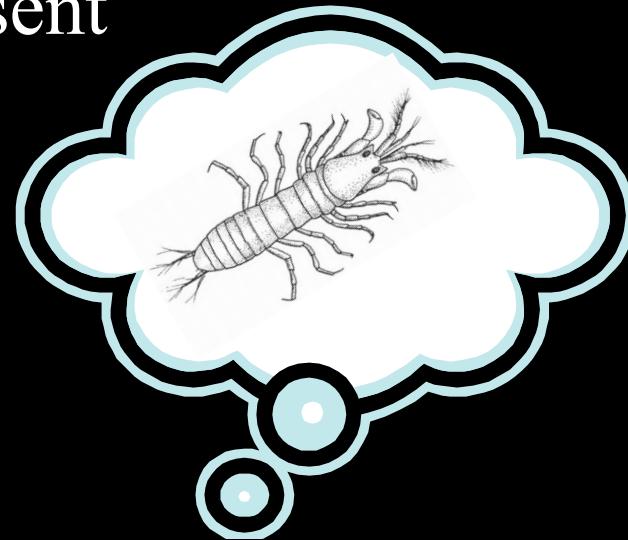


# Notes on Taxonomy of a Highly Diverse and Relatively Uncharacterized Group of Crustaceans in the Northern GOM

Weird example 2 – what is happening here?



What tanaidacean groups are present  
in the Gulf of Mexico?



How does tanaidacean family  
distribution vary by depth?

How does tanaidacean distribution  
vary throughout the Northern  
Gulf of Mexico?



# Data Collection

## Data Sources:

**NGoMCS** (Northern Gulf of Mexico  
Continental Slope)

**TAMUCC – NRDA**

**USGS – NRDA**

**USGS – database**

**Larsen 2005** (book)

**Literature** (compilation of literature)

**USNM** (museum specimens)

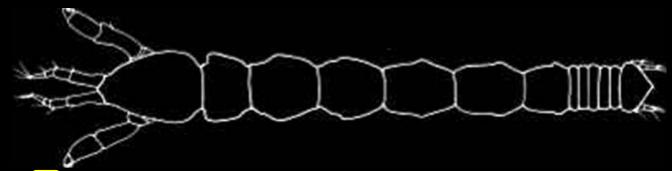
**Online Database**

BioGomex  
GBIF  
IOBIS

## Taxonomic ID

Peracarida  
Tanaidacea  
Tanaidomorpha  
Paratanaoidea  
Colletteidae

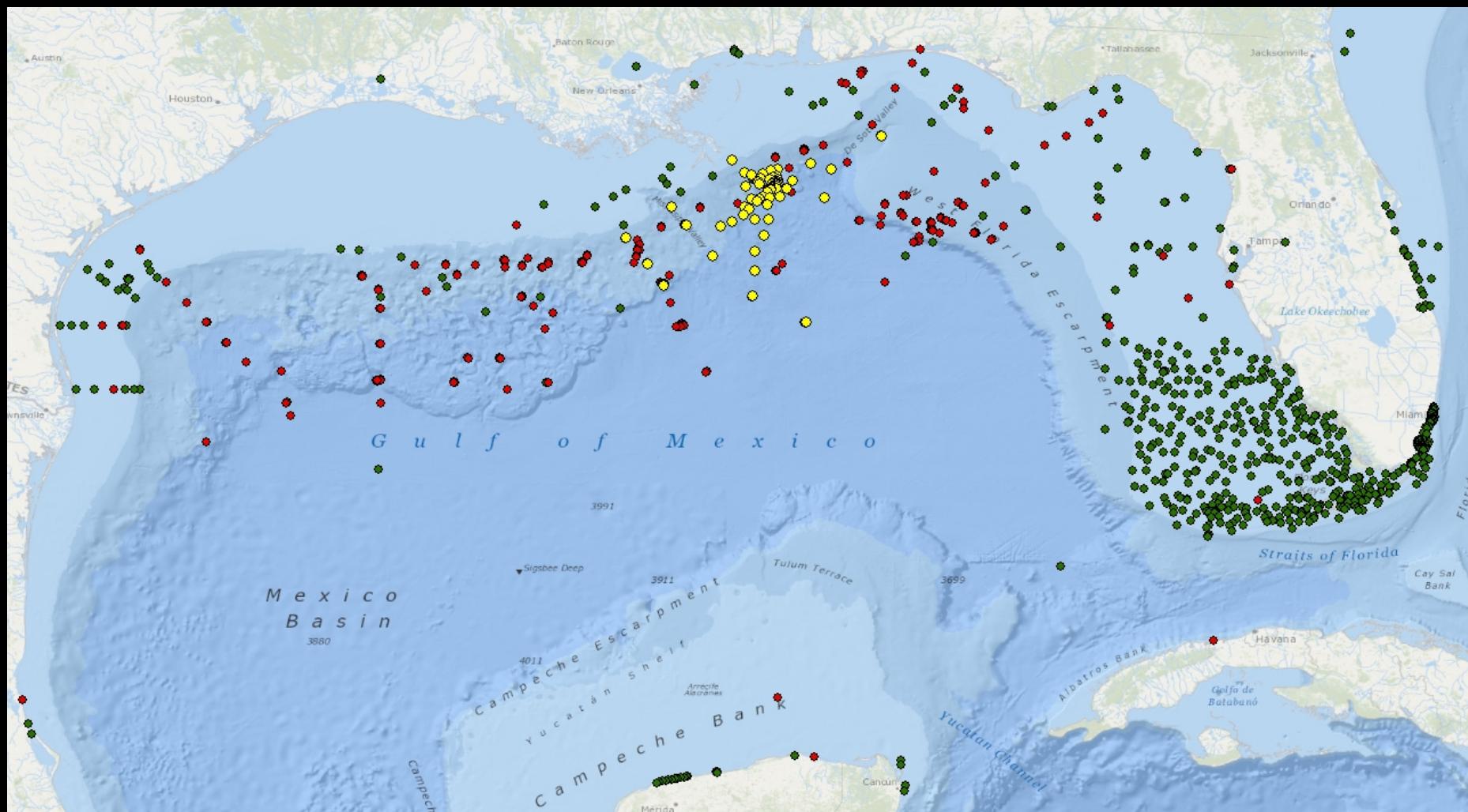




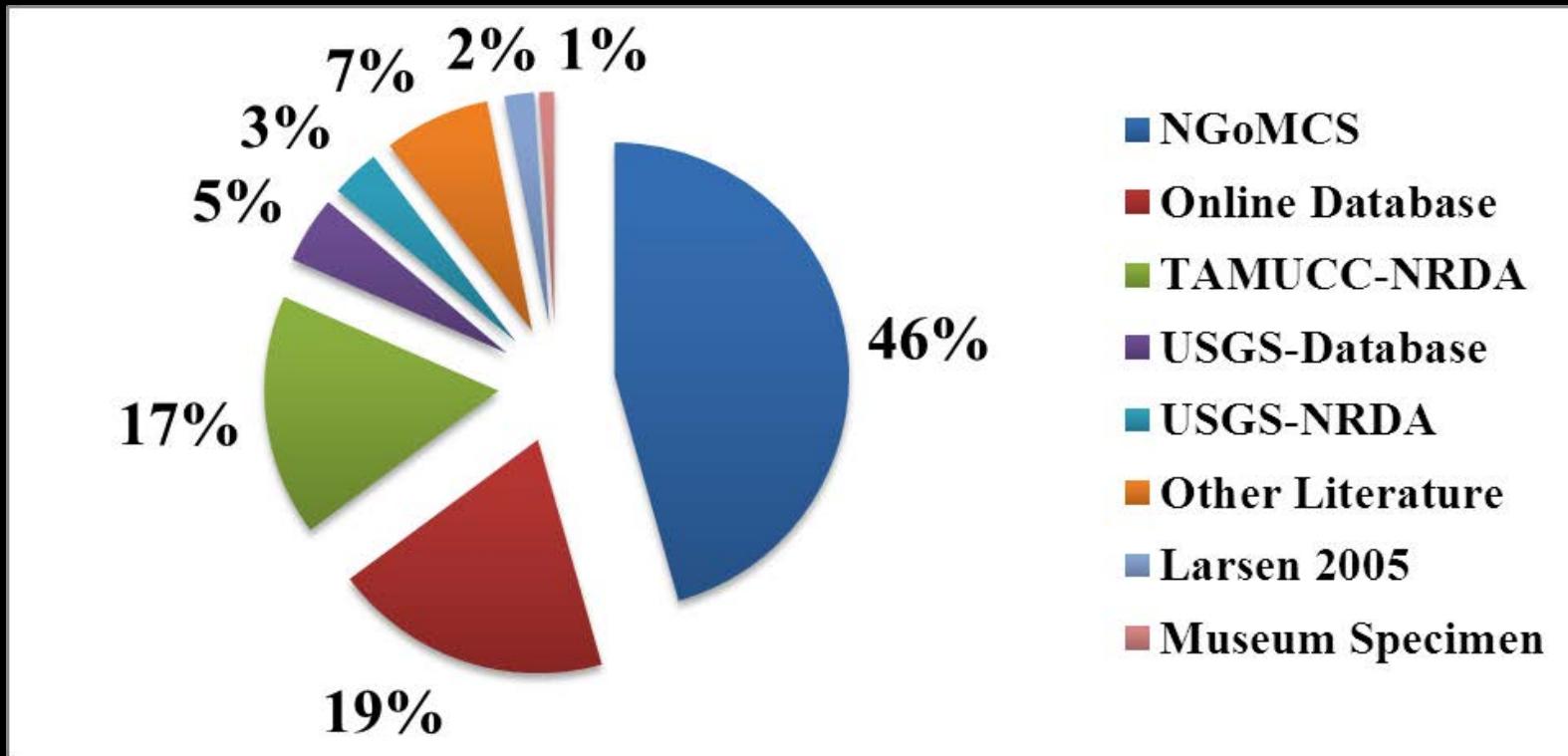
● Online Databases

● Literature Review

● TAMUCC and USGS



# Tanaidacean Observations: Source



4338 total observations

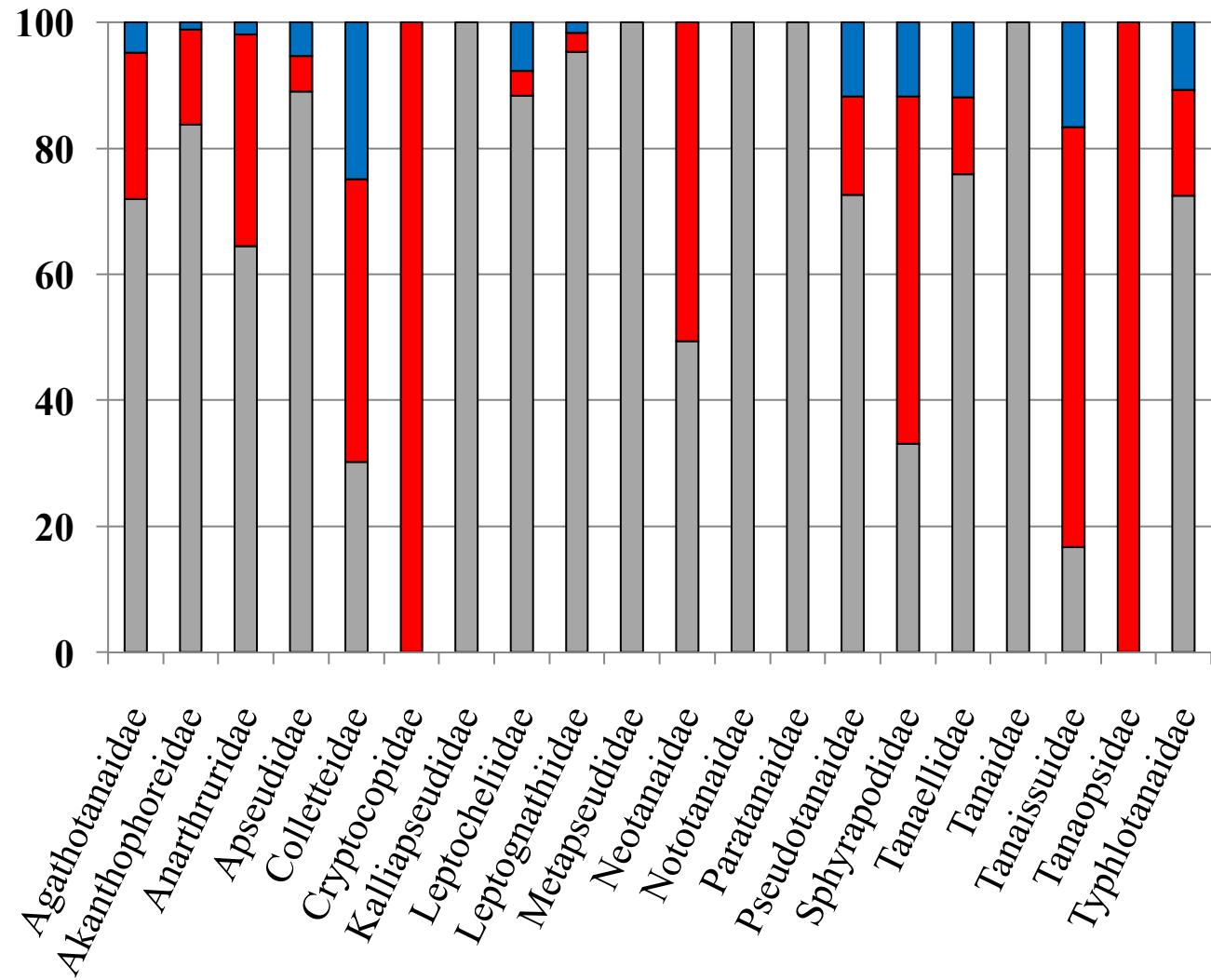
<b>Source</b>	<b>Total number of families and genera incertae sedis observed (30 total)</b>
<b>NGoMCS</b>	<b>12</b>
<b>TAMUCC – NRDA*</b>	<b>23</b>
<b>USGS – NRDA*</b>	<b>13</b>
<b>USGS – database</b>	<b>14</b>
<b>Larsen 2005 (book)</b>	<b>13</b>
<b>Literature</b>	<b>7</b>
<b>USNM (museum specimens)</b>	<b>10</b>
<b>Online Databases (BioGomex, GBIF, IOBIS)</b>	<b>24</b>

\*Combined USGS records include 18 unique families



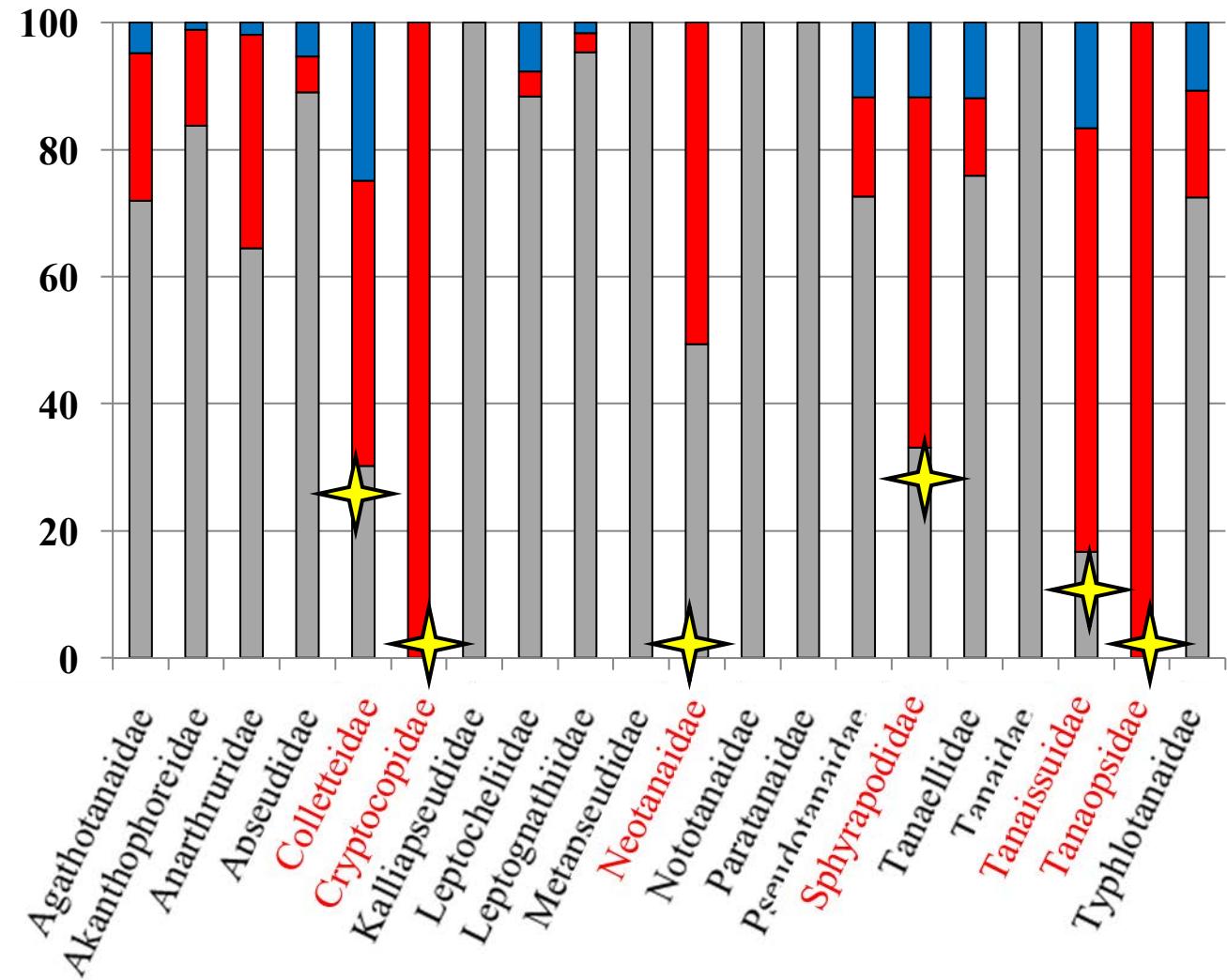


Other Sources      TAMUCC-NRDA      USGS-NRDA

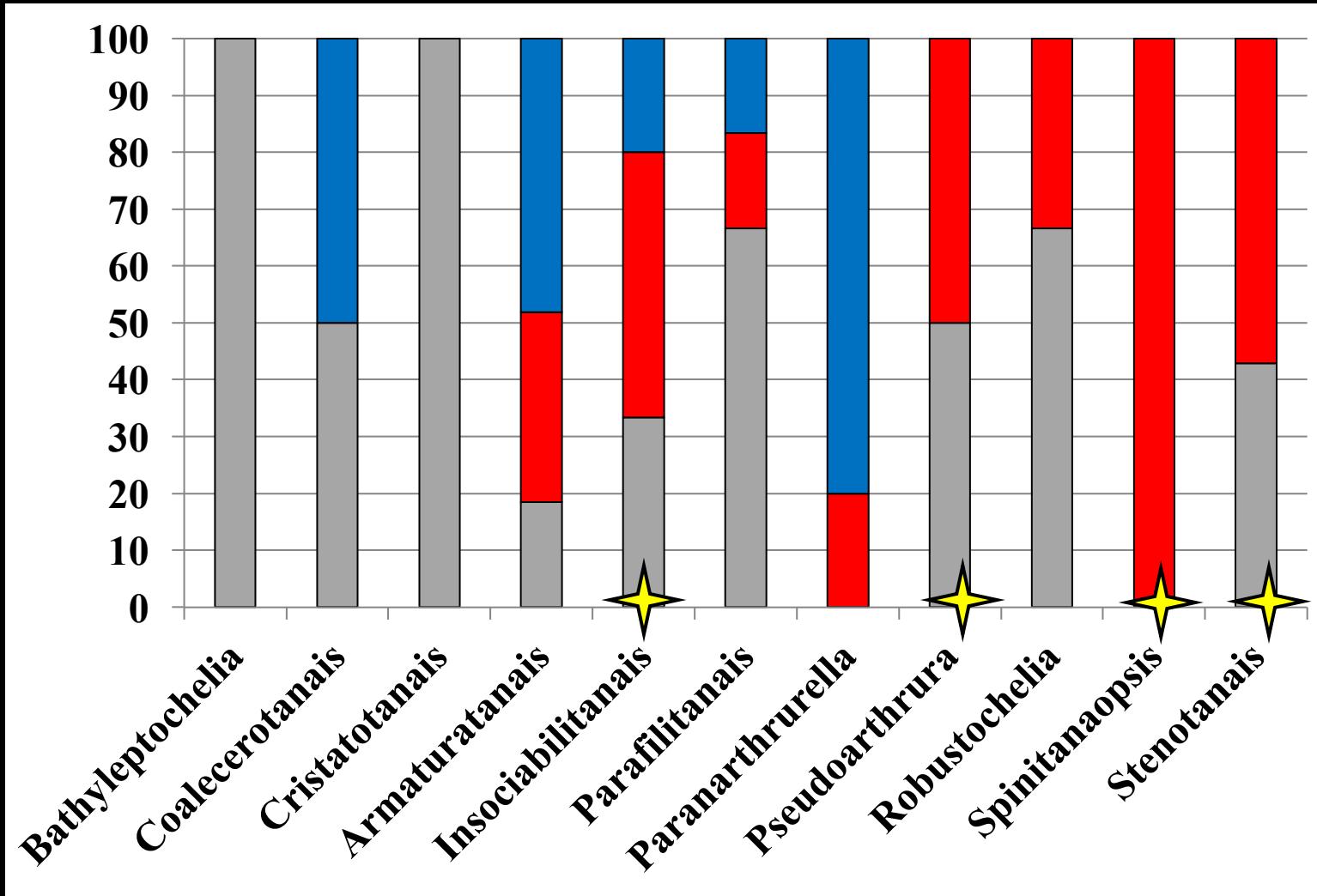




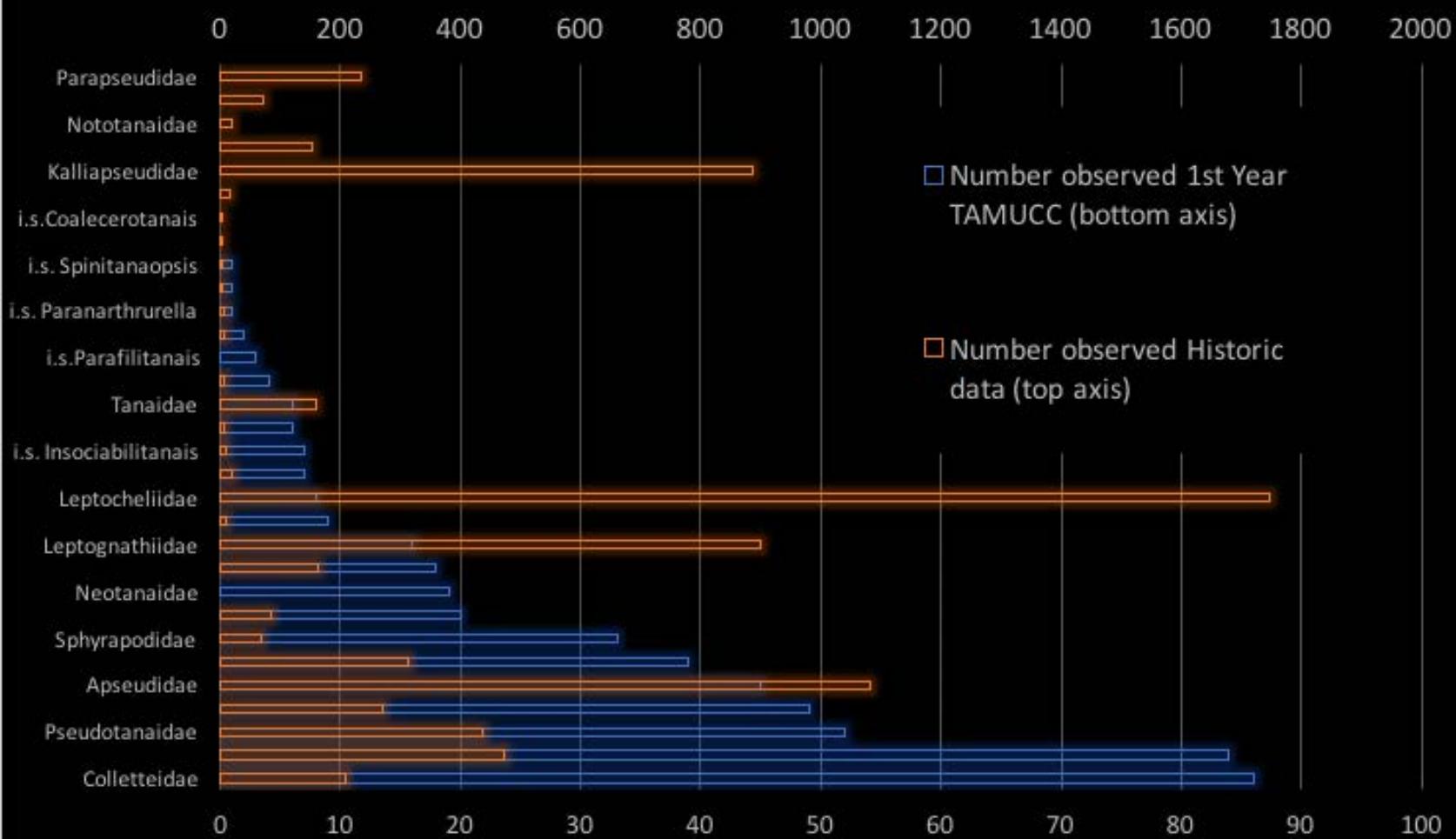
Other Sources      TAMUCC-NRDA      USGS-NRDA



Other Sources    TAMUCC-NRDA    USGS-NRDA



## Number of observations by Family or Genus *incertae sedis*



# New record of family in TAMUCC-NRDA samples:

## Tanaopsidae

# New genera recorded from TAMUCC-NRDA samples:

*Haplocope*

*Larsenotanais*

*Leptognathiopsis*

*Cristatotanais*

*Cryptocoeloides*

*Bathytnaissus*

*Bathytnaais*

*Peraeospinosus*

*Paraleptognathia*

*Portaratum*

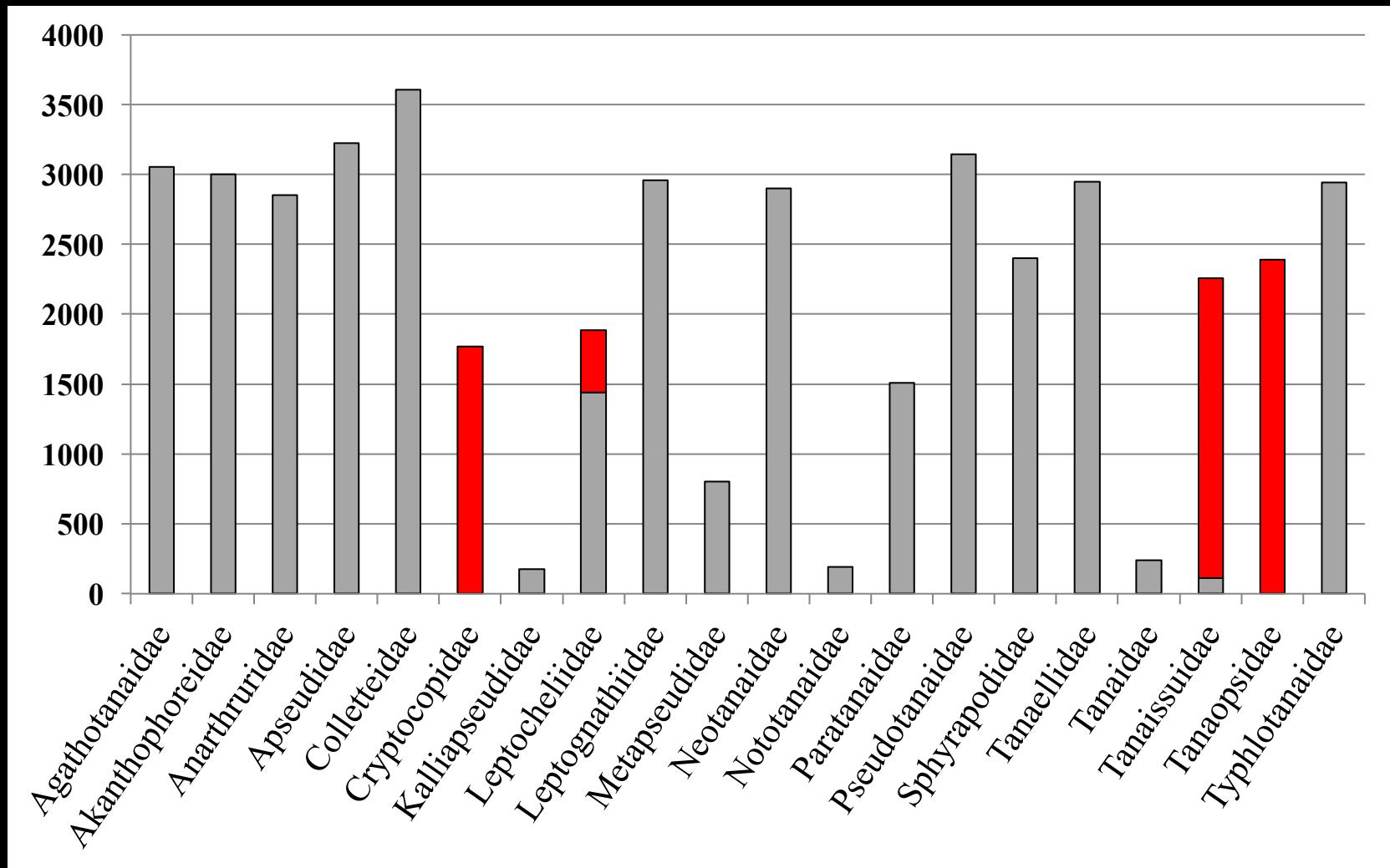
*Siphonolabrum*



*Paraleptognathia gracillis*



# Maximum Depth Records

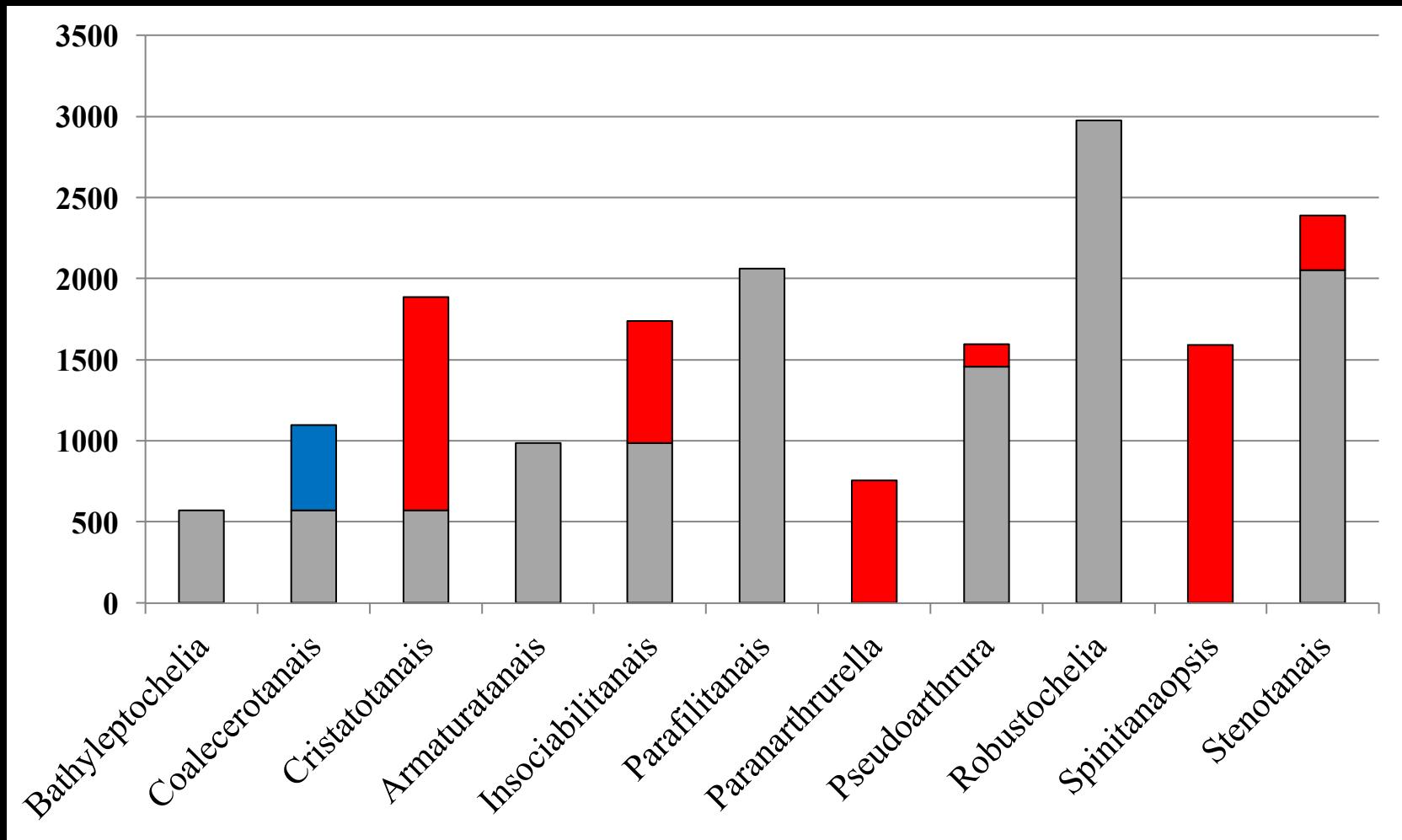


■ Other Sources

■ TAMUCC-NRDA

■ USGS-NRDA

# Maximum Depth Records

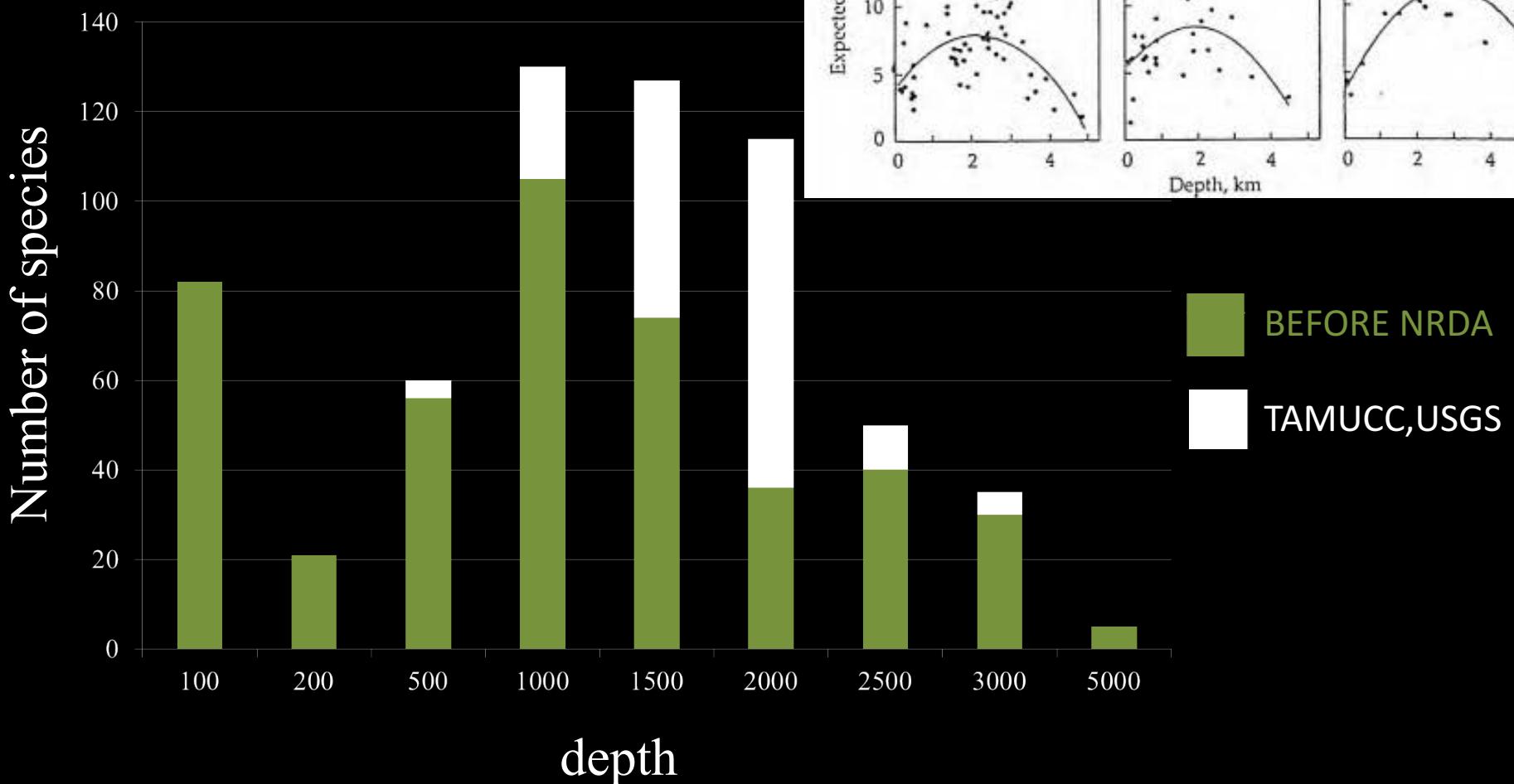


■ Other Sources

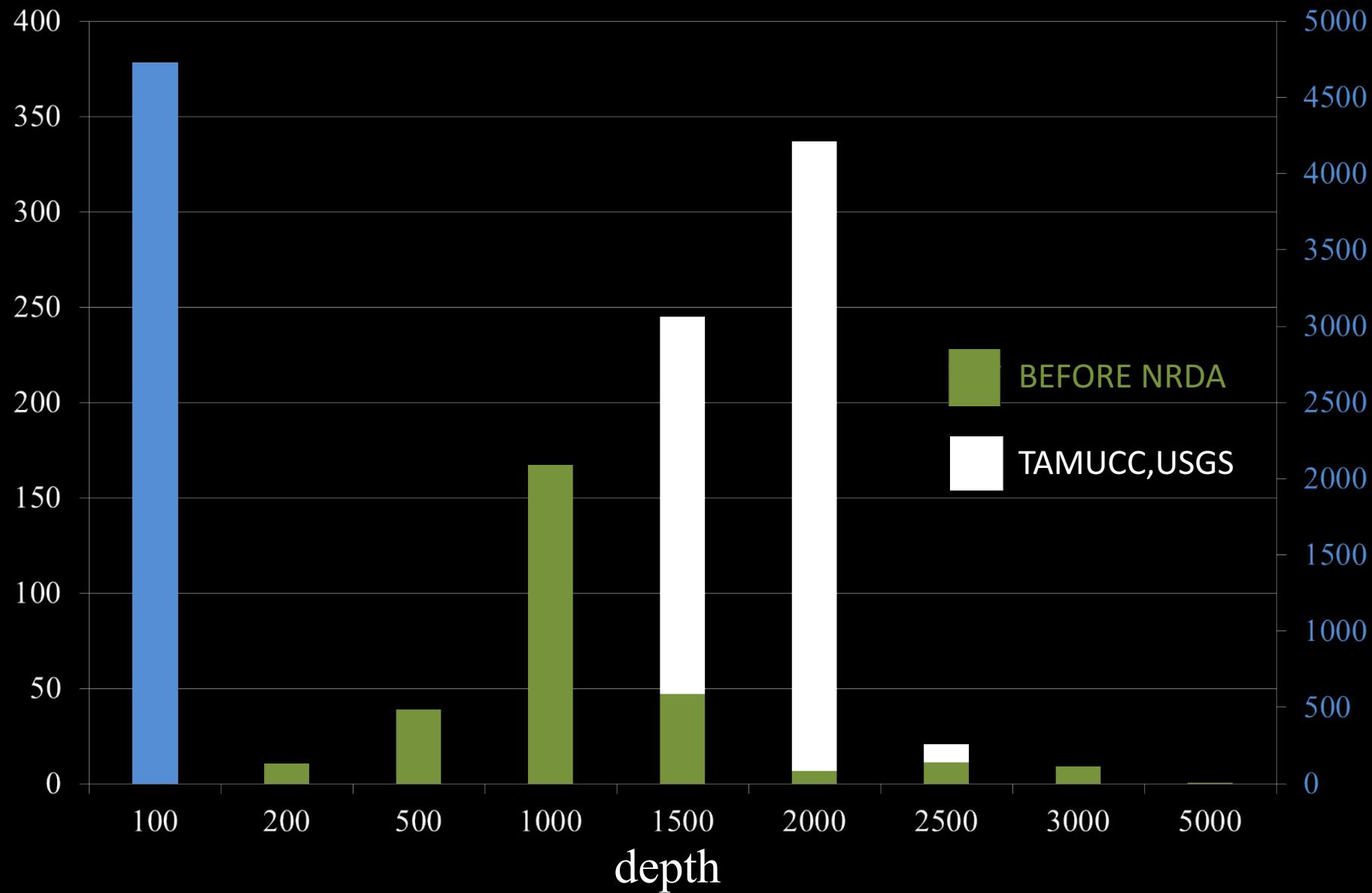
■ TAMUCC-NRDA

■ USGS-NRDA

# Deep Sea Diversity Patterns



# Number of Observations



# Comments on tanaidacean biogeography and diversity in the Northern GOM

TAMUCC-NRDA data added records for one family and eleven genera to Gulf of Mexico inventory

TAMUCC-NRDA data includes specimens from 23 of 30 families and genera *incertae sedis* observed in Gulf of Mexico; and adds to overall observations of several families

USGS-NRDA data added to the observations of tanaidaceans classified as genera *incertae sedis*

# Conclusions

Tanaidaceans have diversity-depth pattern similar to other deep-sea macrofauna

Many undescribed specimens and specimens classified as *incertae sedis* that can be described

First detailed analysis of tanaidaceans in the Northern Gulf of Mexico

# Thank you for listening

Larsen, Kim. Deep-Sea Tanaidacea (Peracarida) from the Gulf of Mexico.  
Boston: Koninklijke Brill, 2005.

Databases:

- ChEss (Deep-water Chemosynthetic Ecosystems)
- GBIF (Downloaded 7/1/2013)
- IOBIS (Downloaded 7/1/2013)
- USGS (provided by Jill Bourque),
- Smithsonian Museum of Natural History
- NGoMCS (LGL)

Various literature – available upon request

Students

- Marissa Amador