AusCPR Survey Newsletter

An update from the Australian Continuous Plankton (AusCPR) Recorder Survey

Australian Continuous Plankton Recorder Survey (AusCPR)

The Australian Continuous Plankton Recorder (AusCPR) survey measures plankton communities as a guide to the health of Australia's oceans. It is part of the Ships of Opportunity (SOOP) Facility in Australia's Integrated Marine Observing System (IMOS) and is jointly operated by CSIRO Marine and Atmospheric Research (CMAR) and the Australian Antarctic Division (AAD). The aims of the survey are to:

- *map phytoplankton and zooplankton biodiversity and distribution*
- *develop the first long-term zooplankton baseline for Australian waters*
- *document plankton changes in response to climate change*
- *provide indices for fisheries management*
- *detect harmful algal blooms*
- *validate satellite remote sensing*
- *initialise and test ecosystem models*

Table of Contents

A note from the AusCPR project directors…

Anthony J. Richardson (CSIRO/UQ) and Graham Hosie (AAD)

Thanks for taking the time to browse through our first newsletter, which will hopefully be one of many. The motivation for this 6-monthly newsletter is to give people more information about what the AusCPR survey is, what we do, and what we have found. This newsletter will hopefully encourage more people to use the plankton data freely available through IMOS (http://imos.aodn.org.au/webportal/) and stimulate collaborations.

First of all we would like to introduce the members of the CPR Team. Photos of staff and a summary of their roles are given on Page 2. AusCPR is jointly led by Anthony J. Richardson (CSIRO/UQ) and Graham Hosie (AAD). Other members of the Team are Frank Coman, Claire Davies, James McLaughlin, Dave McLeod, Anita Slotwinski, Joanna Strzelecki and Mark Tonks. A big thanks to our dedicated and highly skilled Team.

The survey is simultaneously entering a consolidation and an expansion phase. Ongoing routes Brisbane-Sydney and Sydney-Melbourne routes have been operating since mid-2009 and are now bedded down. Our Southern Ocean routes, operated in conjunction with SO-CPR have been in operation for many years. In the Southern Ocean, AusCPR works with the SO-CPR survey, which has been run for the past 20 years by the AAD, to count phytoplankton and zooplankton on selected Antarctic tow routes. Together with the AAD CPR tows, AusCPR contributes to the international SCAR Southern Ocean CPR Survey. This provides access to plankton data beyond Australia helping to understand observed changes in a wider regional and global context.

New routes that have only recently started include the Melbourne-Adelaide route, the Southern Tasman Sea route (Tasmania to NZ), and the east coast of Tasmania route (aboard the Southern Surveyor). Future routes, pending successful negotiation with shipping companies, include the Central Tasman Sea (in conjunction with Rudy Kloser (CSIRO) doing hydro-acoustics), the Great Barrier Reef lagoon, and WA. The expansion of the survey brings challenges associated with logistics, identification of plankton from new regions, and total workload. We are addressing these challenges in a number of ways including:

- ongoing training in phytoplankton and zooplankton identification
- a team environment where taxonomic difficulties are regularly discussed
- a network of collaborating taxonomists
- additional members (Mark Tonks in Brisbane; James McLaughlin and Joanna Strzelecki in a new AusCPR lab in Perth)
- setting a maximum of 50% of time doing microscopic analysis
- enhanced ergonomic features and procedures (see pages 9 and 10)

Finally, we hope that the AusCPR newsletter highlights the great work that the Team is doing and the potential opportunities for scientific research and ecosystem health assessments afforded by the dataset. We would like to thank Anita Slotwinski for putting this newsletter together.

Above: Zooplankton from East Tasmanian waters (from left) a medusa, copepod and larval decapod (Images: A.Slotwinski).

AusCPR survey would like to thank…

*We appreciate the extensive support of many people and would like to highlight a few here (apologies to the many others who we do not have space to mention by name). We thank the shipping company **ANL** for towing CPRs aboard the **ANL Windarra** on the Brisbane-Sydney, Sydney-Melbourne, and Melbourne-Adelaide routes. We also thank the fishing companies **Australian Longline** and **NZ SeaLord** for towing the CPR aboard the **RV Rehua** from Devonport (Tasmania) to Nelson (New Zealand). These companies have been extremely helpful and willing to support scientific research. We thank **Rudy Kloser** and **Tim Ryan** for the collaborative and logistical efforts for this route where we collected phytoplankton and zooplankton and hydro-acoustics for fish and squid on the fishing vessel. We would also like to express our appreciation to the members of the SO-CPR consortium and the Captains and crew who tow the CPR in the Southern Ocean. Also to **Iain Suthers**, **Kerrie Swadling**, **Tom Trull** and **Anya Waite** for towing CPRs on training cruises. We thank **Gustaaf Hallegraeff**, **Tony John** and **Pru Bonham** for training in phytoplankton identification. **Gustaaf** has imbued our survey with his infectious excitement! We thank **Janet Bradford-Grieve**, **Dave Conway**, **Mark Gibbons**, **Dave McKinnon** and **Ruth Böttger-Schnack** for their training in zooplankton identification. We would also like to thank **Iain Suthers** and his students for their support of the NSW routes, and **Kerrie Swadling** and **Peter Thompson** for their support of the Tasmanian routes (and Peter for his expert instrumentation advice). Also a huge thanks to **Steven Edgar** and **Margaret Miller** for helping us to develop a fantastic database. And finally to **Ken Ridgway** and **Tim Moltmann** for their ongoing support of the Survey.*

Australian Government
Department of Innovation, Industry, Science and Research

CSIRO

Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division

The Team

Anthony Richardson

Position: Joint Leader AusCPR
Location: CSIRO, Brisbane, Queensland

I co-manage the AusCPR project, I help secure funding, guide research directions, develop relationships with other plankton surveys, and support and develop AusCPR staff. My research interests are marine climate change ecology, plankton ecology, pelagic ecosystem dynamics, and ecosystem modelling. In my spare time I love to spend time with my family.

Graham Hosie

Position: Joint Leader AusCPR
Location: AAD, Hobart, Tasmania

I co-lead AusCPR and lead the SCAR Southern Ocean CPR (SO-CPR survey). I set research directions, manage resources, develop relationships with other surveys and provide training and instruction. My research interests are community ecology of Southern Ocean plankton, krill ecology, Antarctic marine ecosystem dynamics, impacts of global change on marine biodiversity, biogeography, and building international research collaborations.

Frank Coman

Position: Deputy Leader AusCPR
Location: CSIRO, Brisbane, Queensland

My role involves liaising with ships that tow the CPR, the management of the North Stradbroke Island NRS sampling, zooplankton sorting of IMOS NRS samples, and plankton analysis of AusCPR samples. I am interested in plankton biology and ecology, climate change impacts on marine ecosystems and aquaculture. In my spare time I play sport, enjoy fishing, camping and photographing Australian wildlife.

Claire Davies

Position: Plankton Biologist
Location: CSIRO, Brisbane, Queensland

My job includes identifying and counting zooplankton samples from the NRS, and counting phytoplankton and zooplankton for AusCPR samples. I also manage the NRS and AusCPR databases, and am a boat driver for SE NRS sampling. My research interests include plankton ecology, climate change impacts and the feeding dynamics between zooplankton and megafauna. In my spare time I spend as much time in and out of the water as possible.

Anita Slotwinski

Position: Plankton Biologist
Location: CSIRO, Brisbane, Queensland

I analyse zooplankton samples from the NRS network and phyto- and zooplankton samples from AusCPR. I also manage the project website, communication materials, and the zooplankton species reference collection. My research interests are in marine plankton ecology, environmental change and species response, plankton taxonomy, photomicroscopy, and development of taxonomic guides for zooplankton. In my spare time I like to spend time with family and friends, cook, read and experiment with photography, art and design.

Mark Tonks

Position: Plankton Biologist
Location: CSIRO, Brisbane, Queensland

My tasks include counting zooplankton from the NRS network, phyto- and zooplankton identification of AusCPR samples, and management of project procedure manuals. I have worked for CSIRO for 19 years and spend 60% of my time working on plankton. My research interests include plankton ecology, bycatch sustainability and fish and crustacean ecology. I also enjoy playing a variety of sports including hockey, touch football and cricket.

Dave McLeod

Position: Plankton Biologist (CSIRO)
Location: AAD, Hobart, Tasmania

I analyse Southern Ocean CPR samples for both phytoplankton and zooplankton, contribute to publications, and help with various operational AusCPR project tasks. My research interests include plankton as indicators of ecosystem change and impacts of Southern ocean zooplankton populations on higher trophic levels. In my spare time I like to get outside and go fishing and camping, play and watch sport, and have BBQs with friends.

Joanna Strzelecki

Position: Marine Biologist
Location CSIRO, Floreat, Western Australia

I am helping to expand the AusCPR survey into WA waters and will be responsible for the analyses of phyto- and zooplankton samples and various operational tasks. I have been with CSIRO for 8 years and work 30% of my time with AusCPR. My research interests include plankton ecology, food web dynamics, benthic-pelagic coupling, and the settlement and recruitment of marine invertebrate larvae. In my spare time I love to travel.

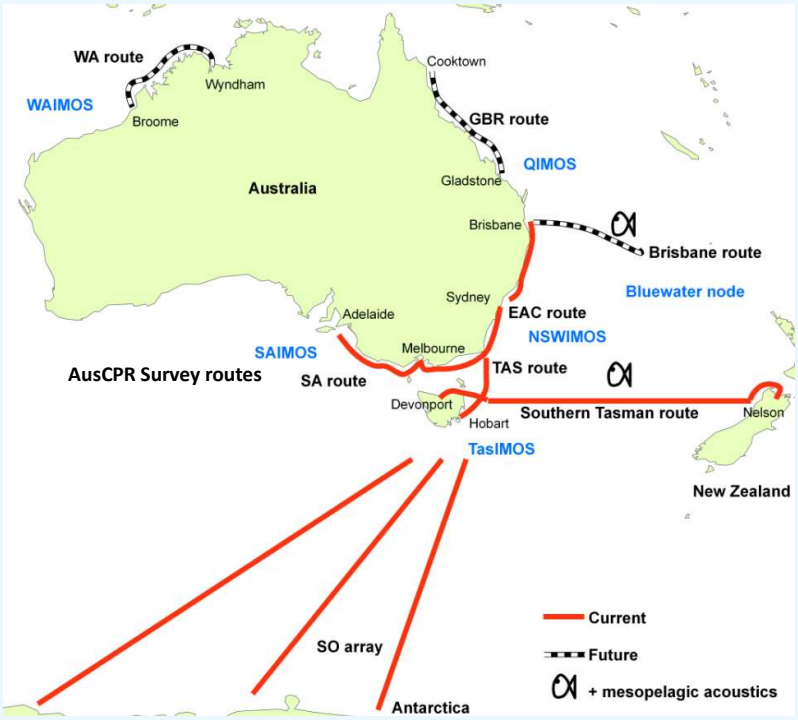
James McLaughlin

Position: Marine Biologist/ Biogeochemist
Location: CSIRO, Floreat, Western Australia

My job is helping to expand the survey into WA waters and the analysis of phyto- and zooplankton samples. I have been with CSIRO for 5 years and work 10% of my time with AusCPR. My research interests include marine phytoplankton dynamics and ecology, benthic and pelagic primary production, and ocean acidification. I enjoy spending time with my family, travelling and keeping tropical aquarium fish.

Survey update

Route	Towed since	Vessel	Frequency
Brisbane - Sydney	Jun 2009	ANL *Windarra*	2 monthly
Sydney - Melbourne	Jun 2009	ANL *Windarra*	2 monthly
Melbourne - Adelaide	Sep 2010	ANL *Windarra*	2 monthly
Tasmania - New Zealand	Aug 2010	FV *Rehua*	annual
Tasmania - Antarctica	Nov 2008	RSV *Aurora Australis*	spring to autumn
Tasmanian East Coast	Sep 2010	*Southern Surveyor*	ad hoc



Above: A map of current and proposed AusCPR routes.

Above: The ANL Windarra (Image: Les Blair www.marinetraffic.com).

Above: The FV Rehua (Image www.action-engineering.co.nz).

Above: The RV Southern Surveyor (Image: Edwina Hollander, CSIRO www.scienceimage.csiro.au).

Above: The RSV Aurora Australis (Image: AAD).

Plankton data update

Route	Brisbane - Sydney	Sydney – Melbourne	Australia – Antarctica*
total distance towed (nm)	3484	3638	6827
total tows processed	7	8	6
phytoplankton colour segments processed	1419	1956	1115
phytoplankton segments processed	360	498	983
zooplankton segments processed	360	495	1115
total phytoplankton taxa	70	71	73
total zooplankton taxa	258	287	164

** This is a part of 30,000 data records (150,000 nmiles) for 228 zooplankton and 73 protistan taxa available from the SO-CPR survey that has been operating for the past 20 years.*

AusCPR and NRS data are available free of charge at http://imos.aodn.org.au/webportal/.

Visit http://imos.org.au/emii.html for information on data use.

Did you know IMOS run regular 'Data User Workshops'? Workshops are free of charge and potential data users participate in hands-on sessions that examine examples using a number of data tools that illustrate data in different ways.

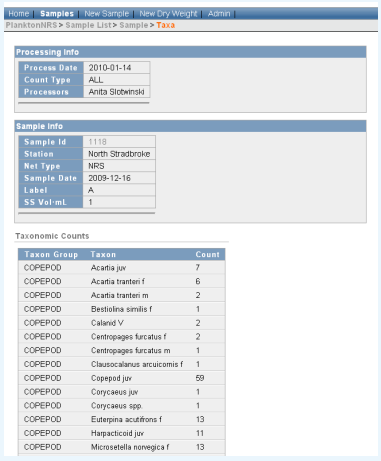
Visit http://imos.org.au/data_user_workshops.html for more information.

Update from Brisbane, Queensland

The AusCPR team was lucky enough to have Dr Ruth Böttger-Schnack visit the Brisbane labs in August 2010. Ruth is based in Germany and is the world expert in the taxonomy of the Oncaeidae family of copepods. The Oncaeidae are widely distributed, occurring at all depths across the globe. They can be found in tropical seas right across to sea-ice habitats, and are even associated with hydrothermal vents. It is not uncommon for species new to science to still be found in the deep ocean. Oncaeids are very difficult to identify due to their small size and only minute variations between females of the different species. Males are near impossible to identify as they are even smaller than females and basically all look very much the same (at least to us humans, probably not to the females!). Ruth was able to help the team confirm over 25 species in our Australian samples and as a result we have been able to increase the resolution of our Oncaea species identifications and hence the quality of our data.

Right: A female Oncaeidae with egg sac from east Australian waters (Image: A.Slotwinski).

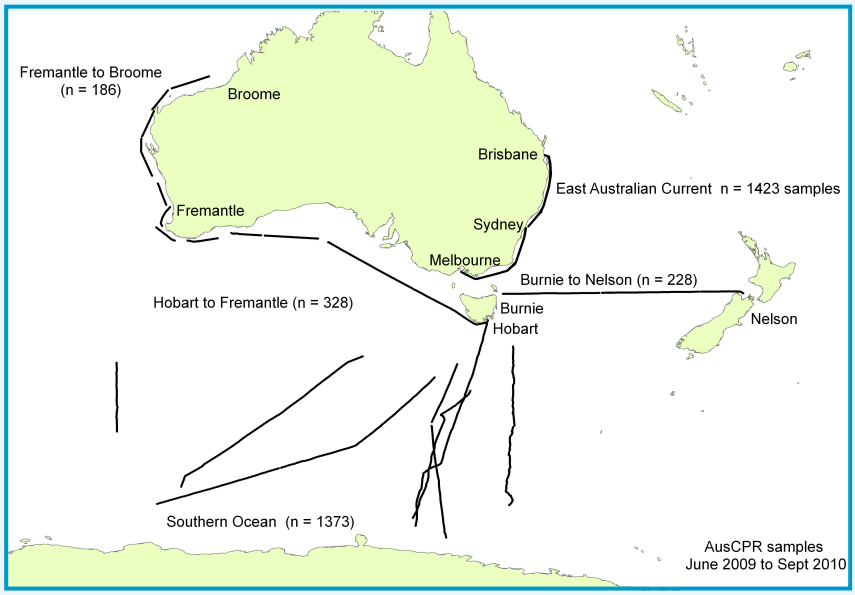
Other exciting news includes our fantastic new plankton database that has been developed for the AusCPR and NRS projects. AusCPR and NRS plankton data are stored in an oracle database which was built with the help of CSIRO data centre's, Steve Edgar and Margaret Miller from CSIRO. The team can now enter their plankton data immediately after counting whether they are based at the Brisbane, Hobart or Perth labs. The database is fast, easy to use and can produce a range of interesting outputs and maps. The database allows us to export data automatically to EMII, manipulate data easily, and maintain data integrity. We also have a data entry Apex interface, which allows for ease of input and vigorous quality control of the data.



Left: Screen shot of the database showing part of a plankton count for a North Stradbroke Island sample.

Below: A map showing all the plankton data collected by the AusCPR survey as of October 2010.

In terms of our analysis, zooplankton and phytoplankton counts have been completed for the silks collected from the ANL Windarra until June 2010. For all samples, including those from August when the tow was extended to Adelaide, the Phytoplankton Colour Index (PCI) has been completed. PCI has also been completed for the tow from Burnie (Tasmania) to Nelson in NZ, while the samples collected from the Southern Surveyor in April, between Fremantle and Broome (an *ad hoc* training cruise), will be used for training our new staff in Perth. Over the past couple of months, zooplankton samples have arrived from 6 of the National Reference Station sites and we are currently counting these to get up to date as soon as possible. Claire has also been counting samples collected from the Maldives as part of a manta ray research project.



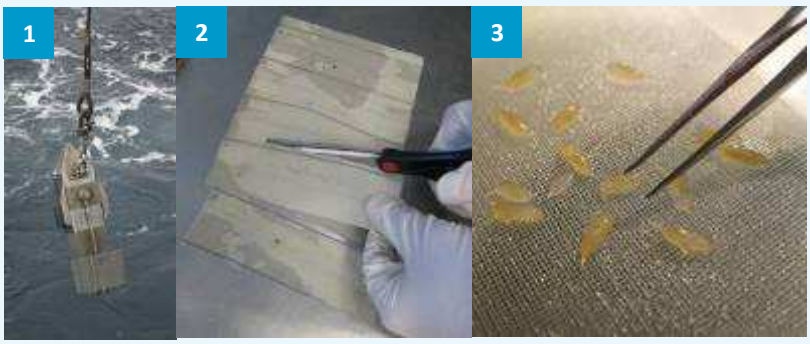
AusCPR Methodology: How do we collect our data?

1. The CPR is towed 100 metres behind the ship at about 10 metres water depth. It is towed for about 400 nautical miles per 'tow' and plankton is trapped between layers of silk in an internal cassette.

2. The internal CPR cassette is returned to the lab within a few days of towing and the silk samples are unrolled and cut into segments.

3. Silk segments are analysed for phyto- and zooplankton.

If you are interested to learn more about the methodology please visit our website http://imos.org.au/auscpr.html



Note: The methods used by AusCPR are a combination of SAHFOS and SO-CPR methodology. For further information go to http://www.sahfos.ac.uk/about-us/cpr-survey/the-cpr-survey.aspx and http://data.aad.gov.au/aadc/cpr/

Update from Brisbane, Queensland…continued

These species lists are a record of all the phyto- and zooplankton species we have identified (as of September 2010) from the AusCPR Brisbane to Melbourne route. The species are listed in **decreasing total abundance**.

Phytoplankton Species (Plants) Brisbane - Melbourne

Thalassiosira spp.
Fungal hyphae (non-phytoplankton)
Aspergillus sydowii
Climacodium frauenfeldianum
Ceratium vultur
Unknown gold balls
Chaetoceros (Hyalochaete)
Nematocysts
Ceratium spp.
Rhizosolenia spp.
Guinardia spp.
Silicoflagellate 4 points
Silicoflagellate
Navicula-shaped
Sagenoarium spp.
Silicoflagellate 6 points
Unknown spikey balls
Paralia sulcata
Proboscia spp.
Trichodesmium spp.
Ceratium furca
Dactyliosolen spp.
Radiolarian spp.
Noctiluca scintillans
Coscinodiscus spp.
Ceratium macroceros
Foraminifera (zooplankton)
Ceratium trichoceros
Ceratium lunular
Ceratium fusus
Lauderia spp.
Ceratium carriense
Thalassionema spp.
Hemiaulus spp.
Bacteriastrum spp.
Rhizosolenia setigera
Ceratium longipes
Cerataulina spp.
Ceratium hexacanthum
Scrippsiella spp.
Chaetoceros (Phaoceros)
Fragilaria spp.
Corethron spp.
Diatom chain
Leptocylindrus spp.
Nitzschia spp.
Ceratium biceps
Ceratium pentagonum
Protoperidinium spp.
Codonellopsis orthoceras
Amphisolenia spp.
Gazelletta hexanema
Tintinnid (micro-zooplankton)
Alexandrium spp.
Acantharia
Fungal spores (non-phytoplankton)
Ceratium horridum
Ditylum spp.
Skeletonema spp.
Stepanopyxis spp.
Ceratium massiliense
Flagellate
Dinoflagellate cyst
Silicoflagellate 8 points
Codonellopsis spp.
Filamentous algae (branching)
Ceratium lineatum
Parundella spp.
Ceratium kofoidii
Plastic (non-plankton)
Cyttarocylis spp.
Filamentous algae (non branching)
Gonyaulax polygramma
Dinophysis tripos
Dinophysis spp.
Xystonella spp.
Fish scales (zooplankton)
Favella spp.
Chaetoceros (Hyalochaete) *lorenzianus*
Prorocentrum spp.
Eutintinnus spp.
Podolampas sp.
Bacillaria spp.
Echinoderm spine (zooplankton)
Asterionellopsis glacialis
Undella spp.
Gonyaulax spp.
Ceratium contrarium
Codonellopsis pusilla
Chaetoceros socialis
Eucampia spp.
Plated dinophyte
Pseudonitzschia spp.
Egg (zooplankton)
Melosira spp.
Gymnodinium spp.
Odontella spp.
Coccolithophore
Phaeocystis
Ceratium extensum
Ceratium tripos
Pollen (non-plankton)
Ceratium candelabrum
Ceratium gravidum
Ceratocorys horrida
Bellerochea malleus
Spicule

Thalassiosira spp. (diatom)

Tintinnid,
Favella spp.

Colonial radiolarian
Sagenoarium spp.

Ceratium vultur (dinoflagellate)

Dinophysis fortii
(dinoflagellate)

Ceratochoris horrida
(dinoflagellate)

Ceratium garvidum
(dinoflagellate)

Ceratium bucephalum
(dinoflagellate)

Above images taken by the AusCPR team. Images show phytoplankton species in AusCPR samples.

Zooplankton Species (Animals) Brisbane - Melbourne

Note: f=female, m=male, juv=juvenile

Penilia avirostris
Temora turbinata m
Oncaea venusta f
Temora turbinata f
Chaetognatha
Oncaea venusta m
Copepod juv
Copepod damaged
Oikopleuridae
Temora juv
Acartia tranteri f
Doliolum spp.
Paracalanus indicus f
Decapod larvae
Temora discaudata m
Acrocalanus spp. f
Temora discaudata f
Oithona Grp3 (pointy head) f
Salpidae
Evadne spinifera
Eucalanidae juv
Clausocalanus furcatus f
Acartia danae f
Cladoceran
Oncaea media f
Copepod nauplii calanoid
Corycaeus spp.
Clausocalanus spp. f
Egg
Oithona juv
Oncaea spp. f
Farranula gibbula f
Copepod nauplii cyclopoid
Pseudevadne tergestina
Oncaea spp.
Acartia tranteri m
Clausocalanus arcuicornis f
Oithona spp.
Prosobranch
Podon spp.
Acartia juv
Oncaea spp. m
Calanid V
Lucifer spp. f
Oncaea juv
Barnacle nauplii
Corycaeus (Corycaeus) crassiusculus m
Nannocalanus minor f
Nauplii copepod
Euchaeta juv
Euphausiid adult
Lucifer spp.
Ostracod
Paracalanus indicus m
Centropages furcatus f
Subeucalanus subcrassus f
Thalia democratica
Lucicutia flavicornis f
Amphipod
Clausocalanus spp. m
Calocalanus spp. f
Euchaeta spp.
Oithona spp. f
Corycaeus (Corycaeus) crassiusculus f
Temora turbinata
Nannocalanus minor m
Eucalanus spp.
Farranula spp. f
Polychaete
Pleuromamma juv
Oncaea mediterranea m
Fritillariidae
Copilia mirabilis f
Canthocalanus pauper f
Macrosetella gracilis f
Candacia juv
Euchaeta spp. f
Centropages furcatus m
Pleuromamma gracilis f
Oithona Grp1 (flat head) f
Oncaea mediterranea f
Pleuromamma quadrungulata f
Cavoliniidae shell
Microsetella rosea f
Acrocalanus spp. m
Microsetella norvegica f
Corycaeus spp. f
Lucifer spp. juv
Paracalanus spp. m
Corycaeus (Onychocorycaeus) agilis f
Mecynocera clausi f
Oncaea clevei f
Brachyuran zoea
Acartia pacifica f
Oncaea media m
Corycaeus juv
Cavoliniidae body
Canthocalanus pauper m
Farranula spp. m
Oncaea venusta
Delibus sp. f
Temora spp.
Euterpina acutifrons f
Lucicutia flavicornis m
Undinula vulgaris m
Undinula vulgaris f
Evadne spp.
Paracalanus spp. f
Bivalve
Candacia ethiopica m
Sapphirina scarlata f
Bryozoan
Echinoderm larvae
Corycaeus spp. m
Lucifer spp. m
Pleuromamma gracilis m
Clausocalanus jobei f
Ctenocalanus vanus f
Subeucalanus crassus m
Acartia spp.
Cosmocalanus darwinii m
Cavoliniidae
Corycaeus (Corycaeus) speciosus f
Sapphirina stellata f
Centropages orsinii m
Corycaeus (Corycaeus) spp. m
Calycophoran
Sapphirina spp.
Harpacticoid copepod
Corycaeus (Corycaeus) speciosus m
Farranula concinna f
Calocalanus pavo f
Calocalanus plumulosus f
Calanid IV
Calanidae spp. f
Calanus australis f
Oncaea clevei m
Heteropod
Candacia truncata f
Gastropod
Corycaeus (Ditiricohocorycaeus) asiaticus m
Euphausiid furcilia larvae
Cosmocalanus darwinii f
Acartia danae m
Corycaeus (Ditiricohocorycaeus) aucklandicus f
Acrocalanus spp.
Centropages bradyi f
Copilia quadrata f
Stomatopod
Euphausiid calotype larvae
Centropages juv
Siphonophore
Candacia catula m
Copilia spp. f
Heteropod - atlantid
Corycaeus (Onychocorycaeus) pacificus m
Microsetella spp. f
Calanidae spp. m
Candacia ethiopica f
Corycaeus (Ditirichocorycaeus) dahlii m
Candacia spp. f
Pleuromamma abdominalis f
Hyperiid amphipod
Harpacticoid copepod juv
Paracalanus aculeatus f
Amphipod juv
Labidocera juv
Acartia spp. f
Pleuromamma spp. f
Pleuromamma borealis f
Corycaeus (Agetus) limbatus m
Candacia ethiopica
Candacia bipinnata f
Pleuromamma spp.
Bestiolina similis f
Fish larvae
Limacina
Centropages australiensis f
Corycaeus (Corycaeus) spp. f
Candacia catula f
Sapphirina opalina f
Farranula spp.
Candacia spp. m
Centropages australiensis m
Nauplii harpacticoid copepod
Subeucalanus spp. f
Sapphirina spp. f
Pleuromamma borealis m
Candacia truncata m
Corycaeus (Ditirichocorycaeus) erythraeus m
Mecynocera clausi m
Clausocalanus brevipes f
Corycaeus (Ditirichocorycaeus) dahlii f
Microsetella spp.
Subeucalanus spp. m
Centropages orsinii f
Calanidae copepod unidentified
Centropages bradyi m
Lucicutia juv
Scolecithrix danae f
Mollusc
Candacia spp.
Corycaeus (Onychocorycaeus) latus f
Corycaeus (Onychocorycaeus) pumilus f
Sapphirina juv
Pontellina plumata f
Eucalanus spp. f
Farranula spp. juv
Corycaeus (Ditirichocorycaeus) erythraeus f
Calocalanus juv
Thalia democratica sol
Labidocera acuta m
Rhincalanidae juv
Corycaeus (Agetus) flaccus f
Corycaeus (Onychocorycaeus) agilis m
Pontellina plumata m
Paracalanus aculeatus m
Corycaeus (Onychocorycaeus) spp. f
Subeucalanus juv
Corycaeus (Corycaeus) claussi m
Pleuromamma xiphias f
Corycaeus (Onychocorycaeus) catus f
Lucicutia spp. f
Corycaeus (Ditirichocorycaeus) asiaticus f
Pleuromamma abdominalis m
Acartia negligens f
Calanopia minor f
Corycaeus (Agetus) limbatus f
Corycaeus (Onychocorycaeus) spp. m
Pontella juv
Lucifer spp. calyptope
Acartia spp. m
Corycaeus (Corycaeus) claussi f
Barnacle cyprid
Acartia pacifica m
Sapphirina stellata m
Clausocalanus furcatus m
Fish egg
Farranula curta f
Labidocera cervi m
Centropages spp.
Candacia bradyi m
Egg Mass
Corycaeus (Ditirichocorycaeus) spp. m
Copilia spp. m
Porcelain crab zoeae
Rhincalanus cornutus f
Pontella spp.
Lucifer typus f
Eucalanidae spp. m
Medusa
Euchirella rimana m
Rhincalanus spp.
Lucifer typus m
Euchaeta spp. m
Corycaeus (Agetus) typicus f
Bestiolina similis m
Centropages calaninus m
Unidentified invertebrate larvae
Isopod
Pleuromamma pieski f
Corycaeus (Onychocorycaeus) latus m
Labidocera acuta f
Pleuromamma spp. m
Acrocalanus gibber f
Euterpina acutifrons
Corycaeus (Onychocorycaeus) giesbrechti f
Labidocera spp. m
Candacia bradyi f
Gammarid amphipod
Euterpina acutifrons m
Candacia bipinnata m
Megalope
Macrosetella gracilis m
Euchaeta indica m
Corycaeus (Ditirichocorycaeus) tenuis f
Temora discaudata
Labidocera minuta m
Canthocalanus spp. m
Temora spp. f
Euchirella rimana f
Mecynocera juv
Centropages gracilis f
Podon intermedius m
Rhincalanus nasutus m
Corycaeus (Ditirichocorycaeus) andrewsi f
Corycaeus (Ditirichocorycaeus) aucklandicus m
Calanopia elliptica m
Pontellina spp. juv
Fish juv
Farranula concinna m
Centropages elegans f
Oithona Grp1 (flat head) m
Cyclopoid
Acartia sinjensis m
Acrocalanus gibber m
Corycaeus (Urocorycaeus) longistylis f
Scolecithrix spp. f
Metridia spp. m
Corycaeus (Onychocorycaeus) ovalis f
Labidocera spp. f
Farranula rostratus m
Eucalanus elongatus f
Aetideus spp. f
Heterorhabdus papilliger f
Mysid
Farranula concinna
Pontellina morii m
Clytemnestra spp.
Corycaeus (Agetus) typicus m
Labidocera minuta f
Sapphirina scarlata m
Phyllosoma larvae
Clytemnestra spp. f
Acrocalanus spp. i
Cnidarian tissue
Clausocalanus spp. i
Candacia discaudata f

Penilia avirostris
(Cladoceran or
'waterflea')

Temora turbinata
(copepod)

Head & teeth of a
chaetognath
(arrow worm)

Oikopleuridae
(larvacean)

Doliolid

Acartia tranteri (copepod)

Above images taken by A.Slotwinski. Images shown are of live animals from the SEQLD NRS station and not from AusCPR samples. They are shown as an example of the types of species we see regularly in AusCPR samples. Often animals collected in AusCPR samples are destroyed and identification must often made from small bits and pieces.

Update from Hobart, Tasmania

David McLeod

Processing of samples collected from the 2009/2010 Antarctic season by the RSV *Aurora Australis* is well underway with Voyages 1 and 2 complete. Planning for the upcoming season is also in progress, with Voyage 1 due to depart Hobart for Antarctica (Davis Station) on October 19. Recent samples have been interesting, as they have many phytoplankton species new to AusCPR. With the help of Rick van den Eden from the 'Electron Microscopy Unit' at the Australian Antarctic Division, some initial images of phytoplankton collected by the CPR have been taken, revealing many diatoms and coccolithophorids, and scales from very small flagellates. Such images are used to help confirm identifications by light microscopy.

Above: Diatoms including Chaetoceros and Thalassiosira (left), and Ceratium pentagonium (right).

During the transit cruise of the RV *Southern Surveyor* from Hobart to Broome in April, 8 CPR tows were collected totalling ~3000 nautical miles of samples. These data will help understand the distribution of plankton along the Leeuwin Current, and will also complement data from the National Reference Station project, a component of IMOS. These samples were the first collected from the *Southern Surveyor;* this vessel will be used more in the future for tows down the east coast of Tasmania as part of TasIMOS. A CPR is currently being purchased by the National Facility.

Above: CPR being retrieved on the RV Southern Surveyor (Image: David McLeod).

In August, AusCPR conducted the first CPR tows from the FV *Rehua*, across the Tasman Sea to New Zealand. The vessel left Burnie (Tasmania) and travelled to Nelson (NZ) collecting 3 successful tows along ~1200 nautical miles. Thanks to all involved in getting this done at short notice, including the shipping company, captain and crew, as well as staff from CSIRO in Hobart. Data from this transect will not only provide information on plankton abundance and community composition in the Tasman Sea but also aid interpretation of bio-acoustic data used to identify aggregations of small fish and squid collected simultaneously by CSIRO.

Update from Perth, WA

Joanna Strzelecki

Exciting news on the west coast: the AusCPR survey is expanding into WA waters in 2011. These samples will be processed at CSIRO in Perth. Joanna Strzelecki and James McLaughlin from CSIRO joined the AusCPR team on the July 1 this year and are helping to establish the new route and have been involved in taxonomic and logistical training. The exact route is yet to be confirmed, as negotiations with shipping companies are ongoing. We are hoping to collect samples from along the Leeuwin Current, one of the few poleward-flowing eastern boundary currents in the world. The current flows predominantly along the shelf bringing warm, tropical and low nutrient waters and transporting tropical species south. It is responsible for the region's low pelagic productivity relative to other eastern boundary current regions. The current flows all year round, but is stronger in winter (6 Sv) than in summer (1-2 Sv). In winter, the Leeuwin Current can be tracked all the way to southern Tasmania, a distance of 5500 km making it the world's longest coastal current.

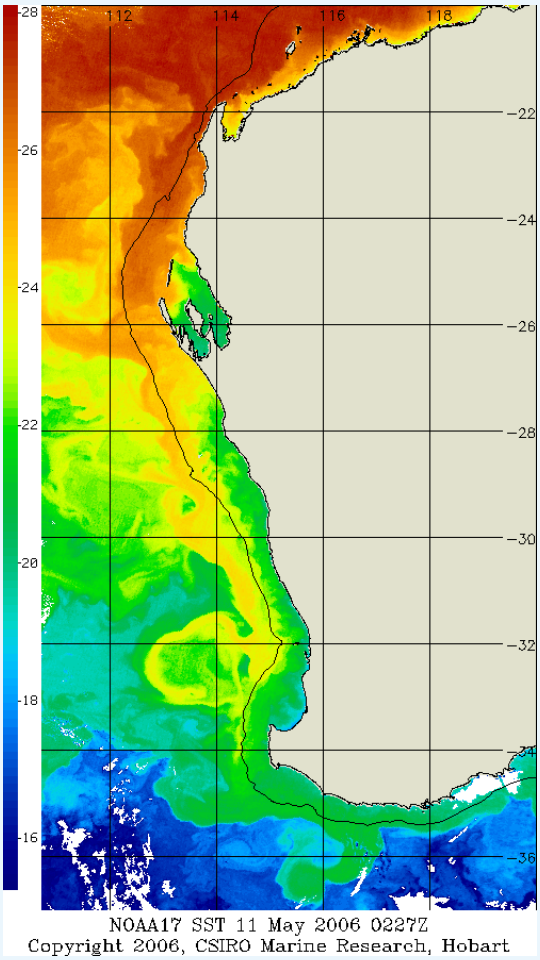


Fig. 1 Satellite image of SST showing flow of warm Leeuwin Current.

The plankton off WA is poorly known. The only offshore seasonal survey of the eastern Indian Ocean was conducted in the 1960s along 110°E. More recently, monthly phytoplankton and zooplankton sampling has been initiated off Two Rocks (north of Perth) with the National Reference Stations project. There are no long time series of plankton off WA and AusCPR survey and the NRS project are addressing this gap.

AusCPR Survey hosts first 'Australian zooplankton taxonomic workshop'

From the 6-11 December 2009, the AusCPR team hosted a Zooplankton Taxonomic Workshop at the University of Queensland Moreton Bay Research Station on North Stradbroke Island in Queensland. The Workshop was designed to increase the participants' skills in the taxonomic identification of zooplankton, whilst enhancing networks within the Australian zooplankton research community.

Three international plankton experts were carefully selected based on their interactive teaching style, and their expertise over a wide range of zooplankton taxa. They supplemented the home grown Australian experts. The Workshop had short theory sessions on each zooplankton group, followed by longer practical microscope sessions to identify specimens from tropical to polar waters and encompassing estuarine, coastal and oceanic habitats. This was also an ideal opportunity for participants to identify specimens from their own samples under the guidance of experts, and to see plankton that they have never seen before.

Left: Hands-on lab session.

Morning sessions were dedicated to the copepods, the dominant zooplankton group globally. Janet Bradford-Grieve from the National Institute of Water and Atmospheric Research in New Zealand, gave informative sessions on the taxonomy, identification techniques, and use of keys for the calanoid copepods.

Dave McKinnon from the Australian Institute of Marine Science demonstrated dissection and mounting techniques, and provided insights into species identification of the cyclopoid copepods, a particularly challenging group.

Dave Conway from the Plymouth Marine Laboratory in the UK, and Mark Gibbons from the University of the Western Cape in South Africa, gave sessions on the non-copepod zooplankton taxa, including amphipods, chaetognaths, cladocerans, decapods, doliolids, euphausiids, jellyfish, larvaceans, molluscs and salps. These groups have immense ecological importance in terms of nutrient cycling and food for higher trophic levels, but are often overlooked in zooplankton work because of their poor preservation in samples (e.g. jellyfish) or taxonomic difficulty (e.g. decapod larvae).

Above: Dave Conway from the Plymouth Marine Laboratory presenting a lecture on molluscs.

Our own Graham Hosie led a session on euphausiids (krill) in the Southern Ocean.

Presenters provided valuable taxonomic information, which will allow participants to tackle these groups in the future. Participants came from all over Australia and research a variety of different aspects of zooplankton ecology. Many have been working with zooplankton for a number of years (some had >40 years experience) and were keen to hone their identification skills and learn about groups they had not previously focused on. Others were students with more specific taxonomic requirements to identify samples collected for their research projects.

All participants were excited and enthused by the amount they learned during the Workshop. The Workshop also helped to forge new relationships and cement older ones throughout the Australian zooplankton research community. Ideas of collaboration and further training were discussed for the future.

The AusCPR team would like thank all presenters, participants, the UQ Moreton Bay Research Station and Leica Microsystems for making the workshop both successful and enjoyable. A strong component of its success was the excellence of the microscopes and logistical support generously provided by Leica Microsystems. The continued support of IMOS, CSIRO and the AAD is always appreciated.

Above: Leica provided excellent quality microscopes and camera equipment.

Above: Workshop participants at the University of Queensland Moreton Bay Research Station, North Stradbroke Island.

David Tranter's taxonomic zooplankton collection donated to CSIRO Brisbane plankton laboratory

The CSIRO Plankton Ecology Laboratory (Brisbane, Qld) hosted the opening of the David Tranter Plankton Reference Collection in August 2009. This collection is a comprehensive compilation of rare and out-of-print zooplankton reference guides and materials that Dr David Tranter collected over a 40 year career in zooplankton ecology. He has generously donated the collection to the CSIRO library, and it is actively being used by the Team at the Brisbane laboratory. It has been fully catalogued and all guides are available for external loan.

The collection includes over 100 bound volumes and many separate issues, and includes the renowned plankton works of Sars, Russell, Rose, Giesbrecht, Sewell and Gurney from the late 1800s and early 1900s. Many of these books are not housed anywhere else in Australia and together represent one of the best taxonomic works available for zooplankton identification in the world, mainly due to the general international demise of taxonomic work. The volumes cover a broad range of zooplankton taxa including Copepoda, Decapoda, Mysidacea, Siphonophora, Schizophora, Tunicate, Amphipoda, Chaetognatha, Hyperiidaea and Euphausiacea. Many of the books have exquisite drawings and are a cherished addition to the Brisbane Plankton Ecology Lab. The library is used on a daily basis by the plankton team for identification of zooplankton to species level from samples collected as part of the Integrated Marine Observing System of Australia (IMOS).

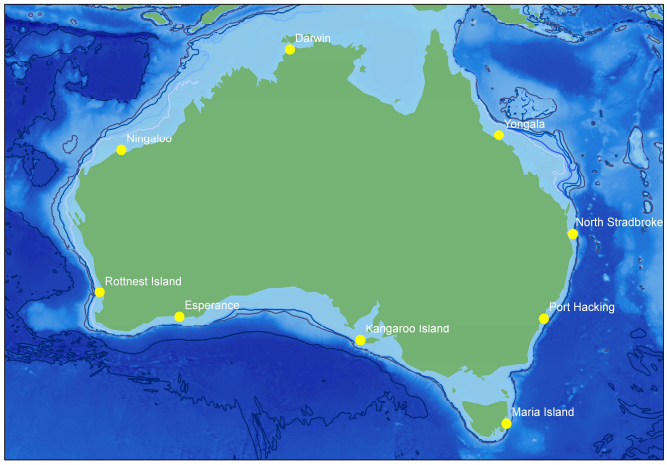
The library opening was held in Brisbane in August and saw three generations of plankton ecologists within Australia come together. David Tranter and Helen Tranter (formerly CSIRO), Jack Greenwood and Joan Greenwood (formerly University of Queensland), Peter Rothlisberg (CSIRO), David McKinnon (Australian Institute of Marine Science), Anthony J Richardson (University of Queensland/CSIRO), Sarah Pausina (UQ PhD student), Dave McLeod, Frank Coman, Claire Davies and Anita Slotwinski (CSIRO).

The AusCPR team are very grateful to David for the valuable contribution to the zooplankton reference collection within CSIRO. David's contribution to marine science and zooplankton within Australia goes beyond this library. David has been involved in pearl oyster biology and culturing, zooplankton sampling methodology, iron enhancement research off the NW shelf, Indian Ocean studies in Australia and India, eddies and the marine biological impacts of El Niño Southern Oscillation events. His library and publication record demonstrates his wide interests and collaborations in Australian marine science.

From left: David McKinnon, Claire Davies, Dave McLeod, Anita Slotwinski, Anthony Richardson, Sarah Pausina, David Tranter, Helen Tranter, Peter Rothlisberg, Joan Greenwood, Jack Greenwood.

National Reference Stations (NRS)

The NRS project consists of nine sites located in shallow depths (<110 m) on the Australian continental shelf. The project is part of the National Mooring Network Facility in IMOS and is coordinated by CSIRO (see http://imos.org.au/anmn.html). The NRS network provides a comprehensive physical, chemical and biological description of regional water masses, and documents their variability, especially in the context of climate change. At each site there is a mooring that measures physical and chemical attributes of the water column continuously, and biological samples are collected monthly. The Team at Brisbane counts zooplankton samples from each NRS and collects all physical, chemical and biological samples from the North Stadbroke Island NRS.



Above: Map of NRS stations.

	Darwin	Esperance	Kangaroo Island	Maria Island	Ningaloo	North Stradbroke	Peel Island	Port Hacking 4	Port Hacking B	Rottnest Island	Yongala
samples counted	0	4	0	11	0	23	7	72	19	2	4
total taxa per station	0	72	0	122	0	220	95	199	184	79	101
average taxa per sample	0	43	0	44	0	59	42	54	53	53	46

Above: Summary of NRS zooplankton data (up to September 2010).

If you would like to join the

'Friends of the AusCPR Survey'

mailing list and receive newsletters and updates on research and developments please email Anita.Slotwinski@csiro.au

Contacts

AusCPR Project Leaders:

Anthony J. Richardson
Phone: +61 07 3826 7183
Anthony.Richardson@csiro.au

Graham Hosie
Phone: +61 03 6232 3364
Graham.Hosie@aad.gov.au

Visit the AusCPR website at http://imos.org.au/auscpr.html

Visit the NRS website at http://imos.org.au/anmnrs.html

Further team contact details can be located at http://imos.org.au/australiancontinuousplanktonr6.html

Newsletter author: Anita Slotwinski

IMOS Integrated Marine Observing System

Australian Government Department of Innovation, Industry, Science and Research

IMOS is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and the Super Science Initiative

CSIRO

Australian Government Department of Sustainability, Environment, Water, Population and Communities Australian Antarctic Division

Microscope ergonomics: lessons learnt by the AusCPR Team

The AusCPR & NRS planktologists spend many hours each day at the microscope, and recently have learnt how to improve our health and safety at the microscope and the importance of an excellent ergonomic set up in the laboratory.
Do you spend more than an hour at the microscope daily?
Have you thought about the following?....

Repetitive strain injuries
Laboratory researchers are at a significant risk of repetitive motion injuries. These injuries develop over time and are caused by the stress and fatiguing of muscle fibres and joints, microtrauma of the tendomuscular junction, tendon inflammation, irritation of spinal nerves and when nerves are pinched and flow of blood is restricted. As this type of injury develops gradually over time it can be easy to ignore, until it becomes too late! Recovery from repetitive strain injuries can take a very long time.

Things to watch out for:
- tingling and numbness
- dull aching pain
- swelling
- neck stiffness
- headaches
- weakness
- self-massage
- reduced stamina on task

If you don't do anything and go on with the same work, it is likely that long term damage will result:
- chronic inflammation (including pain during sleep)
- muscle weakness due to protected use or avoidance of use
- deteriorating work productivity and increased error rate
- mood changes due to pain – work and home life affected
- permanent nerve damage
- loss of time due to lengthy rehabilitation

What should you do? Carefully ensure your workspace is the best it can be ergonomically, carefully plan your workload, speak with your OH&S officer if you have one, and read on for further recommendations and advice…

Posture and sitting at the microscope
It is essential to get this right if you are spending prolonged hours sitting in one spot. Few of us fit our workstations so it is important to take the time to make adjustments so the workstation can fit us!

First thing is to ensure you have a good ergonomically designed chair or lab stool. Your chair should meet all of the following requirements:
- ensure the seat base is not too small, the seat base should reach to the back of your knees (but not press into the back of your legs)
- ensure the seat back support is not too small, your seat back should be long enough to support your lower back and upper back at the same time
- if your seat has arm rests, consider whether it is stopping you from getting under the desk and close enough to the microscope, arm rests may prevent you from getting close enough and cause you to lean forward to reach your microscope
- sitting on hard surfaces such as plastic or metal increases the impact on your lower and upper back, ensure your chair is padded with cushioned soft foam support
- your chair should have a minimum of 3 adjustment controls (seat tilt, seat height, back tilt)
- if you work at a high lab bench your chair should have a supportive foot ring, however beware of small foot rings

Once you have your chair organised, the second thing to concentrate on is how to sit properly at the microscope. The diagram (right) highlights the correct posture.
- occulars level with eyes, raise bench or microscope to suit
- occulars over front edge of bench, move microscope to suit
- upright posture with major joints at right angles
- neutral spine and shoulders relaxed
- forearms parallel to the floor
- wrists straight & hands in a 'shake-hands' position
- thighs parallel to the floor
- feet flat on the ground or on a foot rest (beware of lab stools that have a foot ring that is small and cause you to tuck your legs under the stool and out of the right angle position, foot rests are recommended instead)

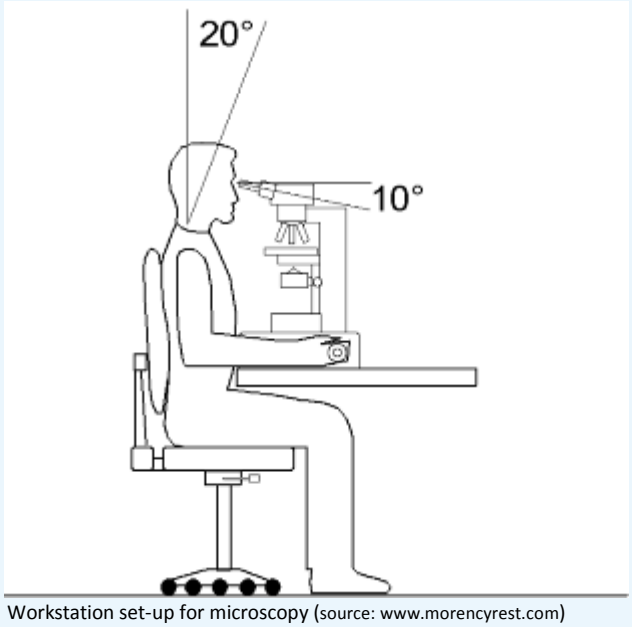
!! Important specialist advice!! It is essential that your forearms are supported and not under long periods of static load.
Tasks such as sorting & identifying plankton require the forearms to be raised up off the bench and additional support should strongly be considered. We have found a few different options:

- plastic arm rests/supports (a) can be purchased from your microscope supplier to suit your microscope, an example is the Leica Ergorest http://www.leica-microsystems.com/products/stereo-microscopes-macroscopes/ergonomics/details/product/leica-ergorest-1/ and some suppliers have angled arm support pads (b)

- adjustable forearm supports (c) can be purchased from ergonomic office suppliers, such as the adjustable forearm supports available online from 'Ergonomic Office' http://www.ergonomicoffice.com.au/catalogue_view.asp?catID=49&prodID=81&nav=workstationessentials

- blocks of foam (d) can be purchased from foam suppliers (such as www.pjbowers.com.au) cut to a height that sits horizontal with the base of your microscope, we have found this works very well in our lab, as we have blocks of foam that are wide enough also for microscope tools, sorting equipment and reference books

If you don't have access to any of the above, even a old telephone book would provide better support than nothing!



Workstation set-up for microscopy (source: www.morencyrest.com)

Microscope ergonomics…continued

Tips regarding microscopes, micro-manipulation & fine motor skills

• spread microscope work throughout the day and keep frequently used items within arms reach

• adjust the eyepieces and angle of observation to prevent neck strain, use adjustable microscope stands to adjust height and angle of the microscope, move the microscope close to the edge of the counter to avoid bending your neck

• to reduce eyestrain, every 15-20 minutes look away from your work and focus on an object 20 feet away for 20 seconds

• when using forceps, use small pieces of foam similar to the type used on pencils and pens, to prevent soreness on the fingertips, this will distribute the force over a greater surface area, thus reducing the compressive forces on the soft tissue

• practice using the forceps between the 1st and 2nd digits instead of using the thumb and 1st digit, then try alternating between the two positions to reduce the use of the thumb, the thumb is used repetitively with almost every job task performed in the laboratory

• use 'fatter' pencils or pens with good grip

• rotate tasks intermittently between left and right hands to avoid overuse of any one side

• take regular microbreaks away from tool use (at least every 15-30 minutes) and do hand exercises

• take stretch breaks and rotate task, get out of the chair every 30 minutes to help relieve stress on the back

Stretch breaks and exercises

Your body was designed to perform a variety of tasks while actively using your muscles. Sustained muscle activity (like holding your arms up to sort plankton) robs the muscles of life giving blood flow. It is very important to actively stretch during breaks to flush out toxins that build up in the muscles that were used for sustained posture.

The following body areas typically need stretching or relaxation exercises during and after microscope use: neck, hands and wrists, upper back and shoulder, lower back, eyes and legs.

Eyes exercises and stretches

Eye Comfort Exercises

- blinking (produces tears to help moisten and lubricate the eyes)
- yawning (produces tears to help moisten and lubricate the eyes)
- expose eyes to natural light

Palming

1. while seated, brace elbows on the desk and close to the edge
2. let weight fall forward
3. cup hands over eyes
4. close eyes
5. inhale slowly through nose and hold for 4 seconds
6. continue deep breathing for 15-30 seconds

Eye Movements

1. close eyes
2. slowly and gently move eyes up to the ceiling, then slowly down to the floor
3. repeat 3 times
4. close eyes
5. slowly and gently move eyes to the left, then slowly to the right
6. repeat 3 times

Focus Change

1. hold one finger a few inches away form the eye
2 focus on the finger
3. slowly move the finger away
4. focus far into the distance and then back to the finger
5. slowly bring the finger back to within a few inches of the eye
6. focus on something more than 8 feet away
7. repeat 3 times

Recommended musculoskeletal system exercises and stretches

Cable Stretch

1. while sitting with chin in, stomach in, shoulders relaxed, hands relaxed in lap, and feet flat on the floor, imagine a cable pulling the head upward
2. hold for 3 seconds and relax
3. repeat 3 times

Sidebend: Neck Stretch

1. tilt head to one side (ear towards shoulder)
2. hold for 15 seconds
3. relax
4. repeat 3 times on each side

Diagonal Neck Stretch

1. turn head slightly and then look down as if looking in your pocket
2. hold for 15 seconds
3. relax
4. repeat 3 times on each side

Shoulder Shrug

1. slowly bring shoulders up to the ears and hold for approx 3 seconds
2. rotate shoulders back and down
3. repeat 10 times

Executive Stretch

1. while sitting, lock hands behind head bring elbows back as far as possible
2. inhale deeply while leaning back and stretching
3. hold for 20 seconds
4. exhale and relax
5. repeat 1 time

Foot Rotation

1. while sitting, slowly rotate each foot from the ankle rotate 3 times in one direction, then 3 times in the opposite direction
2. relax
3. repeat 1 time

Hand Shake

1. while sitting, drop arms to the side
2. shake hands downward gently
3. repeat frequently

Hand Massage (Note: Perform very gently!)

1. massage the inside and outside of the hand using the thumb and fingers
2. repeat frequently (including before beginning work)

Finger Massage (Note: Perform very gently!)

1. massage fingers of each hand individually, slowly, and gently move toward nail gently
2. massage space between fingers
3. perform daily

Wrist Stretch

1. hold arm straight out in front of you and pull the hand backwards with the other hand, then pull downward
2. hold for 20 seconds
3. relax
4. repeat 3 times each

Buy a stress ball and use it a few times a day to exercise your hands and fingers.

Sources:
'Overuse Injuries in the Laboratory', 2005, Australian National University
http://www.safetyoffice.uwaterloo.ca/hse/ergonomics/lab_ergo.htm
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http://www.working-well.org/articles/pdf/Lab_Ergo_3.pdf