A Tutorial for New Users of the Marine Data Model

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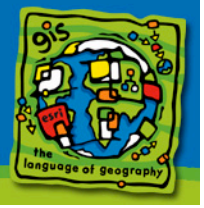
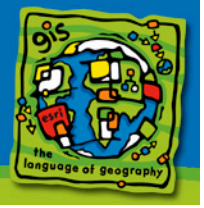
Oregon State University

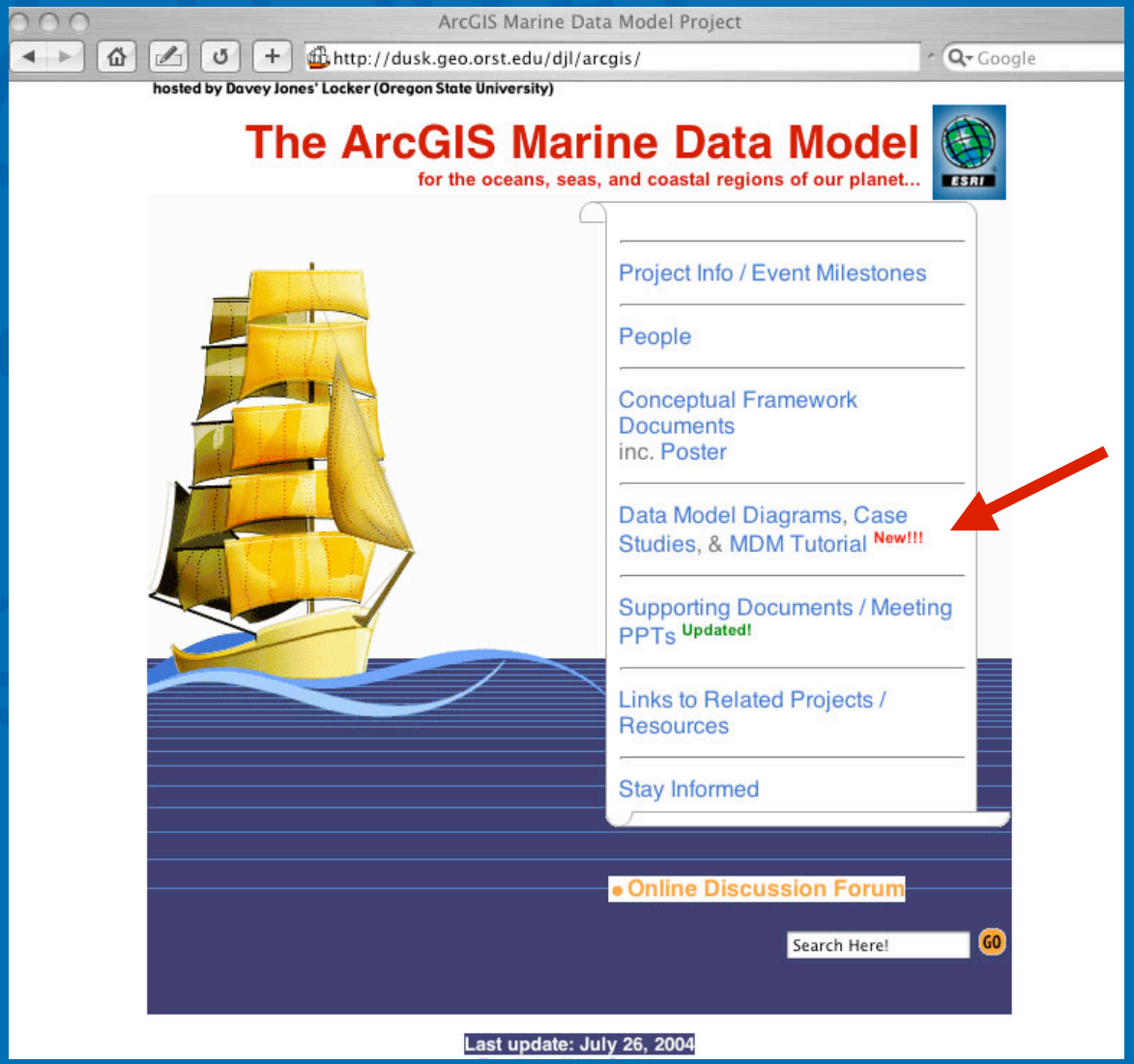


Tutorial Purpose

- Assist in simple data entry into MDM
  - Starting point for project work or specific database design.
  - Personalize MDM to fit your needs
- Support for Case Studies
- Laboratory exercise or module
- General publicizing



Entry Point on Web
dusk.geo.orst.edu/djl/arcgis



Using the Marine Data Model in ArcGIS 8.3/9.0

Links for this Tutorial

- PowerPoint file of MDM Tutorial at ESRI UC 2004

- Marine Data Model Home Page
- Marine Data Model at ESRI
- More Samoa Source Data

Basics:

- Introduction to the ArcGIS Marine Data Model
- Tutorial Objectives
- Computer and Data Requirements

Setting Up the Geodatabase:

- Downloading the MDM Geodatabase
- Downloading the Data
- Applying the MDM Model Schema to the Geodatabase

Loading Data into the MDM Geodatabase

- Assess Your Data and Determine Your Database Setup

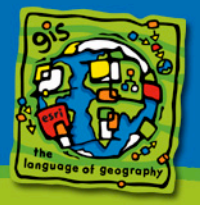
- Personalizing the MDM to Fit Your Data
- Loading Data into the MDM

Adding the Geodatabase Features to your ArcMap Project

- How to add your data
- How to query the data

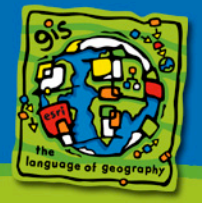
Tutorial Setup

- Tutorial divided into four sections
  - Basics
  - Setting Up the Geodatabase
  - Loading Data into the MDM Geodatabase
  - Adding the Geodatabase Features to your ArcMap Project

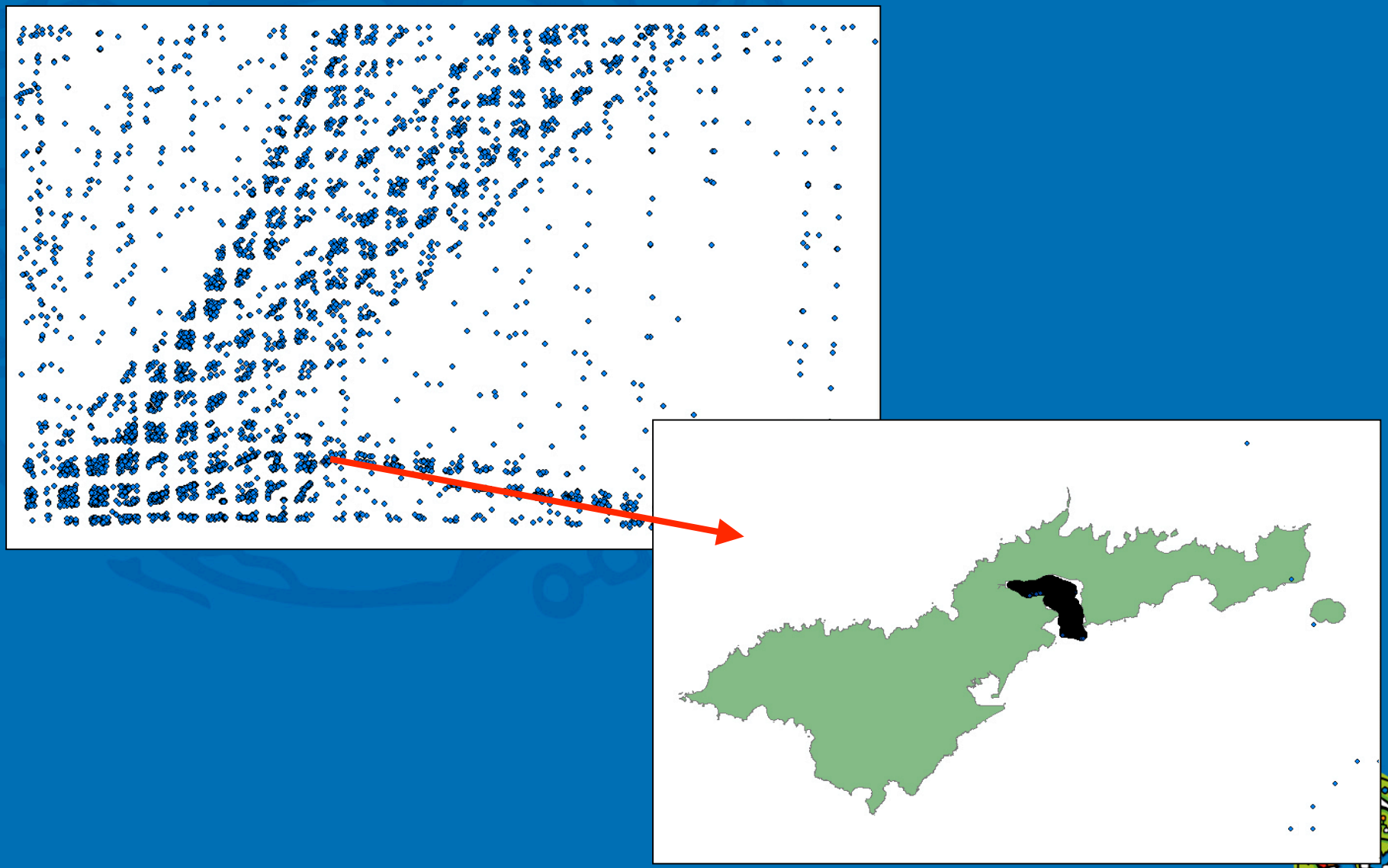


(1) Basics

- Introduction to the ArcGIS MDM
  - Why created
  - Intro to geodatabases
  - Helpful links
- Tutorial Objectives
  - Apply, prepare and load
- Computer and Data Requirements
  - Tested using ArcGIS 8.3 and 9.0
  - Need MDM schema, Tutuila Island and XYBottle shapefiles, Pago Pago 5m grid and XYBottle data tables.

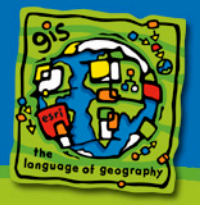


(1a) Views of Data



(2) Setting up the Geodatabase

- Downloading the MDM Geodatabase
- Downloading the Data
- Applying the MDM Model Schema to the Geodatabase



(2a) Downloading the MDM Geodatabase

The ArcGIS Marine Data Model
Analysis/UML Diagrams
Case Studies

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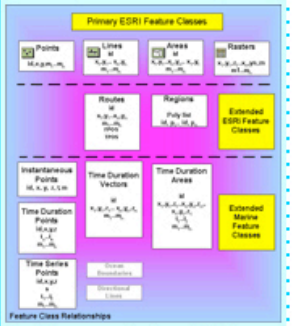


Draft diagram of primary ESRI marine feature classes (P. Halpin)

Click image to enlarge

Levels in data modeling include:
reality --> conceptual model --> logical model --> physical model, increasing in abstraction as one goes from human-orientation to computer-orientation.

The first step in the data modeling process is to define the overall scope and content of the model. From a conceptual standpoint, this involves the challenging task of identifying the common, essential "things" that are modeled in most GIS projects within your application domain. Next is the creation of an analysis diagram, with the identification of major thematic groups and an initial set of object classes within these groups. The analysis diagram is at the "conceptual" level in the data modeling process.

Next, an initial model is built in Unified Modeling Language (UML) and a schema is generated in ArcCatalog. The UML diagrams and schema are at the "logical" level in the data modeling process. Fortunately the marine community will not have to deal directly with UML (unless it really wants to!). Instead, users may take advantage of an existing repository of CASE tools in order to generate their own schemas (CASE = computer aided software engineering, and the tools are for object-oriented design and analysis).

Analysis Diagram
GIF Image, 642K (7/19/02)

UML Diagram and Repository
Visio and .mdb, 2.2 Mb zip file (9/07/03)

Common Marine Data Types Diagram
GIF Image, 204K (6/29/03)
PPT file, explaining fragment of UML , 164K (5/30/03)

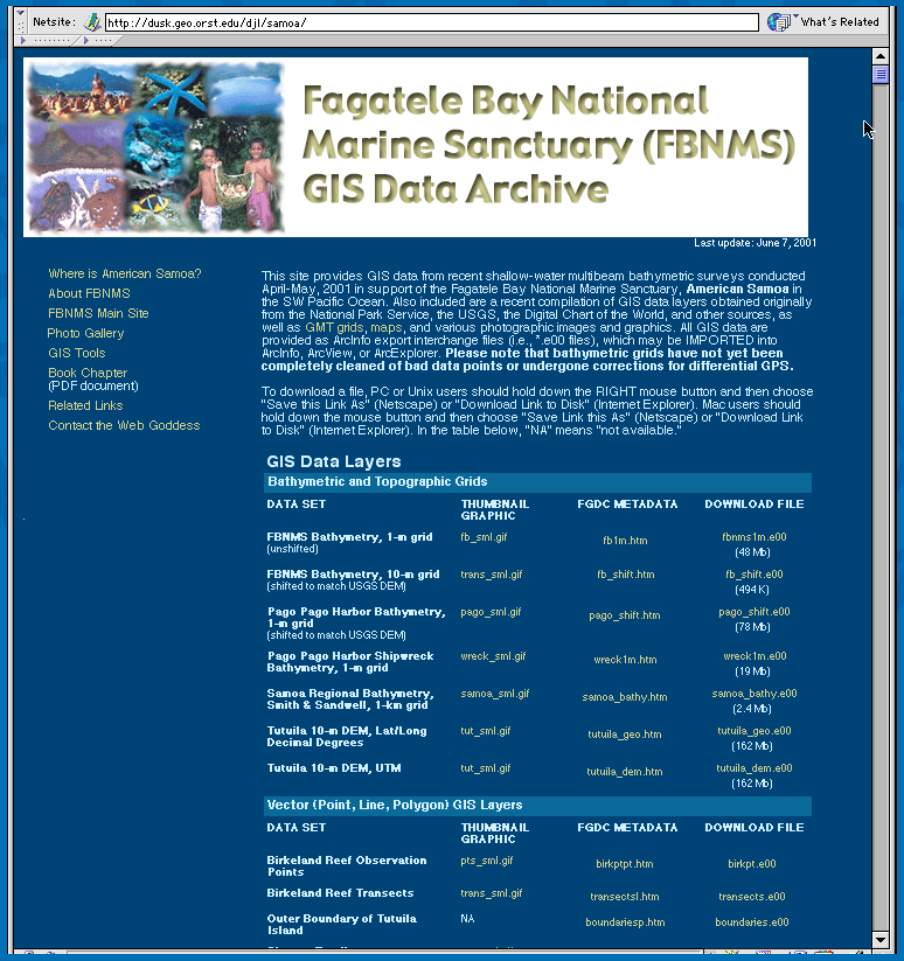
Scientific Information Model Diagram (1997)
(May help w/ understanding semantics in Analysis and UML Diagrams)
GIF Image, 168K (7/20/02)

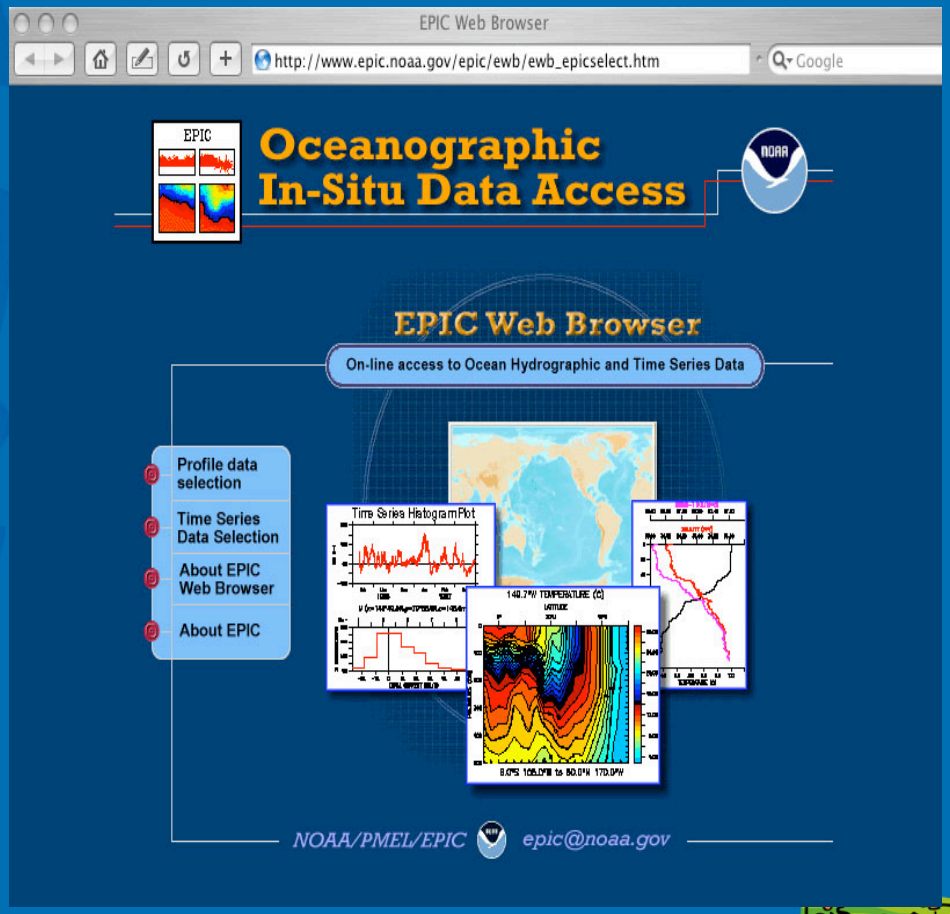
Marine Feature Classes Document
Zip file, 507K (9/07/03)

(2a) Downloading the MDM Geodatabase

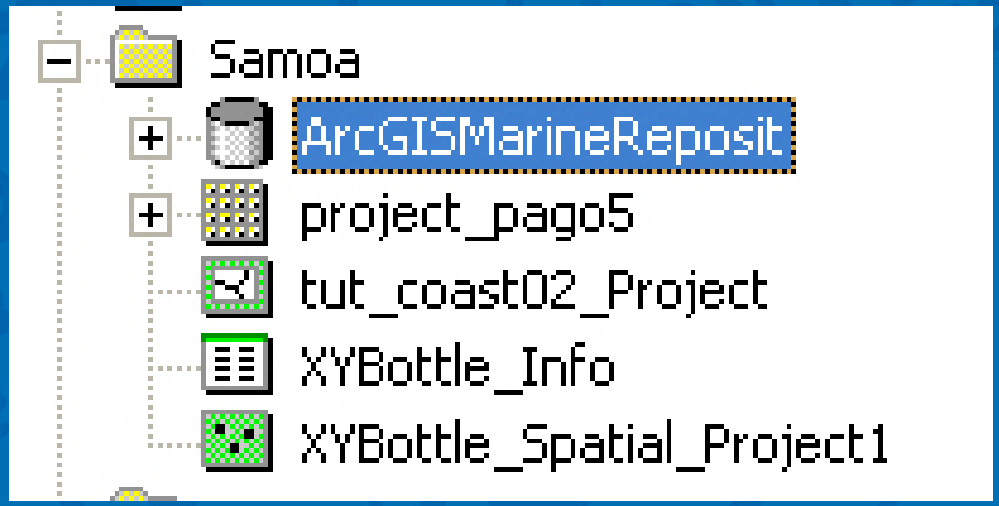
- **Tip #1**: ArcCatalog does not always refresh automatically. If you do not see the *ArcGISMarineReposit.mdb* file in the *Samoa* folder after you extract it, refresh ArcCatalog by going to *View-->Refresh*.

(2b) Downloading the Data
(if additional test data sets needed)





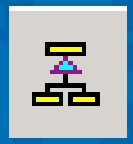
The MDM Repository and Test Data



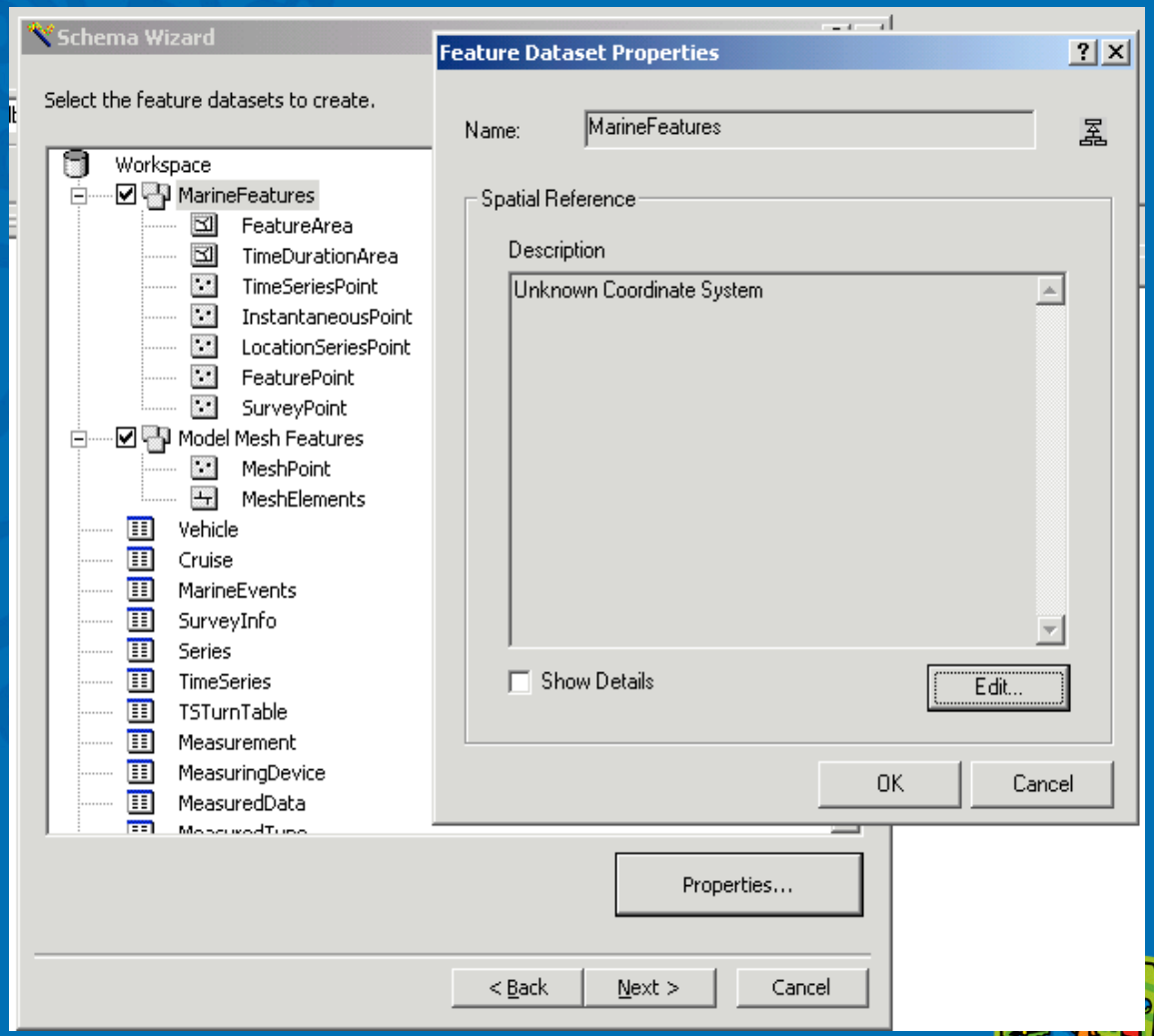
- All data contained in a feature dataset must have the same coordinate system and fit within the set spatial extent
- Tutorial used: WGS 1984 UTM Zone 2S

(2c) Applying the MDM Model Schema to the Geodatabase

- Use Schema Tool in ArcCatalog

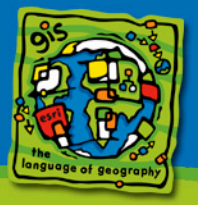


- Select coordinate system and spatial extent
- Tutorial used XYBottle Data



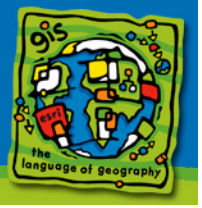
(2c) Applying the MDM Model Schema to the Geodatabase

- **Tip #2:** Use *Import* option and select a shapefile/coverage with the largest extent needed and desired coordinate system
- **Tip #3:** Make sure that the schema and your data match exactly



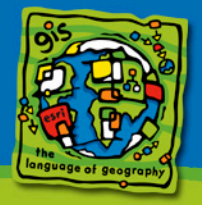
(3) Loading Data into the MDM Geodatabase

- Assess Your Data and Determine Your Database Setup
- Personalizing the MDM to Fit the Data
- Loading Vector Data into the MDM
- Creating a Relationship
- Loading Raster Data into the MDM

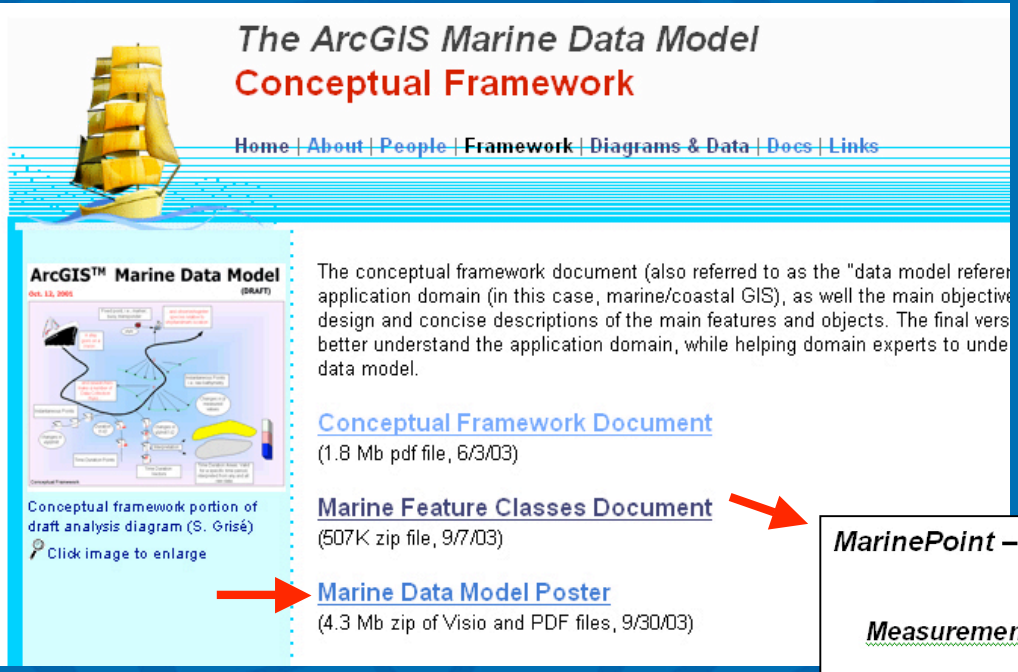


(3a) Assess Your Data and Determine Your Database Setup

- Most important, but also most time consuming step
- Important things to consider:
  - Which feature classes should the data go into?
  - What are the attributes of each data set?
  - Do you want to relate any of your data? If so, through what key fields?



(3a.1) Matching Data with Feature Classes
Feature Classes Document and MDM Poster



MarinePoint – an abstract class defining subclasses of point features.

MeasurementPoint – an abstract subclasses of MarinePoint used for categorizing points that are associated with Time or Measurements.

InstantaneousPoint – An instantiable subclass of MeasurementPoint for representing features that are a single observation in time and space. Meaning the X, Y coordinates plus a timestamp create the unique point feature. An InstantaneousPoint can have multiple Z depths via implementing the Measurement object class.

Properties: None
Attributes: RecordedTime – the time step for identifying the point
Examples: CTD (conductivity/temperature/depth), XBT (eXpendable BathyThermograph), SVP (Sound Velocity Profile) casts below the water surface, all with multiple Measurements.

Instantaneous Point = CTD or measurement package
Measurement Table – Measure ID of 1st CTD measure stop at depth z
MDevice Table = bottle, or could be same device but calibrated different way
MType = reading is of type dissolved O_2 (could be salinity, temp, photosynthetically available radiation (PAR), etc.)
MData = that actual numerical value of dissolved O_2

(3a.1) Matching Data with Feature Classes
Common Marine Data Types Diagram

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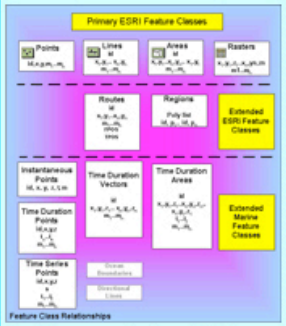

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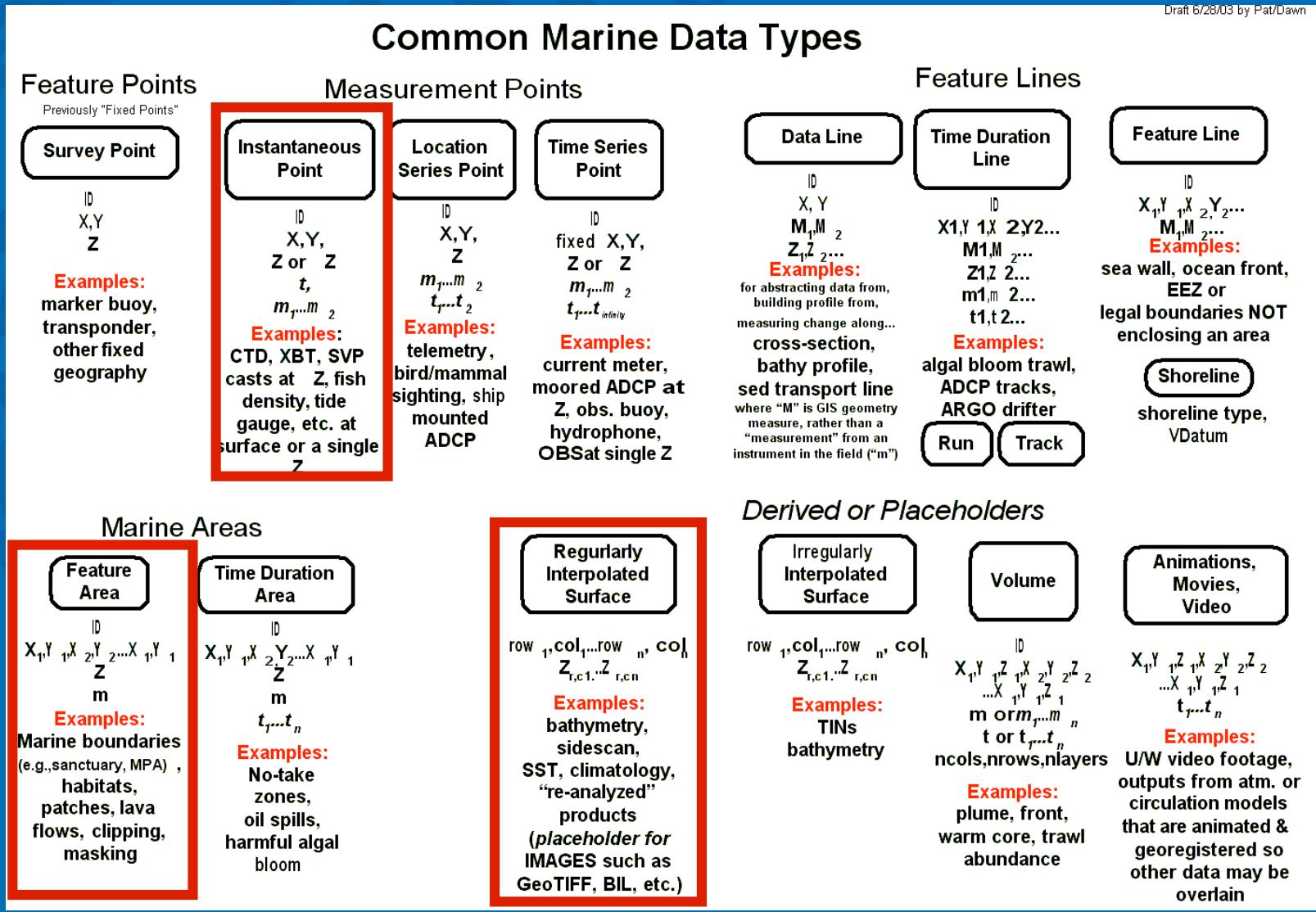
MDM Common Marine Data Types



(3a.2) Matching Spatial with Non-Spatial

XYBottle Spatial Data

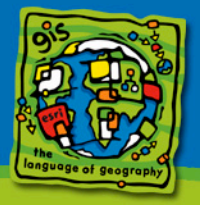
- Feature class: InstantaneousPt
- Attributes:
  - *RefID* (Long Integer)
  - Cast (Text, 50 Characters)
  - Lat (Double)
  - Long (Double)
  - MaxDepth (Double)
- Will create a 1-to-1 relationship class between the *RefID*

XYBottle Non-Spatial Data

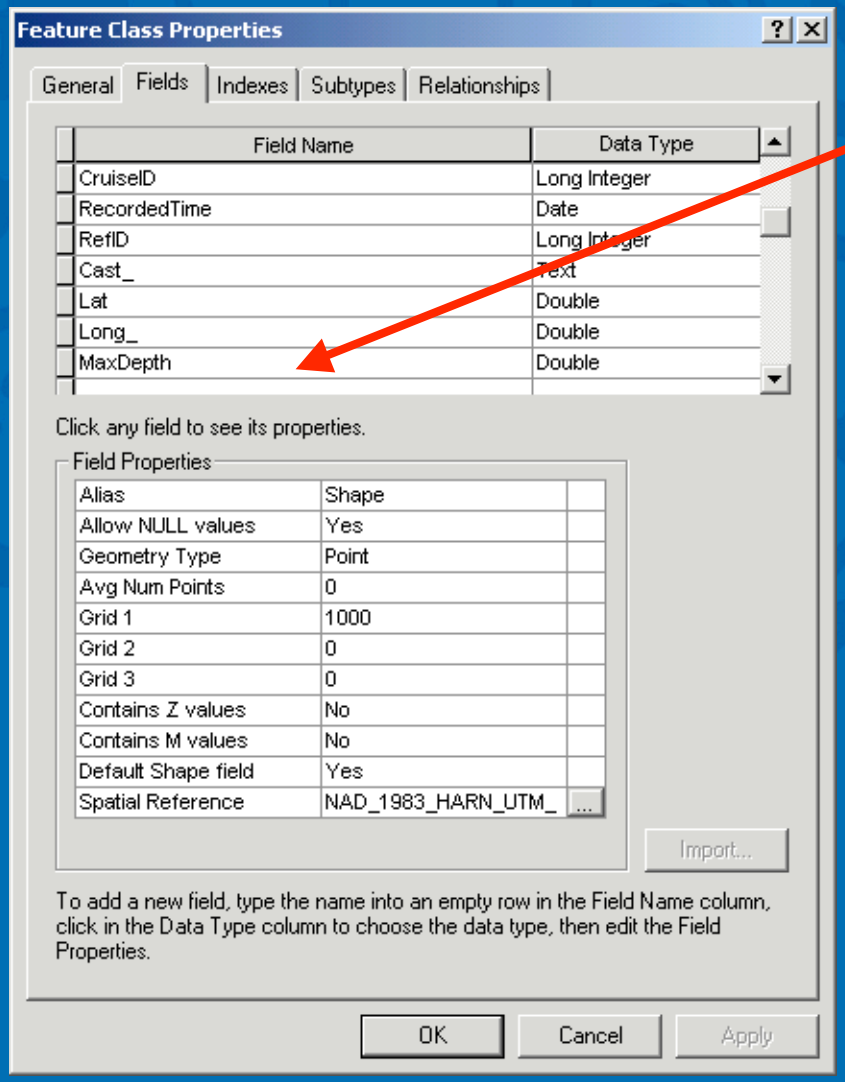
- Table: create new
- Attributes:
  - *RefID* (Long Integer)
  - Cast (Text, 50 Characters)
  - MMDDYYYY (Date)
  - Temperature (Double)
  - Oxygen (Double)
  - Salinity (Double)
  - Phosphate (Double)

(3a) Determine the Database Setup

- **Tip #4:** Relationships between data columns can only be established if attribute data type is Long Integer



(3b) Personalizing the MDM to Fit the Data



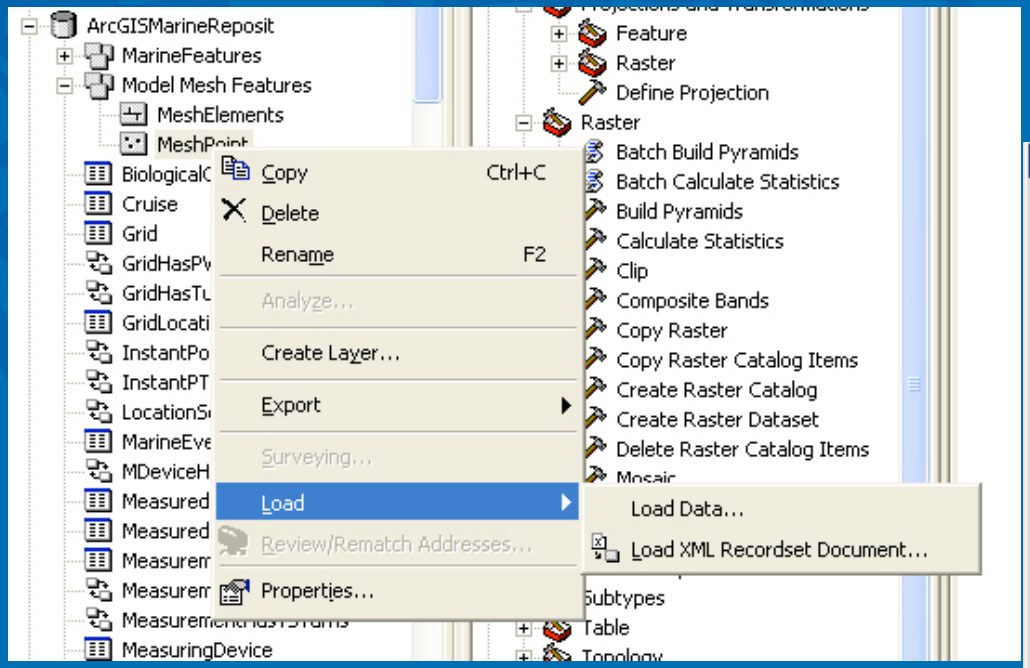
- Feature class personalized to fit XYBottle Data
- Field names were added to the InstantaneousPT feature class
- Can add additional field names later, but cannot modify once data have been added to those fields

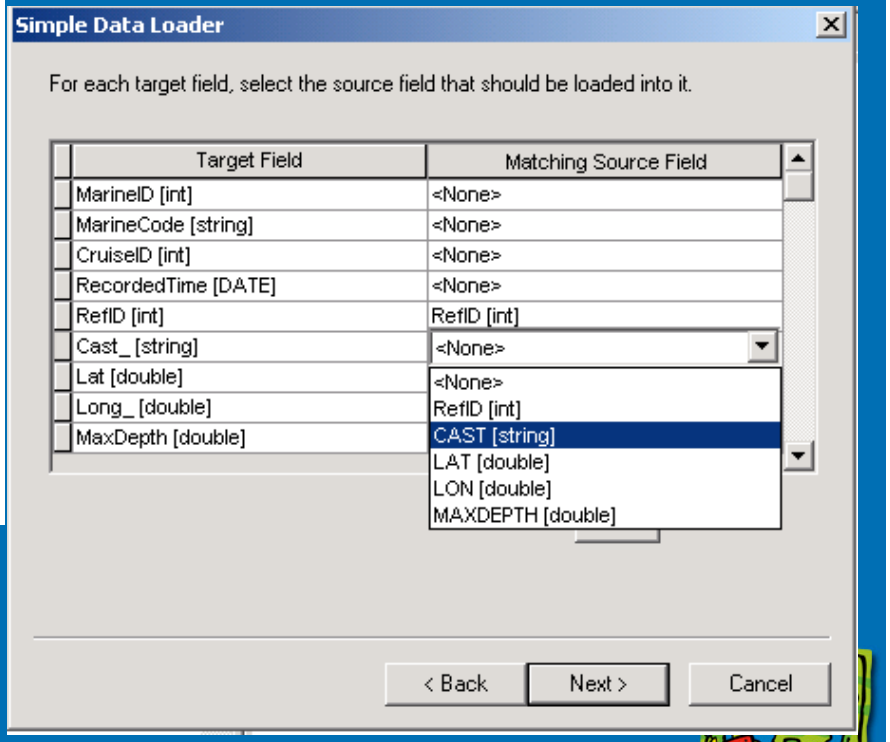
(3b) Personalizing the MDM to Fit Your Data

- **Tip #5:** Make sure data types match up exactly, or your data will not load

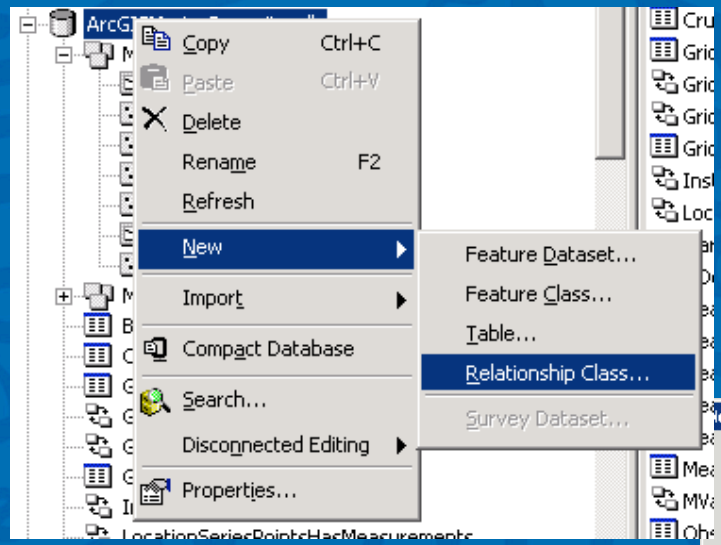
(3c) Loading Vector Data into the MDM

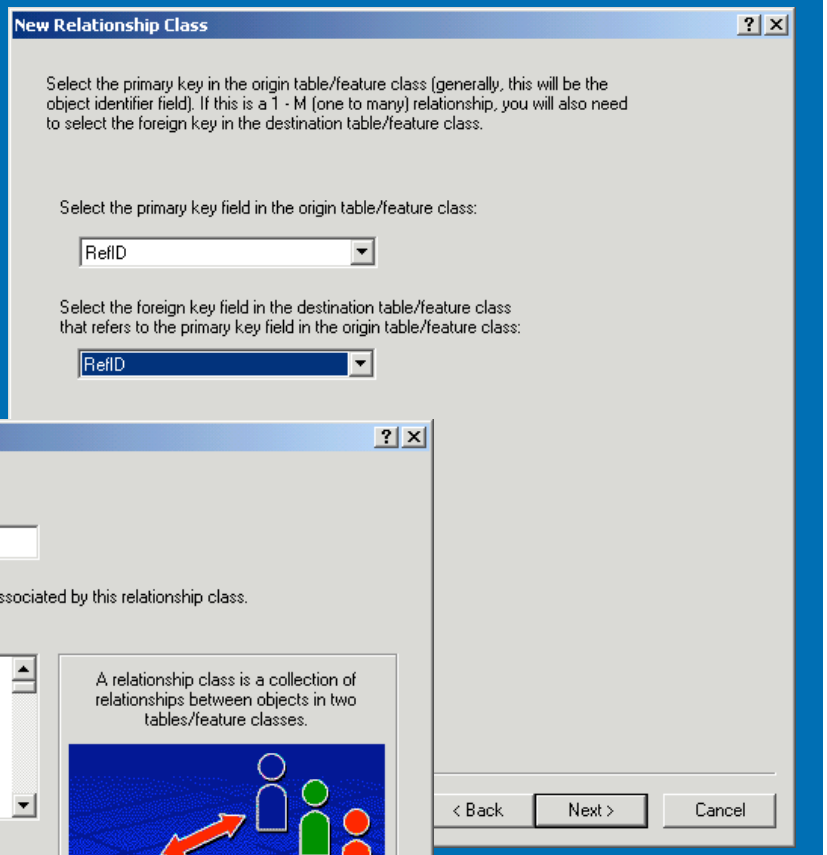
- Load data into feature class/table
- Match field names and data types

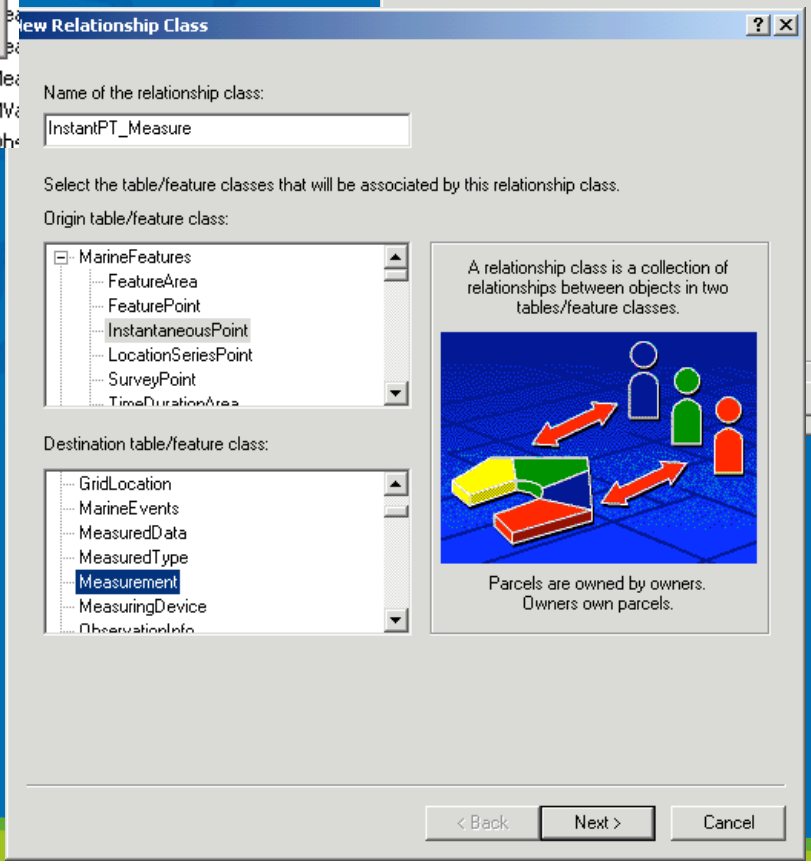




(3d) Creating a Relationship

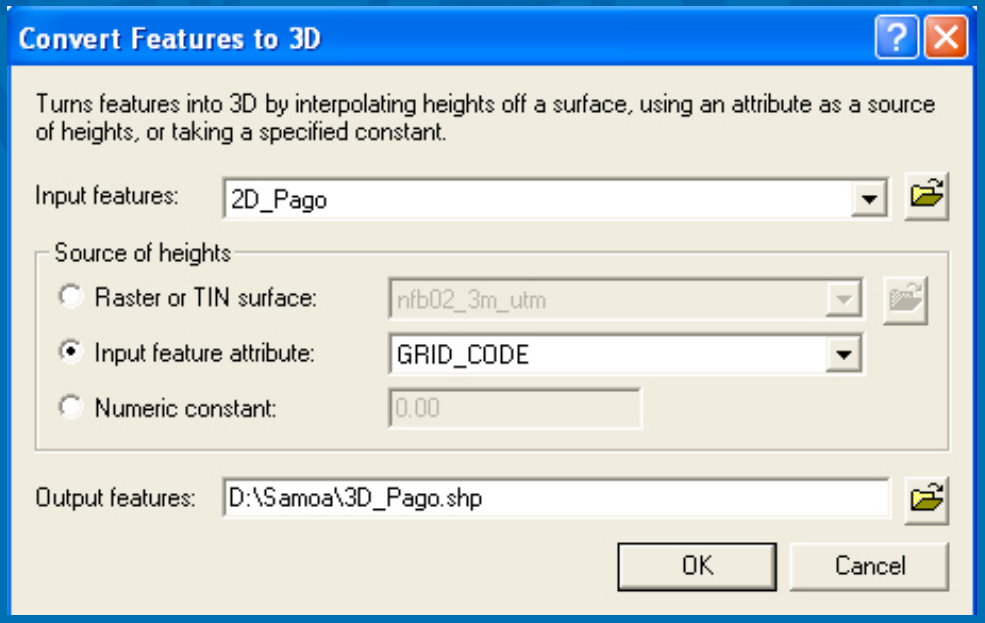


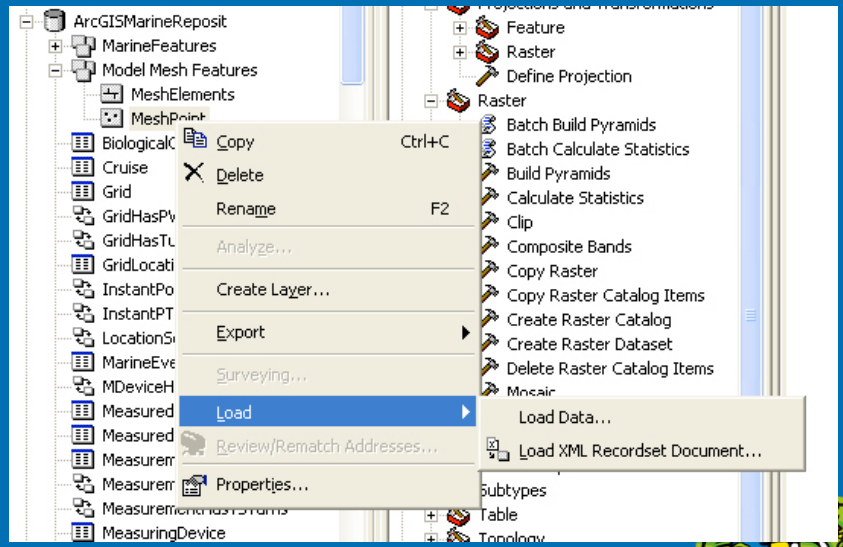




(3e) Loading Raster Data into the MDM (ArcGIS 8.3 only)

- To add raster data (without ArcSDE):
  - Can add standalone grid
  - Or can convert grid to shapefile
- Convert Pago 5m grid to 3D shapefile
- Loaded data into MeshPoint feature class



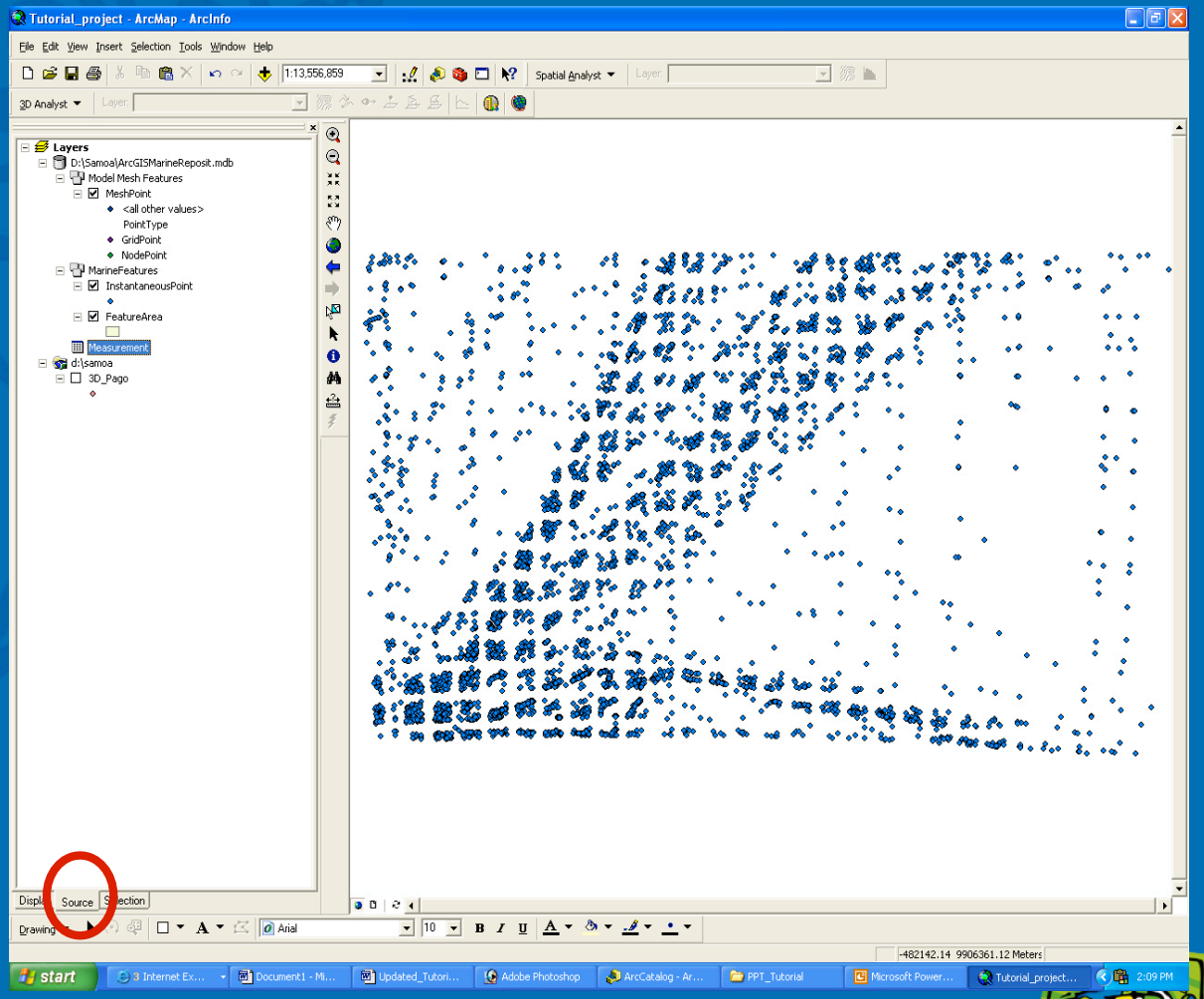


(4) Adding the Geodatabase Features to your ArcMap Project

- How to add the data in ArcMap
- How to query the data in ArcMap

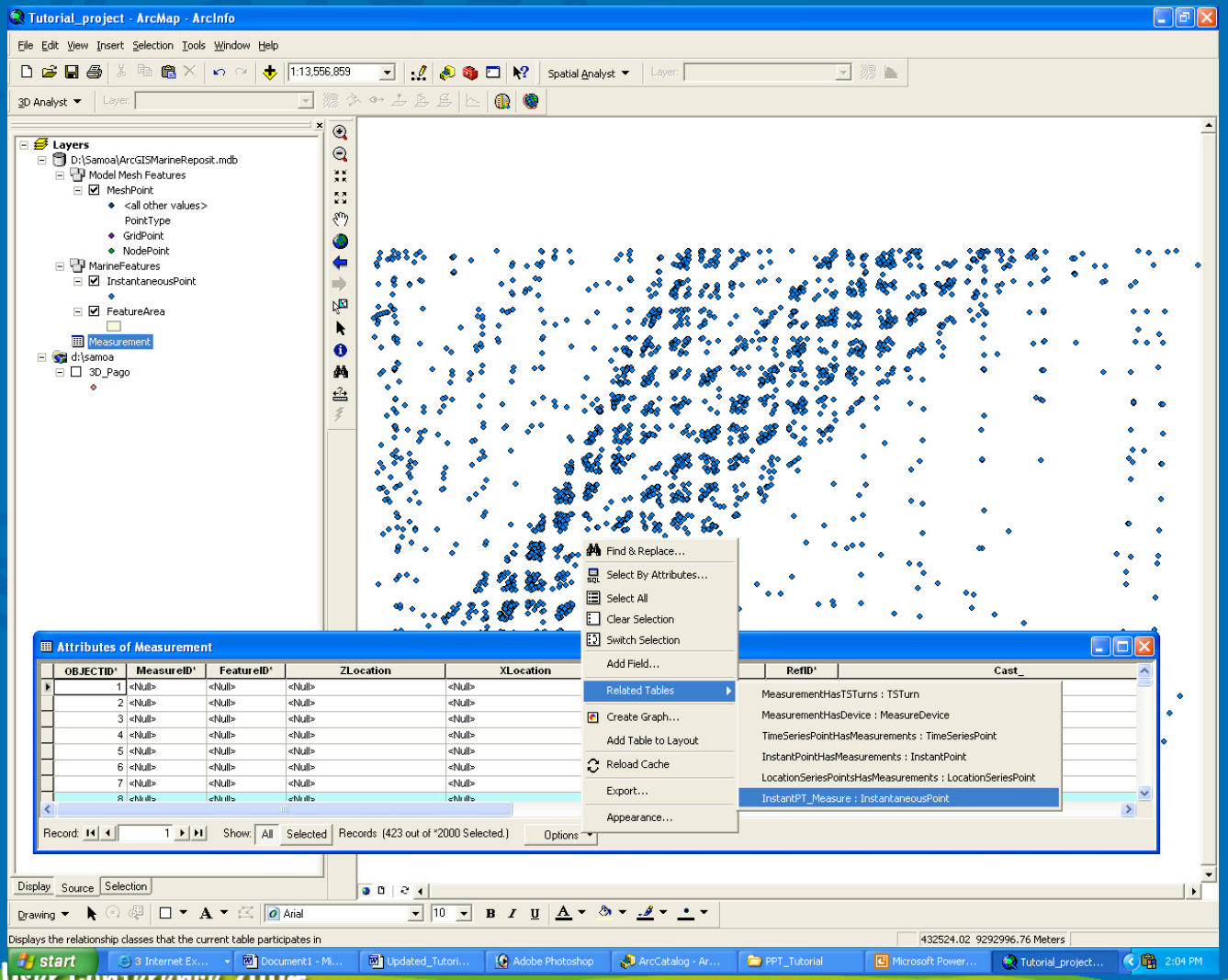
(4a) How to add the data

1. Add the three feature classes: FeatureArea, InstantaneousPoint and MeshPoint, from the geodatabase.
2. Add the Measurement table.
3. Now you are ready to query for information through the tables.



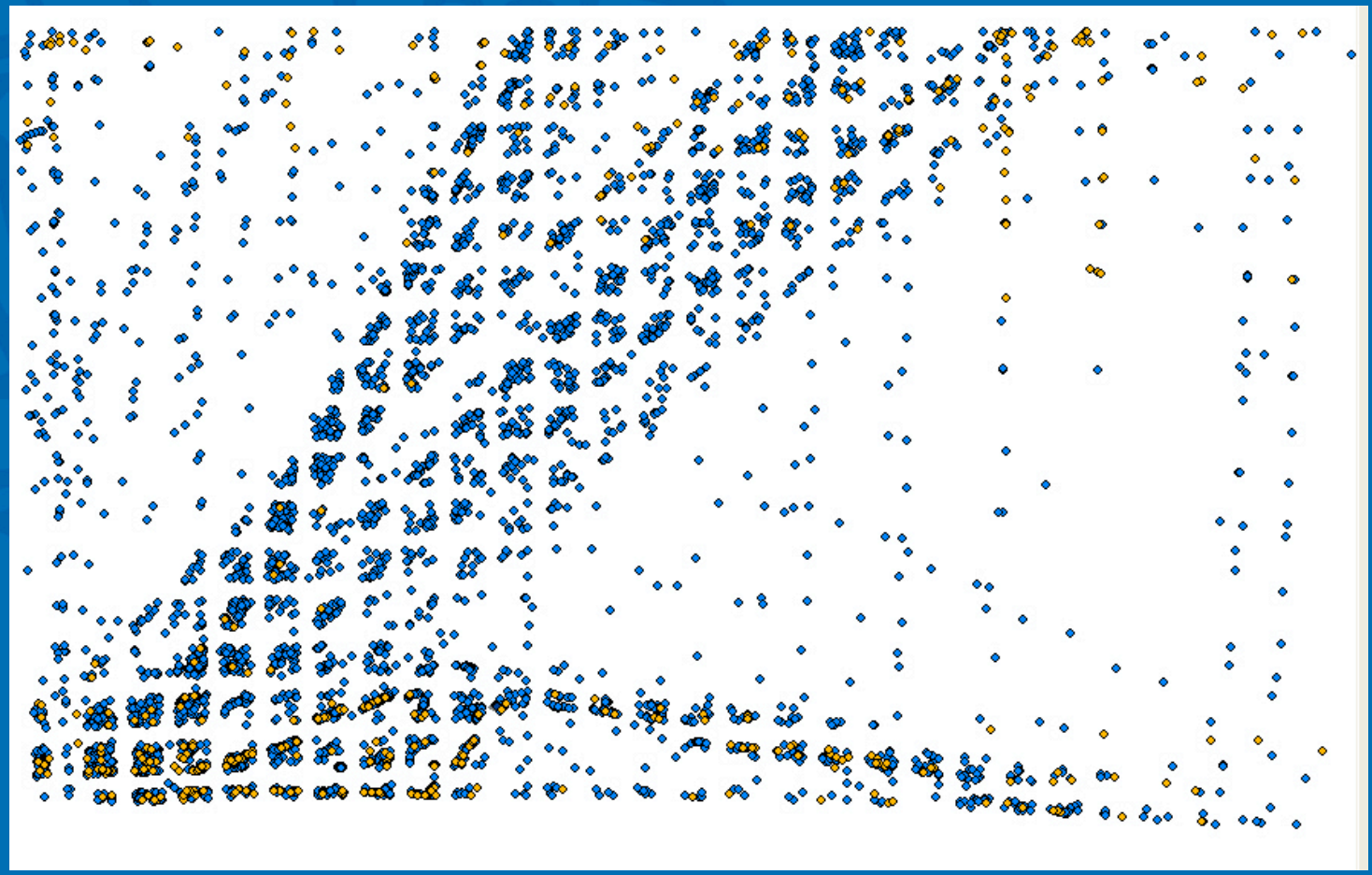
(4) How to query the data

- **Sample query:** How many points have a temperature of 30 °C ? (Larger issue: Effect of global warming on coral reefs)



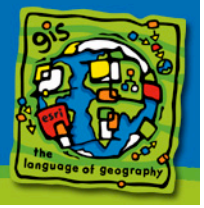
Sample Result of query

- 423 (in orange) out of 4780



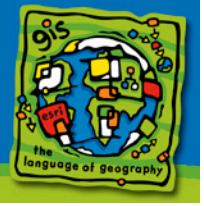
Summary:
Important Things to Consider

- Coordinate system and spatial extent
- Identifying any possible differences between the schema and your data
- Which feature classes should the data go into?
- What are the attributes of each data set?
- Do you want to relate any of your data? If so, through what key fields?



Summary of "Tips and Tricks"

- **Tip #1:** ArcCatalog does not always refresh automatically. If you do not see the *ArcGISMarineReposit.mdb* file in the *Samoa* folder after you extract it, refresh ArcCatalog
- **Tip #2:** Use *Import* option and select a shapefile/ coverage with the largest extent needed and desired coordinate system
- **Tip #3:** Make sure that the schema and your data match exactly
  - Ex: M value for MeshGrid feature class
- **Tip #4:** Relationships between data columns can only be established if attribute data type is Long Integer
- **Tip #5:** Make sure data types match up exactly, otherwise, your data will not load



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