

Creating and Using Taxonomic Keys with HyperCard

by

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The preparation and use of taxonomic keys is an essential part of the work of many biologists. However, the difficulty of collecting taxonomic information that is often dispersed in many hard-to-use and difficult-to-find references discourages the common use of taxonomy in the work of many ecologists. This manuscript describes the computer program Linnaeus, which was designed to solve this problem. Linnaeus was developed at the Institute of Marine Research in Bergen using the Macintosh computer and the program HyperCard. Linnaeus allows taxonomic keys for the identification of any type of organism to be created, and includes both pictures and text. Keys may be simply created, even by those without previous computer programming experience. The use of an example key for the identification of zooplankton is described and the creation of further keys specific to groups of species or geographical areas is discussed.

Using Linnaeus "Zooplankton"

Linnaeus "zooplankton" is the first taxonomic key made with HyperCard. Linnaeus may be run on any Macintosh computer with at least 1 Mb of memory; a hard-disk drive is recommended. Linnaeus is designed as an introduction to the use of HyperCard for taxonomic work. As such, I have kept the programming examples very simple. Future keys

HyperCard Taxonomy

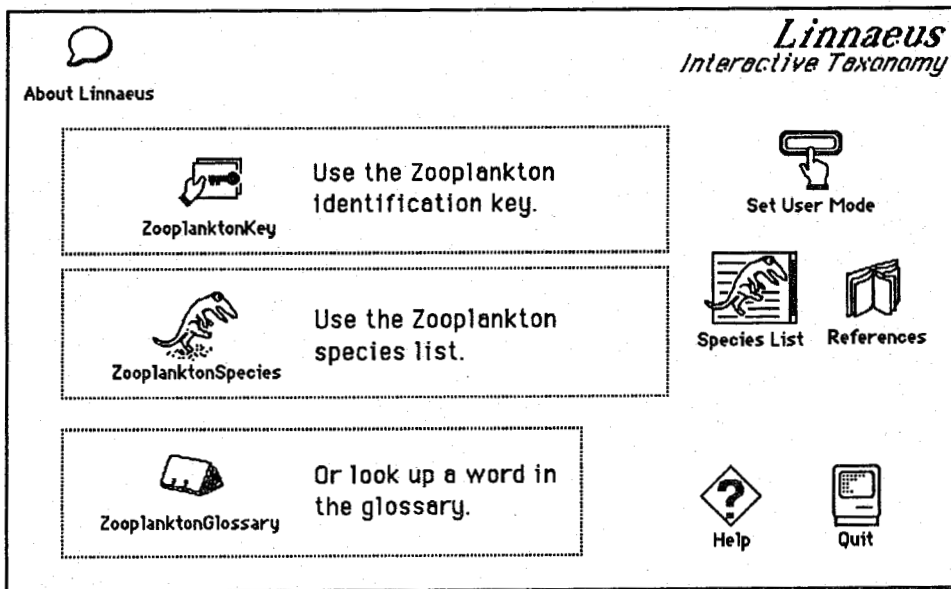
will include much more complicated examples of HyperCard programming.

To use the example key, copy the files from the Linnaeus disk to your hard-disk drive and click on the file "Read Me First." This file has complete instructions on the installation into your HyperCard Home stack. If you wish, you can print a copy of the instructions by choosing the "Print Instructions" button.



After you have installed Linnaeus, you can move to the program from your HyperCard Home card by clicking on the Linnaeus button on your Home card.

This will bring you to the Index card for Linnaeus.



The Index card has 3 main icons (the ones on the left side of the card). The first icon, named "Zooplankton Key", allows you to move to a binary-choice key for keying out the species in the program. The second icon, "Zooplankton Species", takes you directly to the species cards, which

HyperCard Taxonomy

contain the pictures and description of each species in the key. The third icon, "Zooplankton Glossary", takes you to a set of cards that contain definitions of unfamiliar or technical terms in Linnaeus.

The Index card also includes the buttons "Species List", "References" and "Set User Mode". The **Species List** is a card with a list of all species in the present version of the key. To move directly to a species card, you need only click on its name. The **References** button moves to a card containing a list of the references used in the preparation of this version of the key.

User Mode:

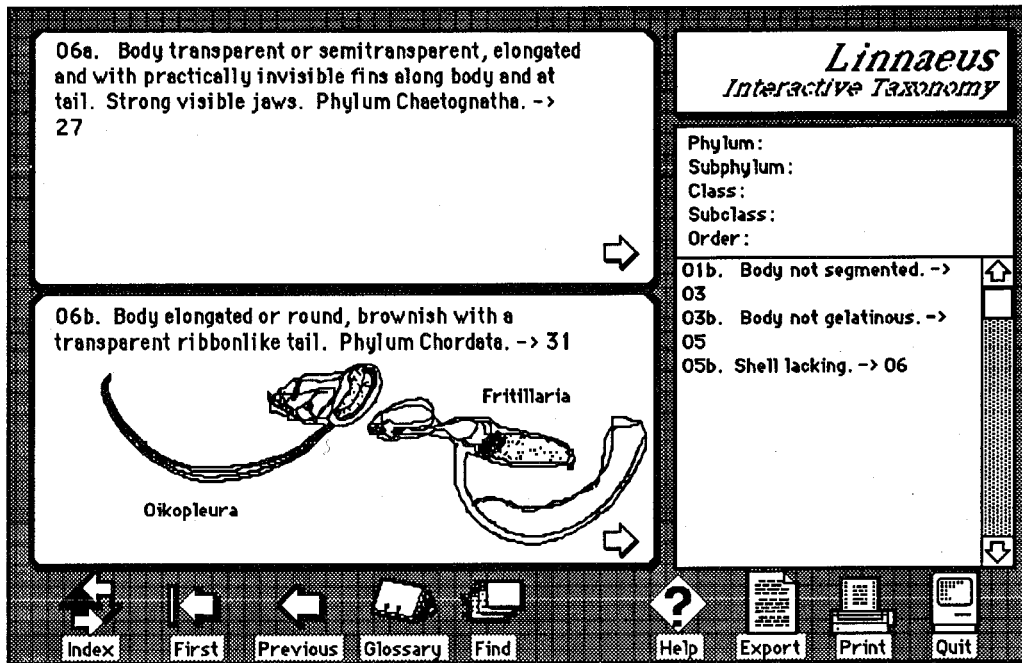
- I want to use Linnaeus.
- I want to change Linnaeus.
- I want to program Linnaeus.

Set User Mode allows you to set

the user level. The user level determines the extent to which you can change Linnaeus.

When set at "I want to use Linnaeus", you can browse through the existing key, but you can't make any changes to the text or pictures. "I want to change Linnaeus" lets you make changes to the text and pictures in the key, but does not allow you to create or delete cards, or to change the HyperTalk programs (scripts) that run the system. "I want to program Linnaeus" gives you complete access to the cards and scripts in the program, allowing you to make any changes you wish. Of course, it also allows you to accidentally destroy the key, so always work on a backup copy.

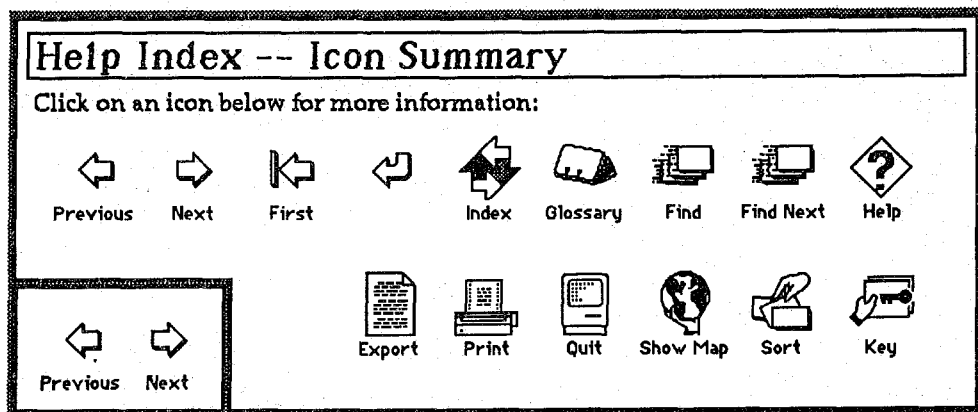
To start the identification process, click on the **Zooplankton Key** button. This will take you to the first card of the binary-choice key. You make choices in the key by clicking on the arrows at the lower-right of each small card containing the text for the choices.



As you make choices during identification, Linnaeus keeps track of a running taxonomic identification called the "Decision Map." The Decision Map is a list on the right-hand side of the choice cards that is updated each time a choice is made, so it always contains a record of the decisions you have made in your identification. To see how this process works, choose one or two alternatives in the key cards and watch the decisions being recorded in the Decision Map. You may also step backwards in the key, for example, if you find you have made an incorrect choice earlier in the key. This is done by choosing the **Previous** or **First** buttons on the bottom of the card. When stepping backwards, the Decision Map is updated by removal of the last item. When you have made a final identification, the Decision Map may be viewed by clicking on the Decision Map icon on the bottom of the species card. You may then compare the choices you have made with the final species description. From the species card you may go back to the key and try another identification by clicking on the curved arrow above the

Quit icon. Some species in the key have a second card, for example, a card with a detailed picture of a part of the species. In addition, some cards list related species, which may be viewed by clicking on their names.

Linnaeus includes a Help stack that can be viewed from any part of the program. The Help file explains the function of all parts of Linnaeus, and includes a button summary that guides new users to the program.



If you are using Linnaeus for the first time, the Help stack should guide you in learning the function of the program. In addition, a printout of the zooplankton species cards and key choices are included in Appendices 2 and 3. The rest of this manuscript describes the modification of Linnaeus and the creation of new taxonomic keys using HyperCard.

Expanding Linnaeus

Starting with the basic "zooplankton" key, Linnaeus can be expanded into a key to any group or geographical region. The process of making a new key involves selection and digitization of species pictures, preparation of text for species card and keys, and creation of new cards. You should not attempt to change Linnaeus until you have at least a basic understanding of HyperCard and some knowledge of its programming language HyperTalk.

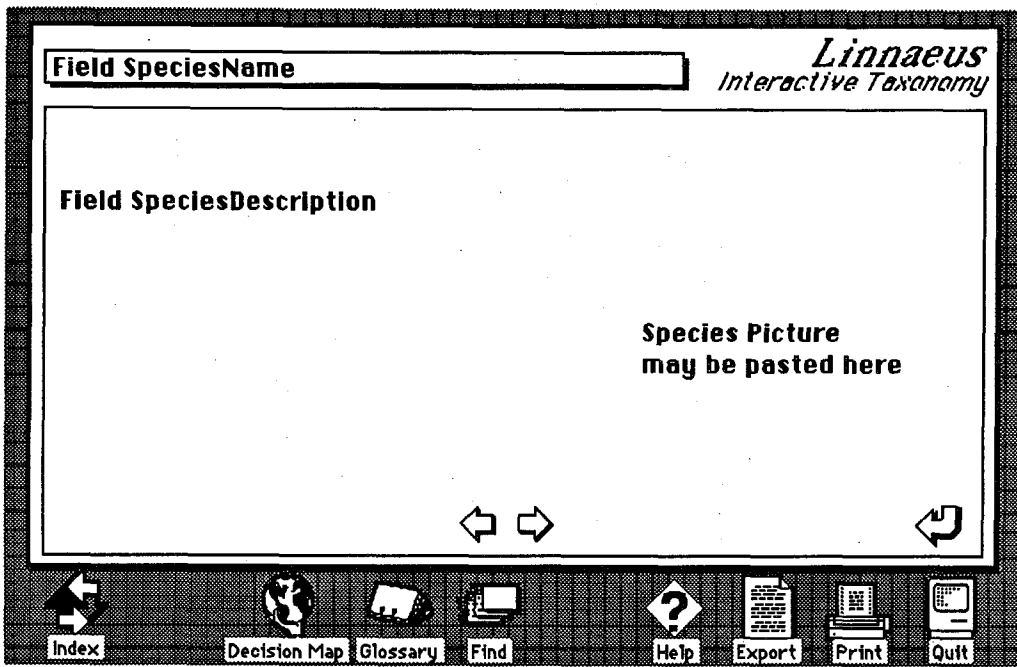
HyperCard Taxonomy

Changing the Text

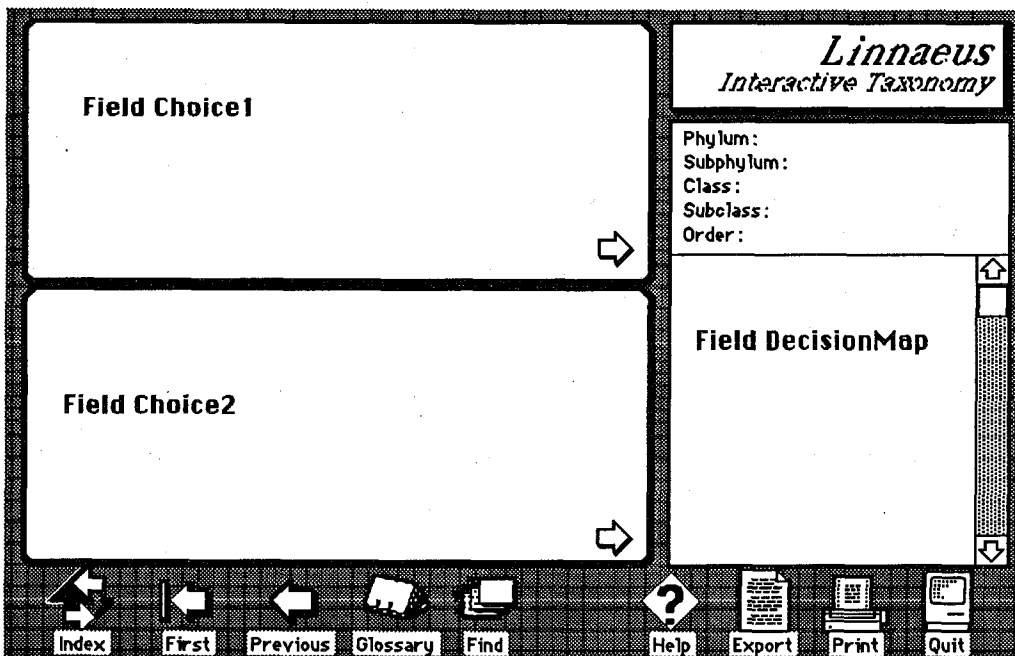
If you wish to change the text contained on any of the cards in Linnaeus, set the User Mode to "I want to change Linnaeus". To set the user mode, click the **Set User Mode** button on the Linnaeus Index card. You may now move to any of the Key or Species cards and make the changes you wish.

Adding Cards

If you wish to expand the existing key, you need only add cards to the zooplankton key and zooplankton species stack. You must first choose "I want to program Linnaeus" on the User Mode card. Cards are added to the species stack by choosing New Card from the Edit Menu. HyperCard will create a blank species card on which you may paste a picture of the species. The species cards also contains fields where you may type the species name and species description. When you type the species description, you must "wrap" the text around the picture by pressing the return key at the end of each line.

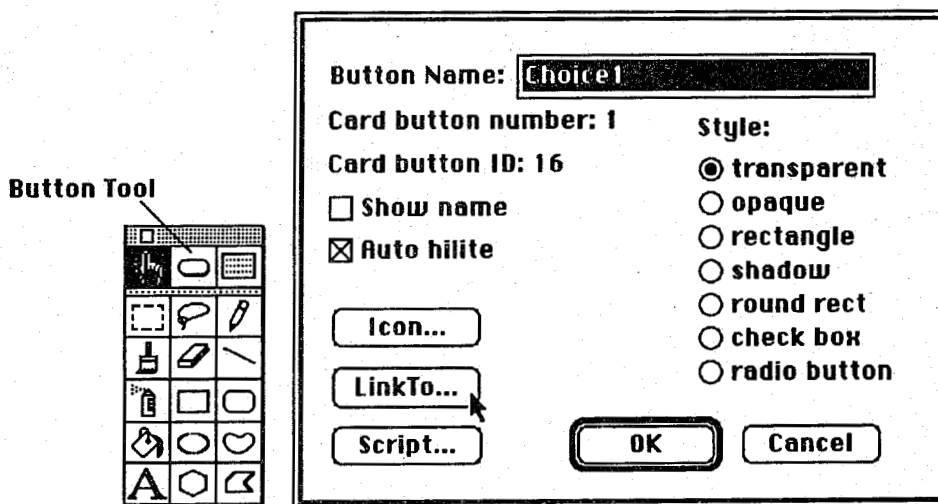


New cards for the taxonomic key are created in the same way, but the process is a bit more complicated. After selecting New Card from the Edit menu, you are presented with a blank card containing fields "Choice1" and "Choice2" into which you enter binary choices from your key.



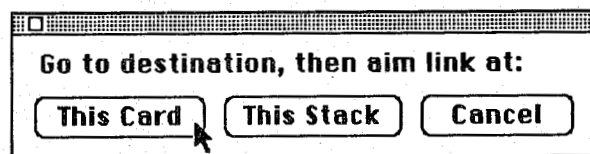
The field DecisionMap does not need to be filled, as this happens automatically as the key is used.

When you first create a card, the arrows on the choice cards do not lead anywhere, so clicking on them has no effect. In practice the best way to create a key is to first write the key in full on paper. It is best if the key is written in the traditional fashion, ie., with the choices numbered in numeric order 1a,1b,2a,2b... Next, create a number of cards equal to the number of binary choices in the key, and type the numbers and text into the cards you have created.



Button-Information Dialogue Box

Now you can link the key cards you have made. To link the cards, go to the first card in the key and select the button tool in the tool palette. Now double-click the Choice1 button to move to the button-information dialogue box. In the dialogue box, choose Link To...



Now move to the next binary choice indicated by choice 1 and click the "This Card" button in the dialog box. Repeat the same process for the "Choice1" and "Choice2" buttons of each card in the key.

Creating Pictures

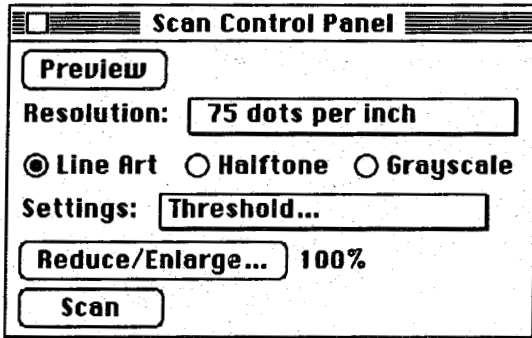
Pictures may be selected from any source and placed into the computer using any Macintosh scanner. For Linnaeus "zooplankton", we have used 2 digitizing systems, ThunderScan and the Apple Scanner.

For any scanner, the first step is to reduce or enlarge the original on a good-quality copy machine so it will fit on within the HyperCard window. It is easiest here to print a blank species card and take it with you to the copy machine. Select an appropriate magnification on the copy machine by comparing the result with the blank card.

When using a scanner, keep in mind the limitation of HyperCard to binary (black & white) images. Though most scanners can digitize pictures as gray-scale images, HyperCard can only display images as black and white.

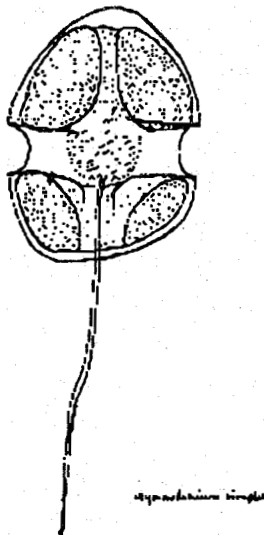


If you are using the Apple Scanner, you will probably want to use the program HyperScan. HyperScan scans images directly into HyperCard and is simpler to use than the AppleScan program.



If you are using the AppleScan program you should set Scan Control Panel to "Line Art" and "75 dots per inch".

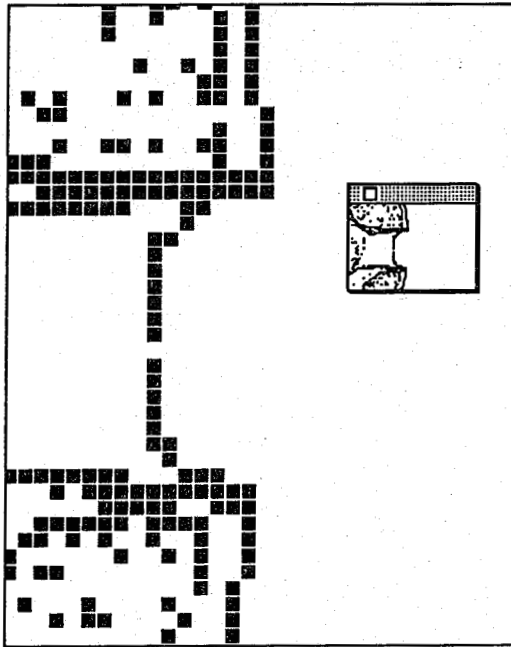
This setting causes the Apple Scanner to scan images at screen resolution, ie., they will be scanned in black and white at the same resolution (and magnification) as the original. Drawings should be placed on the scanner and previewed first. Next select Scan from the Scan Control Panel. You will probably need to try several thresholds to get the correct setting before you have a good image from the scanner.



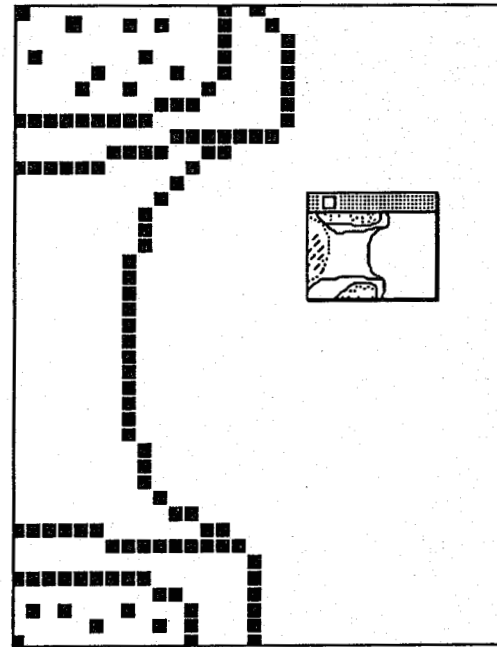
Scanned image showing digitization error

Once you have a scanned image, you can transfer it to the Scrapbook and later paste it into your HyperCard stack. No matter how good the original is, you will certainly need to re-edit the pictures after they are scanned. Images tend to be jagged, ie., they have mistakes due to digitization error that create extra or missing pixels. This is one of the most time-consuming parts of key preparation. The best place to edit the images is directly in HyperCard, though you may use any painting program.

Much of the editing work must be done in FatBits, the pixel-by-pixel magnification of the screen using the drawing tools in HyperCard or your drawing program. The image shown in these examples is from a good original and would require about 30 minutes to edit using FatBits, the exact time depending on the effect you wish to create.



Section of digitized image in FatBits



Section of image after editing

Programming in HyperTalk

Because no part of Linnaeus is hidden from the user, the entire system can be changed by editing the HyperCard scripts that control the program. Before attempting to change the program (or attempting to understand this section), you should have some experience in HyperTalk programming. The books by Goodman (1988, 1989) and Shell (1988) serve as good guides.

HyperCard Taxonomy

The HyperTalk code for Linnaeus is fairly straight-forward. All OpenStack handlers go to the index card in the Linnaeus stack, if the stack is the first-opened stack in this HyperCard session. This is accomplished through the handler GetLinnaeusLevel that checks the current user level and sets program attributes appropriately. OpenCard, CloseCard and CloseStack handlers for all stacks are, for the most part, concerned with keeping control over the decision map. The decision map must be added to or subtracted from, depending on which way you step in the program. Most stacks include handlers to disable menu commands. These are not invoked unless the user level is set at "I want to change Linnaeus", allowing free access to the menu commands if you are changing the program.

The most complicated handlers are for the Find and Export commands. The Find command runs through all of the cards in the stack collecting "hits", or cards with a word that matches the search word. When the hits are collected, the first card with the requested text is displayed and the Find Next button appears. Clicking the find next button moves to the next card in the hit list. Export takes text from the requested field(s) and places them into a variable (temp). When finished collecting text, the variable is written to a text file named with the short name of the stack and the time the file was created.

HyperTalk printouts of the most important handlers in the stack are included in Appendix 1 of this manuscript. If you have any questions or comments, please feel free to contact me.

Attributes and Acknowledgements

I wish to thank those who have worked with the Linnaeus Zooplankton key: L. Omli, A. Hassel, F. MacIntyre and F. Rey. Thanks are also due to A.J.W. Van Hertum for his helpful comments.

References

- Goodman, D. 1987. *The Complete HyperCard Handbook*. Bantam Books, New York, 720 pp.
- Goodman, D. 1988. *HyperCard Developer's Guide*. Bantam Books, New York, 644 pp.
- Shell, B. 1988. *Concise Guide to HyperTalk*. MIS: Press, Portland, 166 pp.

Appendix 1 - HyperText Source Code Listing

Scripts from the stack "Linnaeus"

```
-- SCRIPT OF STACK "LINNAEUS"
-- This is the main on start up script for Linnaeus,
-- and setting the userlevel

    global GlobalDecisionMap -- the variable that knows userlevel

    on startUp
        GetPaths
    end startUp

    on arrowKey
        beep
    end arrowKey

    on help
        if the optionkey is down then
            go help
            exit help
        else
            click at the location of background button help
        end if
    end help

    on sort
        answer "You can't sort this part of Linnaeus." with "Cancel"
    end sort

-- MENU TRAPS
-- This word traps the menu commands to do Linnaeus functions
-- rather than the standard HyperCard stuff. Most are only
active
-- when the UserLevel is < 5.
on doMenu var -- var contains the text of the chosen menu
command
    global LinnaeusLevel

    -- Disabling dangerous menu commands:
    if LinnaeusLevel < 5 then
        if var = "Next"          or~
        var = "First"          or~
        var = "Last"           or~
        var = "Prev"           or~
        var = "Back"           or~
        var = "Recent"         or~
        var = "New Card"       or~
        var = "Delete Card"    or~
        var = "Paste Card"     or~
        var = "Cut Card"       or~
        then
            StopIt
            exit doMenu
        end if

        pass doMenu
    end if
    pass doMenu -- if command is not in list above, do regular
action
end doMenu
```

```

on WaitClick
  set cursor to hand
  wait until the mouse is down
  wait until the mouse is up
end WaitClick

on GetLinnaeusLevel
  global LinnaeusLevel
  set cursor to watch
  set lockscreen to true
  go card "Index"
  if LinnaeusLevel is empty then
    get card field "Level"
    put it into LinnaeusLevel
    go to card "Intro"
    set lockscreen to false
    put "Click the mouse to continue." into card field "waitmes"
    WaitClick
    if LinnaeusLevel = 1 then hide MenuBar else show menubar
    set the userLevel to LinnaeusLevel
    go to card "Index"
  end if
end GetLinnaeusLevel

```

... Utilities

```

on GetPaths
  global stacks, LinnaeusLevel
  set lockScreen to true
  set lockMessages to true
  if LinnaeusLevel is empty then
    push this card
    go to card "User Preferences" of stack "Home"
    put field "paths" of card "stacks" into stacks
    pop card
  end if
  set lockScreen to false
  set lockMessages to false
end GetPaths

```

```

-- SCRIPT OF BACKGROUND "SPECIES LIST" FROM STACK "LINNAEUS"
-- This is the main on start up script for Linnaeus,
-- and setting the userlevel

```

```

on flashnGo
  global TaxonReturn
  put the short name of the target into thisField
  put getline() into temp
  put line temp of background field thisField into selected
  if selected is empty then exit flashnGo
  if temp≠1
    then get (number of chars in line 1 to temp-1 of bg fld
thisField)+2
  else get 1
  select char it to (it+length of selected) of bg fld thisField
  wait until the mouse is up
  if the mousseloc is not within the rect of bg fld thisField
  then
    if the selection is not empty then select empty
    exit flashnGo
  end if
end flashnGo

```



```

else
  if not (getline()=temp) then
    if the selection is not empty then select empty
    exit flashnGo
  end if
  set cursor to watch
  put line temp of fld thisField into toHere
  if it is empty then exit to HyperCard
  set cursor to watch
  put the long name of this card into TaxonReturn
  visual iris open
  go card toHere in stack "ZooplanktonSpecies"
end if
end flashnGo

function getline
  return ((the mouseV)-(top of the target)+(the scroll of the
target))-
  div (the textheight of the target)+1
end getline

```

-- SCRIPT OF CARD "INDEX" IN STACK "LINNAEUS"

```

on mouseUp
  global CardMap,GlobalDecisionMap,TaxonReturn
  if the target contains "button" then
    set cursor to 4
    get long ID of this card
    put it into TaxonReturn -- remember where you came from
    put empty into cardMap
    put empty into GlobalDecisionMap
    visual effect zoom open
    get short name of the target
    go to it
  end if
end mouseUp

on closeCard
  hide card field "Who?"
  hide card field level
end closeCard

on OpenCard
  global LinnaeusLevel
  get LinnaeusLevel
  if it is empty then exit openCard
  put LinnaeusLevel into card field level
end OpenCard

```

Scripts from the stack "Zooplankton Key"

-- SCRIPT OF STACK "ZOOPLANKTON KEY"

```

on startUp
  getLinnaeusInfo
end startUp

on resume
  getLinnaeusInfo
end resume

```

```

on openStack
  global LinnaeusLevel,GlobalDecisionMap
  getPaths
  getLinnaeusInfo
  put globaldecisionmap into field decisionmap
end openStack

on closeStack
  global LinnaeusExit
  put empty into field "DecisionMap"
  put the long id of this card into LinnaeusExit
  hide background button "Find Next"
end closeStack

on opencard
  global GlobalDecisionMap
  put globaldecisionmap into field decisionmap
end opencard

on closecard
  global GlobalDecisionMap,TaxonReturn
  put empty into field decisionmap
  put long ID of this card into TaxonReturn
end closecard

-- MENU TRAPS
-- This word traps the menu commands to do Linnaeus functions
-- rather than the standard HyperCard stuff. Most are only
active
-- when the UserLevel is < 5.
on doMenu var -- var contains the text of the chosen menu
command
  global LinnaeusLevel

  -- Disabling dangerous menu commands:
  if LinnaeusLevel < 5 then
    if var = "Next"      or~
    var = "First"       or~
    var = "Last"        or~
    var = "Prev"        or~
    var = "Back"        or~
    var = "Recent"      or~
    var = "New Card"    or~
    var = "Delete Card" or~
    var = "Paste Card"  or~
    var = "Cut Card"
  then
    beep
    exit doMenu
  end if

  -- Trapping the Find command from the Menu:
  if var = "Find..." then
    click at the location of background button "Find"
    exit doMenu
  end if

  -- Trapping the Print Commands from the Menu:
  if var = "Print Card" or~
  var = "Print Stack..." or~
  var = "Print Report..."
  then

```

```

    if the optionkey is down then
        doMenu "Page Setup..." else
            click at the location of background button "Print"
        end if
        exit doMenu
    end if

    pass doMenu
end if
pass doMenu -- if command is not in list above, do regular
action
end doMenu

on arrowkey
    global LinnaeusLevel
    if LinnaeusLevel < 5 then
        beep
        exit arrowkey
    end if
    pass arrowkey
end arrowkey

on help
    if the optionkey is down then
        go help
        exit help
    else
        click at the location of background button help
    end if
end help

```

UTILITIES

The word tt is useful if you change the background of the choice cards, ie. if you move the card pictures and therefore have to move one or more of the buttons. Change the number of the button, and the x,y location below to move all buttons in the stack so they are in the same place.

```

on tt
    repeat for number of cards
        choose button tool
        drag from the location of card button "Choice1" to 306,136
        go to next card
    end repeat
end tt

on sortit
    sort by field "Choice1"
end sortit

```

-- SCRIPT OF BACKGROUND "MAIN" OF STACK "ZOOPLANKTON KEY"

```

on newCard
    set the cursor to 4
    set lockscreen to true
    go previous
    choose button tool

```

```

get the location of card button "Choice1"
click at it
doMenu "Copy Button"
go next
doMenu "Paste Button"
put " on mouseup" & return & "Choice1" & return & " end
mouseup" & return into scriptHolder
set the script of card button "Choice1" to scriptHolder
go previous
get the location of card button "Choice2"
click at it
doMenu "Copy Button"
go next
doMenu "Paste Button"
put " on mouseup" & return & "Choice2" & return & " end
mouseup" & return into scriptHolder
set the script of card button "Choice2" to scriptHolder
choose browse tool
set lockscreen to false
end newCard

```

```

on Choice1 -- action for "next" button of choice 1
global GlobalDecisionMap, CardMap
set cursor to 4
set LockScreen to true
put the long id of this card & return after CardMap
put field "Choice1" & return after field "DecisionMap"
put field "DecisionMap" into GlobalDecisionMap
end Choice1

```

```

on Choice2 -- action for "next" button of choice 2
global GlobalDecisionMap, CardMap
set cursor to 4
set LockScreen to true
put the long id of this card & return after CardMap
put field "Choice2" & return after field "DecisionMap"
put field "DecisionMap" into GlobalDecisionMap
end Choice2

```

-- SCRIPT OF BUTTON "EXPORT" OF STACK "ZOOPLANKTON KEY"

```

on mouseUp
answer "Export this key or decision map?" with -
"Map" or "Key" or "Cancel"
if it is empty or it is "Cancel" then exit mouseUp
if it is "map" then exportMap
exportStack
end mouseUp

```

```

on exportMap
global pathName
set cursor to 4
put the visible of the msg into visiBox
put "Exporting text..."
repeat with i = 2 to 2 -- the specific fields to be exported
put field i & tab after temp
end repeat
put return after temp
get the value of word 2 of the long name of this stack
delete last word of it
put it & ".map." & mytime() into textFile
open file textFile

```

```

write temp to file textFile
close file textFile
put empty into the msg
set the visible of the msg to visiBox
exit to HyperCard
end exportMap

on exportStack
global pathName,HFS,textfile
set cursor to busy
put the visible of the msg into visiBox
put return after temp
repeat with i = 1 to the number of cards
    repeat with j = 1 to 2                -- the exported
fields
    set cursor to busy
    put "Reading card" && i
    put field j of card i after temp
    put return after temp                -- return delimited
end repeat
put return after temp                    -- end of record
end repeat
getHFS                                    -- get the path name
put HFS & "Key." & mytime() into textFile
put "Writing to disk..."
open file textFile
write temp to file textFile
close file textFile
put empty into the msg
set the visible of the msg to visiBox
exit to HyperCard
end exportStack

```

Scripts from the stack "Zooplankton Species"

-- SCRIPT OF STACK "ZOOPLANKTON SPECIES"

```

on startUp
getLinnaeusInfo
end startUp

on openStack
global LinnaeusLevel,GlobalDecisionMap
getLinnaeusInfo
put globaldecisionmap into field decisionmap
end openStack

-- CloseStack takes care of the decision map stuff, so the
-- map will be maintained properly whether we go Home
-- or backwards in the key
on closeStack
global GlobalDecisionMap,CardMap,TaxonReturn
put bkgnd field "DecisionMap" into GlobalDecisionMap
delete last line of GlobalDecisionMap
delete last line of CardMap
put empty into bkgnd field "DecisionMap"
hide field "DecisionMap"
hide background button "Find Next"
end closeStack

```

```

on closecard
  HideMap
end closecard

```

Handlers shared by several stacks

```

function collectAllHits text, fieldName
  repeat with i = 1 to 10000 --" large number
    find string text in field fieldName
    if the result is "not found" then
      --couldn't find it at all
      return empty
    else
      --found it at least once
      if i = 1 then
        --first time found
        put the id of this card into firstFind
        put firstFind into result
      else
        --found it some more times
        if the id of this card is firstFind then
          --have come around to first find card
          return result
        else
          --add card id to the result
          put "," & the id of this card after result
        end if
      end if
    end if
    go next card --start looking from next card
    set cursor to busy
  end repeat
end collectAllHits

on GlossaryFind
  global lastFind, findNextList, GlossaryReturn
  get the optionKey
  put it into optionWas

  get long ID of this card
  put it into GlossaryReturn -- remember where you came from

  ask "Text to find" with lastFind
  if it is not empty then
    hide bg btn "Find Next"
    set cursor to busy
    lock screen

    if optionWas is down then
      go to "ZooplanktonGlossary" -- find in glossary, if op
key dwn
    end if

    put collectAllHits(it, "title") into hits
    if hits is empty then
      put it into lastFind
      answer "" & lastFind & "' not found."
      go to glossaryreturn
      unlock screen
    else
      put it into lastFind

```

```

    get item 1 of hits
    go card it
    if the number of items in hits > 1 then
        put "1," & lastFind & "," & hits into findNextList
        show bg btn "Find Next"
    end if
    select empty
    unlock screen
end if
end if
end GlossaryFind

```

```

on findNext
    global findNextList
    lock screen
    put the number of items of findNextList - 2 into max
    put item 1 of findNextList into N
    put item 2 of findNextList into text
    if N = max then
        put 1 into N
    else
        add 1 to N
    end if
    get item N + 2 of findNextList
    hide bg btn "Find Next"
    set cursor to watch
    go it
    show bg btn "Find Next"
    find string text in field "title"
    unlock screen
    put N into item 1 of findNextList
end findNext

```

```

on GetPaths
    global stacks, LinnaeusLevel
    set lockScreen to true
    set lockMessages to true
    if LinnaeusLevel is empty then
        push this card
        go to card "User Preferences" of stack "Home"
        put field "paths" of card "stacks" into stacks
        pop card
    end if
    set lockScreen to false
    set lockMessages to false
end GetPaths

```

```

on getLinnaeusInfo
    global LinnaeusLevel
    if LinnaeusLevel = empty then
        put "Click the mouse to continue"
        set lockScreen to true
        push this card
        go Linnaeus
        pop card
        set userlevel to LinnaeusLevel
        set lockScreen to false
        set lockMessages to false
        hide message
    end if
    if LinnaeusLevel = 1 then hide MenuBar else show menubar
end getLinnaeusInfo

```

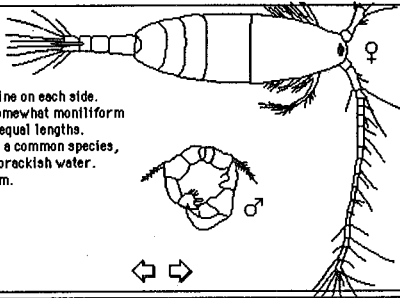
```
function mytime var -- returns the current time with . instead
of :
  put word one of the long time into mytime
  repeat with x=1 to the number of chars in mytime
    if char x of mytime = ":" then
      put "." into char x of mytime
    end if
  end repeat
  return mytime
end mytime
```


Appendix 2 - Linnaeus "Zooplankton" Species Cards

Acartia longiremis*Linnaeus*
Interactive Taxonomy

This copepod has an elongated body with the last thoracic segment bearing a spine on each side. The antennules are somewhat moniliform with setae of very unequal lengths. *Acartia longiremis* is a common species, and is often found in brackish water. Length - 1.1 - 1.2mm.

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Order Copepoda

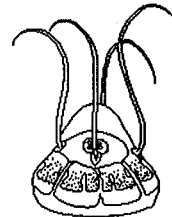


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Aeginopsis laurentii*Linnaeus*
Interactive Taxonomy

This species has a hemispherical or higher bell, 15-25mm wide. It possesses 8 perianth strands 45 degrees apart, projecting from the sides of the bell. The bell margin has 4 deep clefts in the radii of the tentacles and 4 shallow clefts 45 degrees apart from these. Colour is transparent bluish or faint red.

Phylum Cnidaria
Class Hydrozoa
Order Hydroida



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Aglantha digitale*Linnaeus*
Interactive Taxonomy

The Hydromedusae belonging to the suborder Trachymedusae are characterized by a practically hemispherical shape with a thick nematocyst ring, and by gonads usually confined to the margins of the radial canals. Trachymedusae are separated from the Narcomedusae in that the margins of the umbrella are not lobed. There is a large muscular velum. The marginal tentacles are easily detached. Trachymedusae are all oceanic, rarely being found in coastal waters.

Phylum Cnidaria
Class Hydrozoa
Order Hydroida
Suborder Trachymedusae



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Balanus balanoides (larva)*Linnaeus*
Interactive Taxonomy

Larval stages of barnacles are planktonic, while adults are sessile. Cypris larvae are the last larval stage of the barnacles, the preceding stage being the nauplius. Cypris larvae possess a bivalved shell, a compound eye, six pairs of thoracic appendages and a short abdomen. They are brownish in colour. At certain times of the year they may dominate the zooplankton completely. Size - 0.9mm.

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Order Cirripedia

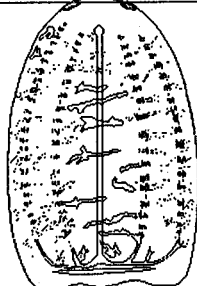


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Berœ cumis*Linnaeus*
Interactive Taxonomy

This species is a ctenophore without tentacles. It has a cylindrical body, which may reach 16mm in length. The mouth is very wide, and the gullet occupies most of the body. The meridional vessels are produced into a complex system of anastomosing branches.

Phylum Ctenophora
Class Nuda

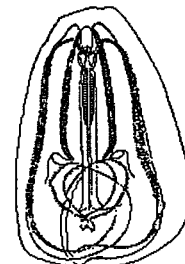


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Bolinopsis infudibulum*Linnaeus*
Interactive Taxonomy

This species is a large transparent ctenophore, without tentacles, up to 150mm long. It has a bilobate structure and is circumpolar in distribution.

Phylum Ctenophora
Class Tentaculata



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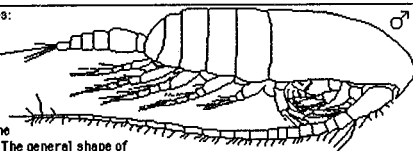
Calanus spp.*Linnaeus*
Interactive Taxonomy

Including the species:
C. finmarchicus
C. glacialis
C. hyperboreus

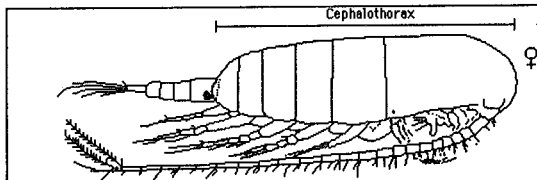
Most useful in identifying this species group are the following criteria: The general shape of the body, five distinct thoracic segments, symmetrical setae or bristles on the furcal rami, antennules longer than the whole body and usually seen trailing back parallel with the body, and very long plumose setae on the borders of the 23th and 24th joints of the antennae.

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Class Copepoda

Note: This species has another card.



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Calanus finmarchicus, glacialis, hyperboreus*Linnaeus*
Interactive Taxonomy

Species may be differentiated by the following criteria:
Calanus finmarchicus: adult cephalothorax length less than 3.1mm
Calanus glacialis: adult cephalothorax length 3.2-4.3mm
Calanus hyperboreus: adult cephalothorax length greater than 4.4mm

Note: This species has another card.

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Carcinus maenas (zoea-larvae)

Linnaeus
Interactive Taxonomy

Zoea-stages of decapoda are characterized by possession of brushes on the outer remi of some or all of the thoracic legs. The pleopods are rudimentary. The zoea-larva of this species has a long dorsal spine.

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Decapoda



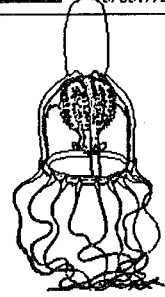
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Cotylema vesicarium

Linnaeus
Interactive Taxonomy

This cnidarian species has a bell of about 25mm in height, with a large apical projections being globular or cylindrical. The walls of the bell are thin. 16 well developed tentacles with flattened basal bulbs are present. 3 rudimentary tentacles are present between each pair of long tentacles. 4 radial tubes are present, along with a large, urn-shaped manubrium. The mouth is surrounded by 4 crenulated lips.

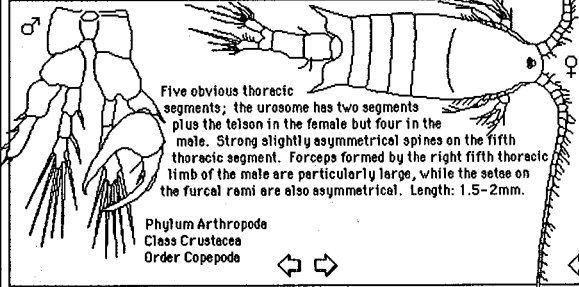
Phylum Cnidaria
Class Hydrozoa
Order Hydroidea



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Centropages sp.

Linnaeus
Interactive Taxonomy



Five obvious thoracic segments; the urosome has two segments plus the telson in the female but four in the male. Strong slightly asymmetrical spines on the fifth thoracic segment. Forceps formed by the right fifth thoracic limb of the male are particularly large, while the setae on the furcal rami are also asymmetrical. Length: 1.5-2mm.

Phylum Arthropoda
Class Crustacea
Order Copepoda



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Class Bivalvia (larvae of)

Linnaeus
Interactive Taxonomy

Eggs of bivalves usually hatch as a trochophore which develops into a bivalved veliger and a veliconcha stage. The size of the larva usually reaches 200-400 µm in length before settling.

Phylum Mollusca
Class Bivalvia



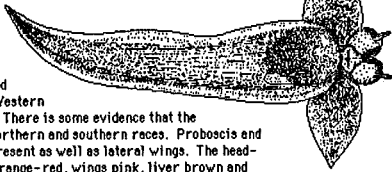
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Clione limacina

Linnaeus
Interactive Taxonomy

C. limacina is an arctic/boreal species with its southern limit at the Bay of Biscay and is found in the North Sea and in Western and South West England. There is some evidence that the species is composed of northern and southern races. Proboscis and paired head-cones are present as well as lateral wings. The head-cones and tentacles are orange-red, wings pink, liver brown and gonad yellow. Southern England specimens are mature at 4-5mm, while Arctic specimens may reach a length of 41mm.

Phylum: Mollusca
Class: Gastropoda
Suborder: Gymnosomata



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Conchoecia elegans

Linnaeus
Interactive Taxonomy

Dorsal margin of the shell is straight and horizontal and the length reaches 1.5-2-5mm. Asymmetrical glands are present on the shell the right valve of which has a postero-dorsal corner produced into a spine with a pair of minute dorsal denticles. Widely distributed species found throughout the North Sea, to the west and south-west of Ireland and to the south of Scotland.

Phylum Arthropoda
Class Crustacea
Subclass Ostracoda



(Drawing after Newell & Newell)



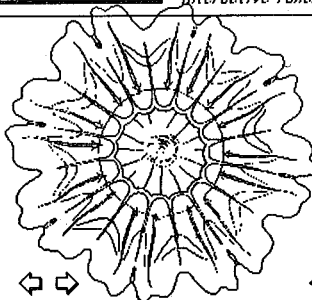
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Cyanea capillata

Linnaeus
Interactive Taxonomy

This cnidarian is seasonally common around the Norwegian coast. It is a large medusae lacking a velum, and usually free-swimming. This species can be easily identified by its red-brown colour and its large size, reaching up to 1m. Several variants are described, one of which is bluish.

Phylum Cnidaria
Class Scyphozoa
Order Semeostomeae



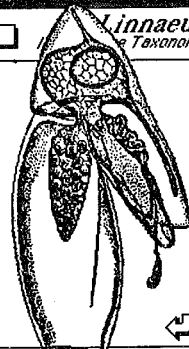
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Diphyes arctica

Linnaeus
Interactive Taxonomy

This cnidarian species consists of polymorphic colonies built up of several kinds of hydroid and medusoid-like zooids. It is found mostly in western waters, although some get transported around Scotland into the northern North Sea.

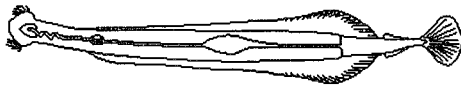
Phylum Cnidaria
Class Hydrozoa
Order Siphonophora



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Eukrohnie hamata

Linnaeus
Interactive Taxonomy



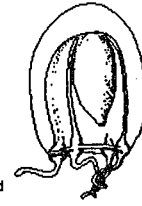
Chaetognaths, or arrow-worms are active, planktonic predators. This species is a cold water chaetognath. It may be distinguished from Sagitta (a species also found in this key) by having on fused lateral fin.

Phylum Chaetognatha
Class Sagittoleida



Euphysa flammea

Linnaeus
Interactive Taxonomy



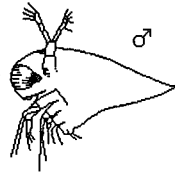
The bell of this cnidarian species is a high oval shape, 12mm high and 7mm wide. The walls of the bell are quite uniform and of moderate thickness. The 4 tentacles have well developed, simple basal bulbs without ocelli. Nematocysts over the distal halves of the tentacles are arranged in prominent, broken rings. Four slender, straight radial canals are present. The manubrium is thick, conical and spindle shaped; only two thirds as long as the depth of the bell cavity. The gonads are ring-like, encircling the manubrium from its base to near the mouth. The stomach and tentacle-bulbs are light fiery-red or orange. Arctic Ocean species.

Phylum Cnidaria
Class Hydrozoa
Order Hydroidea



Evadne nordmanni

Linnaeus
Interactive Taxonomy



The body of this cladoceran is indistinctly jointed and surrounded by a carapace which is elongated and triangular, or oval. The head has a large complex eye. The antennulae are short; antennae are large and biramous. Eggs or embryos are often visible in a large dorsal chamber.

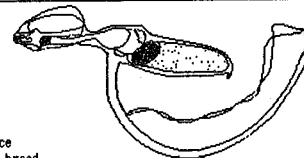
Evadne is distinguished from the species Podon based on the groove demarcating the head from the body in the latter. See the card for Podon.*

Phylum Arthropoda
Class Crustacea
Subclass Ostracoda



Fritillaria borealis

Linnaeus
Interactive Taxonomy



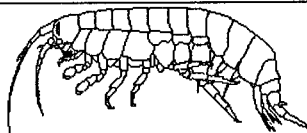
The trunk is long and narrow, being drawn out post-anally to accommodate the testis and ovary. This results in the tail appearing to arise from the mid-ventral surface of the trunk. The tail is short and broad due to the presence of a broad fin. The length of the trunk is approximately 1mm. There are probably 2 sub-species. F. borealis acuta is a cosmopolitan cold-water form found in the polar seas.

Phylum Chordata
Subphylum Urochordata
Class Appendicularia



Gammarus wilkitzki

Linnaeus
Interactive Taxonomy



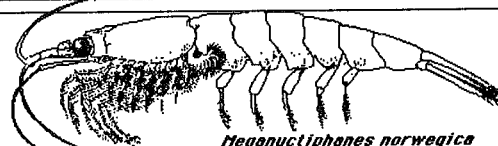
Body laterally compressed, unstalked complex eyes, large antennae. Two pair of legs are gnathopods. Posterior part of body forms an angle with the forepart. Found in northern waters, often associated with sea ice. 25-40mm long.

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Amphipoda
Suborder Gammaridea



Meganctiphanes sp

Linnaeus
Interactive Taxonomy



This is a large krill species 40mm in length. The front end of the carapace has a convex curve, but no rostral spines. A prominent pair of spines occur on each latero-frontal border and a smaller one about halfway along each lateral margin of the carapace. The first antennular segment has a dorsal-backward directed leaflet.

Phylum Arthropoda
Class Crustacea
Order Euphausiacea



Mertensia ovum

Linnaeus
Interactive Taxonomy



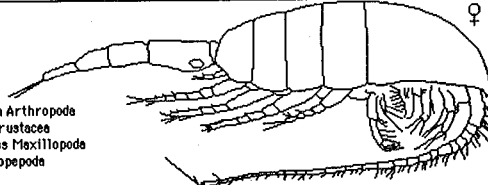
This large, beautiful ctenophore can reach a length of 55mm. The body is compressed, with a ratio of 3:1 in the largest and smallest diameter. The colour of the animal is a faint blue, with a red-violet stomach. The tentacles are very long (up to 1m) and are red. This species has a circumpolar distribution.

Phylum Ctenophora
Class Tentaculata



Metridia sp.

Linnaeus
Interactive Taxonomy



Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Class Copepoda

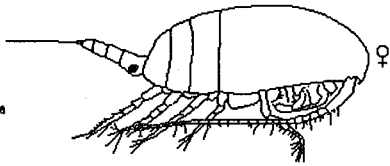
This is a medium-large copepod species (about 4mm) with a strong antennules and a long urosome. The genital segment is long. This species is one of a few copepods known to exhibit bioluminescence. It is a northern species and is quite common. Colour is pale (no red oil drops).



Microcalanus sp.

Linnaeus
Interactive Taxonomy

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Class Copepoda



This species is a small copepod - 0.7-0.9mm in length. It is distinguished by its rather dumpy fore-body and three apparent thoracic segments. It is common in the North Atlantic and Barents Sea.

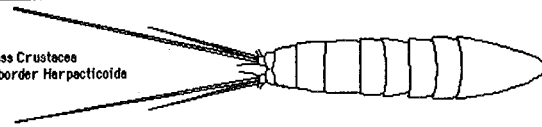


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Microsetella norvegica

Linnaeus
Interactive Taxonomy

Class Crustacea
Suborder Harpacticoida



The body is fusiform and the caudal rami are approximately as long as they are broad. The first segment of the thorax is fused with the head. The setae of the furcal rami are nearly as long as the body but in *M. rosea* they are at least twice the length of the body. *M. norvegica* is a widespread pelagic species occurring in temperate and tropical seas.

(Drawing after Newell & Newell)

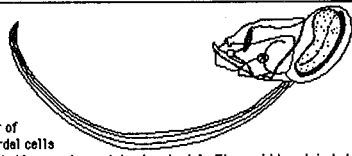


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Oikopleura dioica

Linnaeus
Interactive Taxonomy

A common species that also occurs in estuaries. The tail is narrow, 2-4mm long and about 0.3-0.6mm at its widest point. It bears a pair of characteristic large subchordal cells which are readily distinguishable even in unstained material. The ovoid trunk is between 0.5 and 1.0 mm long and bears either an ovary or a testis posteriorly. Occurs in the northern and southern N. Sea, south and west of Ireland and in the Atlantic, as well as in the English Channel, Bristol Channel and the Irish sea.



(Drawing after Newell & Newell)

Phylum Chordata
Subphylum Urochordata
Class Copeleta

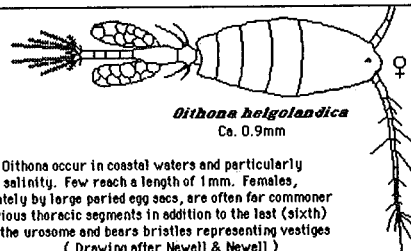


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Oithona sp.

Linnaeus
Interactive Taxonomy

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Class Copepoda
Suborder Cyclopoidea



Oithona belgolandica
Ca. 0.9mm

Several species of *Oithona* occur in coastal waters and particularly in those with reduced salinity. Few reach a length of 1mm. Females, recognizable immediately by large paired egg sacs, are often far commoner than males. Four obvious thoracic segments in addition to the last (sixth) which contributes to the urosome and bears bristles representing vestiges of appendages.

(Drawing after Newell & Newell)



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Oncaea borealis

Linnaeus
Interactive Taxonomy

This copepod has a broad thorax which becomes gradually slender at the posterior end. The antennules are short. Females have a dorsal protuberance on the second thoracic segment, and often have 2 egg sacs. Females are 0.7-1.3mm in length, males 0.8mm.



Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Class Copepoda

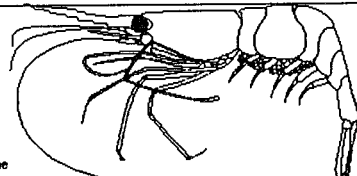


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Pandalus borealis

Linnaeus
Interactive Taxonomy

This shrimp species has a curved rostrum about the same length as the carapace. The colour is red. This is a species that lives on soft-bottoms, thus not an ordinary member of the plankton. Length up to 185mm. *Pandalus borealis* is a cold water species subject to an intensive fishery.



Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Class Decapode

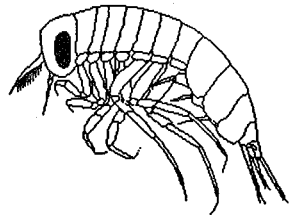


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Parathemisto abyssorum

Linnaeus
Interactive Taxonomy

This species is a dark purple, semitransparent hyperiid amphipod, 9-20mm in length. This species has its main distribution below 200m depth, and is common in the North Atlantic and Barents Sea.



Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Class Amphipoda

Similar Species:
Parathemisto gaudichardi *
Parathemisto libellula *



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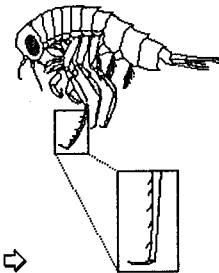
Parathemisto gaudichardi

Linnaeus
Interactive Taxonomy

12-30mm in length

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Class Amphipoda

Similar Species:
Parathemisto abyssorum *
Parathemisto libellula *



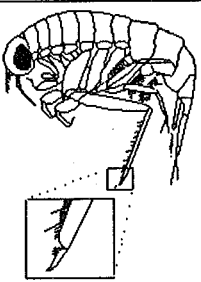
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Parathemisto libellula *Linnaeus Interactive Taxonomy*

This species is a large hypertid amphipod, 40-60mm in length. The prominent eyes are large and purple coloured. This species has a northern distribution and is common in the Barents Sea.

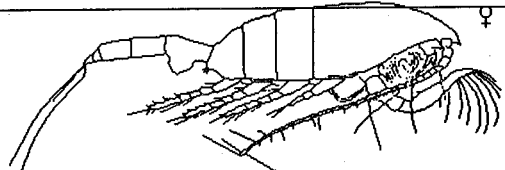
Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Class Amphipoda

Similar species:
Parathemisto gaudichardi *
Parathemisto abyssorum *



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Paranchaeta norwegica *Linnaeus Interactive Taxonomy*



This species is a large, carnivorous copepod, easily recognizable by having brushy maxillae, long setae on the antennules, and long setae on the medial side of the furcal rami. The genital segment has a prominent ventral protrusion. 5.5-11mm in length.

Phylum Arthropoda
Class Crustacea
Order Copepoda

Note: This species has another card.*

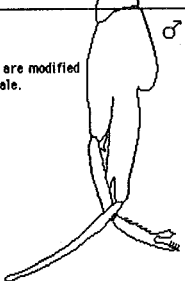
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Paranchaeta norwegica *Linnaeus Interactive Taxonomy*

The females of this species often have large, blue egg sacs. In the males, one of the last pair of thoracic limbs are modified as forceps in transferring the spermatophore to the female.

Phylum Arthropoda
Class Crustacea
Order Copepoda

Note: This species has another card.*




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Podon intermedius *Linnaeus Interactive Taxonomy*

See the card for Evadne.*

Phylum Arthropoda
Class Crustacea
Subclass Ostracoda

(Drawing after Newell & Newell)



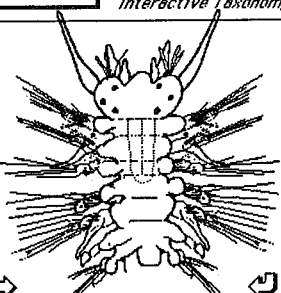
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Polynoid larvae *Linnaeus Interactive Taxonomy*

Lepidonotus sp.

Most adult polychaetes are bottom-dwelling species, while their larval stages are pelagic. The first larval stage is often a trachophora larva. Late stages are similar in appearance to adults, with a segmented body and chaetae.

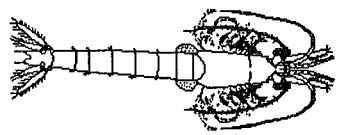
Phylum Annelida
Class Polychaeta



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Praunus flexuosus *Linnaeus Interactive Taxonomy*

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Mysidacea

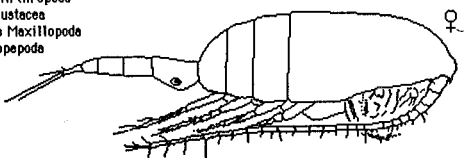


This species is a long, slender mysid with a narrow carapace, a pointed anterolateral region and a rounded rostrum. This species is euryhaline and eurythermic and often swarms in estuaries.

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Pseudocalanus elongatus *Linnaeus Interactive Taxonomy*

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Order Copepoda

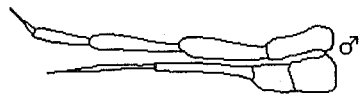


This species is a very common and widespread calanoid copepod, typical of colder waters. The body is cylindrical, without special features, similar to Calanus, but of smaller size (about 1.5mm). The Antennules are shorter than the body. The male of this species has a asymmetrical fifth leg.

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Pseudocalanus elongatus *Linnaeus Interactive Taxonomy*

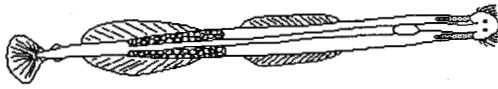
Fifth leg of the male Pseudocalanus elongatus.



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Sagitta elegans

Linnaeus
Interactive Taxonomy



This arrow-worm species is characteristic for mixed oceanic and coastal waters from the North Sea to the Barents Sea. The body has two pairs of lateral fins. The head bears a pair of eyes and a series of curved spines. Maximum size is 25mm.

Phylum Chaetognaths
Class Sagittoidae

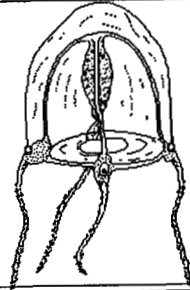


Sarsia eximia

Linnaeus
Interactive Taxonomy

This is the medusa of the hydroid *Syncoryne eximia* and is mainly confined to coastal waters, although widely distributed from April to September around English coasts from the North Sea through the English Channel to S.W. Ireland. It is a fairly large and active medusa even when first liberated from the hydroid stage, finally reaching a height of about 4 mm. The stomach does not extend beyond the margin of the umbrellae and there are no buds formed asexually.

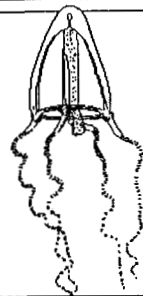
Phylum Cnidaria
Class Hydrozoa
Order Hydroidea



Sarsia princeps

Linnaeus
Interactive Taxonomy

The bell of this cnidarian is thin walled and conical, about 25-40mm high and 15mm wide. This species has 4 tentacles with long basal bulbs. The tentacles are very contractile and 3-4 times as long as the bell height. The manubrium is long and cylindrical, and extends for about one-third of its length beyond the velar opening. Manubrium, gonads and tentacle bulbs are purple, ocelli black. This is a coldwater species, common in the Barents Sea.



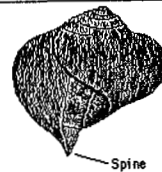
Phylum Cnidaria
Class Hydrozoa
Order Hydroidea



Spiratella helicina

Linnaeus
Interactive Taxonomy

Phylum Mollusca
Class Gastropoda
Suborder Thecosomata



This snail species is specialized for swimming by means of muscular lobes of the foot (parapodia). These lobes are not pictured here, but when swimming, they extend out of the shell. This species has a 5-6mm diameter shell, with a low, non-obvious spine. The colour of the shell is black purple.



Spiratella retroversa

Linnaeus
Interactive Taxonomy

The smallest of the *Spiratella* species and perhaps the most abundant of all pelagic gastropods. The shell, which is sinistrally spiralled, is made up of five whorls and is 2-8 mm long. This species is characteristic of warm Atlantic waters.



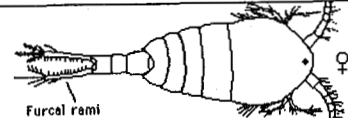
Phylum Mollusca
Class Gastropoda
Suborder Thecosomata



Temora longicornis

Linnaeus
Interactive Taxonomy

Phylum Arthropoda
Class Crustacea
Subclass Maxillopoda
Order Copepoda



This copepod has a pear-shaped body and furcal rami long, but bearing only short setae. It is a common North Sea species and is also found in coastal waters. The fifth leg of the male bears a claw. Length - 1.0-1.5mm



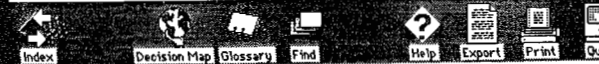
Thysanoessa inermis

Linnaeus
Interactive Taxonomy



This species is the most common krill in the Barents Sea. Length about 30mm. The eyes are subspherical, and slightly higher than broad. The last abdominal segment bears a spine dorsally near the distal end.

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Euphausiacea



Thysanoessa longicaudata

Linnaeus
Interactive Taxonomy



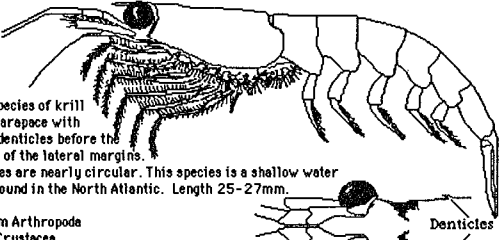
A feature characteristic for this species is the long and stout second pair of legs. The last abdominal segment is equal to or shorter than the combined lengths of the two preceding ones. The eyes are bilobate with a marked transverse constriction in the upper part. This is an oceanic species found in the North Atlantic and Barents Sea. Length 16mm.

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Euphausiacea



Thysanoressa raschii

Linnaeus
Interactive Taxonomy



This species of krill has a carapace with small denticles before the middle of the lateral margins. The eyes are nearly circular. This species is a shallow water form found in the North Atlantic. Length 25-27mm.

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Order Euphausiacea

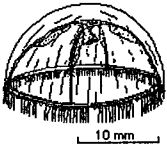
Denticles

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Tiaropsis multicirrata

Linnaeus
Interactive Taxonomy

Phylum Cnidaria
Class Hydrozoa
Suborder Leptomedusae



This is a northern species occurring in the North Atlantic and in Arctic waters and in the northern North Atlantic. The bell reaches 20mm in diameter and bears 4 radial canals with gonads developed along their central region. There are up to 300 marginal tentacles and eight marginal vesicles. Each vesicle has a pigmented ocellus which distinguishes this medusa from other leptomedusae.

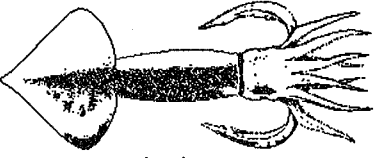
10 mm

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Todarodes sagittatus

Linnaeus
Interactive Taxonomy

This species is a squid with a slender, torpedo-like body with two triangular fins posteriorly. 10 tentacles of which 8 have equal length and 2 are longer than the others. Maximum length 1.5m, weight 15kg.



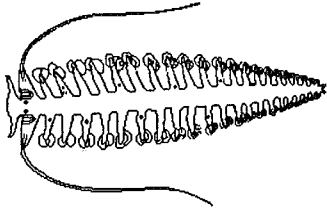
Phylum Mollusca
Class Cephalopoda
Order Decapoda

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Tomopteris septentrionalis

Linnaeus
Interactive Taxonomy

This species is a characteristic, transparent, holoplanktonic polychaete with broad paddle-like appendages.



Phylum Annelida
Class Polychaeta
Order Errantia

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Appendix 3 - Linnaeus "Zooplankton" Key

01b. Body not segmented. -> 03

01a. Body segmented. -> 02

02b. Not typically worm-like. Body covered by a more or less rigid exoskeleton, consisting of chitinous plates (segments) connected by flexible joints. In some cases most of the animal may be hidden between two plates. Phylum Arthropoda. -> 08

02a. Body worm-like, divided externally into a number of rings, typically bearing muscular processes with bundles of bristles. Mostly bottom living, larvae pelagic. Phylum Annelida. -> 07

03b. Body not gelatinous. -> 05

03a. Body gelatinous and transparent, colourless or sometimes lightly coloured. Shape roundish. -> 04

04b. Radial symmetry with bellshaped or diskshaped body. Nemotocysts (stinging cells) in ectoderm. Underside of body with a varying number of tentacles. Phylum Cnidaria. -> 32

04a. Bilaterally symmetrical with flattened, roundish, ellipsoidal body, surrounded by eight rows of ciliated plates (combs) for the purpose of locomotion and food collection. Phylum Ctenophora. -> 38

05b. Shell lacking. -> 06

05a. Body covered by thin twisted shell, 2 lateral shells (shells sometimes not visible). Locomotion by flattened wing-like structures. Phylum Mollusca. -> 40

06b. Body elongated or round, brownish with a transparent ribbonlike tail. Phylum Chordata. -> 31

06a. Body transparent or semitransparent, elongated and with practically invisible fins along body and at tail. Strong visible jaws. Phylum Chaetognatha. -> 27

07b. Body with bristles. -> Polynoid larvae

07a. Parapodia are paddle-like and lacking bristles. -> Tomopteris septentrionalis

08b. Body lacking a carapace. -> 17

08a. Body with a carapace. -> 09

09b. Carapace otherwise. -> 12

09a. Body with a bivalved carapace. -> 10

10b. Carapace fused to two or more thoracic segments, leaving the head free. Hinge not present. 4-6 trunk appendages. A single compound eye. Dorsal cavity serving as brood pouch for eggs. Large antenna with plumose bristles as main locomotory organ. Order Cladocera. -> Evadne nordmanni

10a. Carapace with a hinge and adductor muscle and enclosing the entire animal. Body unsegmented or indistinctly segmented. -> 11

11b. Dorsal margin of carapace curved, 6 trunk appendages. One compound eye. Cypris stage of barnacles. Order Cirripedia. -> Balanus balanoides

11a. Dorsal margin of carapace is straight, body 1.5-2-5mm. No more than 4 trunk appendages. Second antenna strong swimming organ. A simple median nauplius eye present. Subclass Ostracoda. -> Conchoecia elegans

12b. Animal otherwise -> 13

12a. First three pairs of the eight thoracic limbs are modified to form maxillipeds. Long antennula, prominent rostrum, flexed abdomen. Larvae of decapods form a very diverse group of plankton, some recognizable by presence of long spines. Order Decapoda. -> Carcinus maenas (larvae)

13b. Carapace fused with all thoracic segments dorsally. Biramous, unspecialized thoracic limbs. Light organs at the base of some thoracic limbs, and on ventral side of the first four abdominal segments. Order Euphausiacea. -> 14

13a. Carapace covering most of the thorax, fused with first 3 segments. Stalked eyes, statocyst in each endopodite of the uropod. Biramous thoracic limbs, first pair specialized as maxillipeds. Order Mysidacea. -> Praunus flexosis

14b. Ventral margin of carapace without spines. -> 16

14a. Ventral margin of carapace with a small spine. -> 15

15b. Without reflexed leaflet on first antennular segment. Eyes nearly spherical. -> Thysanoessa raschii

15a. First antennular segment with a reflexed leaflet. Large species, up to 50mm in length. ->

Meganyctiphanes norvegica

16b. Second thoracic leg not elongate and thickened. Last abdominal segment with dorsal spine. -> *Thysanoessa inermis*

16a. Second pair of thoracic limbs elongate and thickened. Eyes distinctly bilobate. -> *Thysanoessa longicaudata*

17b. Body laterally compressed. Abdominal appendages present. First thoracic limbs are modified to maxillipeds, second and third thoracic limbs modified to gnathopod (prehensile organs). Eyes complex. Order Amphipoda. -> 29

17a. Body elongated and distinctly segmented. Divisible into head, thorax and abdomen. Head and thorax merging smoothly into the cephalothorax. Abdomen tail-like and without appendages, but provided with a pair of caudal styles. Thorax with 5-6 pairs of limbs, the last 4 (5) biramous. Antennula well developed for swimming. Paired eyes absent. Order Copepoda. -> 18

18b. 3 or 4 segments present behind the head. -> 20

18a. 5 segments present behind the head. -> 19

19b. Body with marked shoulders and a rather truncate anterior end. End of metasome produced into points, asymmetrical in males. Front of head pointed. Long antennae. -> *Centropages* sp.

19a. Body parallel-sided and sausage shaped. Right and left antennules alike in both sexes. Large copepod, about 4mm long. Two long plumose setae at the end of the antennules. Abdomen in the male with five segments, and the first segment of the antennules are prolonged and thickened. -> *Calanus* sp.

20b. 4 segments present behind the head. -> 21

20a. 3 segments present behind the head. -> 26

21b. Adult length greater than 2.5mm. -> 25

21a. Adult length 0.7-1.5mm. -> 22

22b. Body broader at the anterior end than at the posterior end. The caudal furcae are long and narrow. Suborder Calanoida. -> *Temora* sp.

22a. Body broader at the centre than at either end. -> 23

23b. Urosome otherwise. -> 24

23a. Urosome about half the length of the metasome. Prominent black eye. Setae on caudal rami spread out in a fan shape. -> *Acartia longiremis*

24b. Back part of the animal slim, the second thoracic segment has a hump on the dorsal side. Adult length 0.7-1.3mm. -> *Oncaea* sp.

24a. Small, transparent copepod with setae on the last segment of the urosome. Adult length about 0.9mm. -> *Oithona* sp.

25b. Toothed antennules. Abdomen in the male consists of five segments. Adult length up to 4.3mm. -> *Metridia* sp.

25a. Body terminating in a acute rostrum. Adult length about 5mm. Maxillipeds projecting. One of the setae on the caudal furcae is as long as the body. Compound bristles on the tail. -> *Parenchaeta norwegica*

26b. Body otherwise. -> 28

26a. Body fusiform, caudal rami are approximately as long as they are broad and cephalothorax is not wider than the abdomen. There is no natural division between the cephalothorax and abdomen. Adult length usually less than 1mm. -> *Microsetella*

27b. 2 pairs of lateral fins. Eyes visible. -> *Sagitta elegans*

27a. Body with one pair of elongated lateral fins. Eyes unpigmented. Length to 45mm. -> *Eukrohnia hamata*

28b. Body twice as long as broad. Adult length about 0.5mm. -> *Microcalanus* sp.

28a. Female with 4 pair of legs. The fifth pair of legs in the male is assymetric. Adult length: 1.1-1.6mm. -> *Pseudocalanus elongatus*

29b. Eyes large, covering most of the head. Family Hyperiididae. -> 30

29a. Eyes small, covering only a minor part of the head. Family Gammaridae. -> *Gammarus wilkitzki*

30b. Thoracic limbs five to seven of approximately the same length. Dark purple coloured, length 9-20mm. -> *Parathemisto libellula*

30a. The fifth thoracic leg distinctly longer than the sixth and seventh leg. The seventh segment of the fifth leg with small spines. Purple coloured, length 45-60mm. -> *Parathemisto abyssorum*

31b. Trunk long and narrow, being drawing out post-anally to accomodate the testis and ovary. Length of trunk 1mm. -> *Fritillaria borealis*

31a. Trunk ovoid, length to 2.4mm. Numerous large subchordal cells near the tip of the tail. -> *Oikopleura dioica*

32b. Both sessile - hydroid - and planktonic -medusa - stages known. -> 33

32a. Holoplanktonic hydrozoans of polymorphic colonies built up of several kinds of hydroids and medusoid-like zooids. (Intact colonies not found in net-samples). Class Hydrozoa, Order Siphonophora. -> *Diphyes arctica*

33b. Medusae with velum which partly closes the marginal opening of the bell. Class Hydrozoa. -> 34

33a. Mostly large, thick-walled medusa without velum. Tentacle-like entodermal filaments upon the subumbrella-floor of the stomach cavity: True jellyfishes. Class Scyphozoa. -> *Cyanea capillata*

34b. More than 4 tentacles present. -> 35

34a. 4 tentacles present. -> 36

35b. 16 well-developed tentacles 2-4 times the length of the bell when extended, and 48 short tentacles. Bell 25mm high, 12mm wide, with a large solid apical projection. Gonads swollen with transverse folds and corrugations. Manubrium and tentacular-bulbs cinnamon-brown, gonads somewhat darker. Ocelli dark red. -> *Catablema vesicarium*

35a. 200-300 short tentacles. Bell 20-30mm wide, 10-15mm high, thick gelatinous walls, 8 marginal sense organs (ocelli). Colour of gonads, stomach and bell-margin dull yellow, ocelli and tentacle-bulbs red. -> *Tiaropsis multicirrata*

36b. Bell elongated, conical or oval. Tentacles at the margin of the bell. -> 37

36a. Bell hemispherical, 15-25mm wide. Tentacles project from the sides of the bell with length 1-2 times that of the bell diameter. Colour translucent bluish or faint red. -> *Ageinopsis laurentii*

37b. Bell oval, 12mm high, 7mm wide. Tentacle bulbs without ocelli. Manubrium thick, conical 2/3 as long as bell cavity. Stomach and tentacle bulbs light fiery-red or orange. -> *Euphysa flammea*

37a. Bell conical with an apical projection, 25-40mm high, 15mm wide. Tentacles long (3-4 times the bell height) and contractile, with clusters of nematocysts. Manubrium long, protruding 1/3 of its length below the velar opening. Tentacle-bulbs and manubrium purple, ocelli black. -> *Sarsia princeps*

38b. Tentacles are present. Subclass Tentaculata. -> 39

38a. Body naked without tentacles. Mouth opening large, gullet occupies the greater part of the interior of the body. Grows up to 16cm in length. Subclass Nuda. -> *Berøe cucumis*

39b. Numerous non-retractile, lateral tentacles contained in a groove. Body compressed in the lateral plane, and is produced into two large oral lobes. -> *Bolinopsis infudibulum*

39a. Two tentacles, retractile into sheaths. Body laterally compressed. Up to 55mm in length. -> *Mertensia ovum*

40b. Body with shell. -> 42

40a. Body without external shell. -> 41

41b. Body elongated and semitransparent, orange-red at head and tail. Foot is drawn out into lobes by which the animal swims. Total length ca. 4 cm. Class gastropoda, suborder Gymnosomata. -> *Clione lemacina*

41a. 8-10 tentacles. Well developed eyes. Class Cephalopoda. -> *Todarodes sagittatus*

42b. Body enclosed within two oval shells. -> Class Bivalvia (larvae of).

42a. Body enclosed within a thin, twisted shell. Lateral lobes of the body are used for swimming. Colour blueish-brown. Class Gastropoda, Suborder Thecosomata. -> 43

43b. Shell up to 5mm long, spine more flattened. -> *Spiratella helicina*

43a. Shell up to 2.8mm long and with five whorls, spine of whorls elongated. -> *Spiratella retroversa*