

CORALWATCH

FAQs

THE PROGRAM

What is CoralWatch?

CoralWatch is a non-profit research organisation, initiated and underpinned by leading coral and sensory biologists from the University of Queensland in Brisbane, Australia. We are committed to helping maintain and conserve the coral reefs of the world to ensure that present and future generations may enjoy the natural wealth and beauty of the most diverse ecosystems on earth.

CoralWatch offers rapid assessment coral health monitoring and education tools that can be used by anyone who wants to increase understanding of coral bleaching and contribute to the protection of coral reefs worldwide. You can join scientists, students, divers, tourists, businesses and concerned citizens using coral health colour charts to monitor bleaching and add essential data to a global monitoring database.

What can coral colour tell us about the reef?

Coral colour, or more specifically brightness and saturation, correlate with chlorophyll content and density of symbiotic algae (zooxanthellae) in coral tissue, providing a measure of coral health. Coral bleaching results from a loss of symbionts or pigmentation from stressed coral.



Healthy Coral



Bleached Coral

What is CoralWatch trying to achieve?

CoralWatch aims to increase understanding of coral reefs, coral bleaching and climate change and encourage reef protection through interactive learning and monitoring tools. Relatively little is known about trends of coral bleaching on a global scale. Traditionally coral health monitoring occurs around a few reefs that are regularly visited by scientists. We hope to continually expand our online coral bleaching database by including as many people as possible in monitoring their reefs. We also work to build the capacity of individuals, groups and communities to adopt a more sustainable way of life and contribute to reef conservation.

Where does the funding come from?

The University of Queensland's Vice Chancellor's Strategic Initiative (VCSI) fund has been central to the development of the CoralWatch project. Seed funding received from Sustainable Tourism Centre for Co-operative Research (STCRC), during 2002 and 2003, facilitated the initial research and development of the CoralWatch Coral Health Charts and ongoing support of

the dedicated website www.coralwatch.org. Project AWARE have also provided financial support for the creation and distribution of CoralWatch materials.

THE PEOPLE

Who is involved with the program?

At mid 2010, at least 1320 groups have used Charts worldwide, within more than 80 countries and territories. Groups using the Chart include:

- 350 monitoring and research groups
- 850 tourism and diving groups
- 100 education and media groups

Project AWARE

CoralWatch has joined forces with Project AWARE Foundation, a non-profit environmental organisation working with divers to conserve underwater environments through education, advocacy and action. Project AWARE has registered over 700 CoralWatch monitoring operators worldwide making it easy for divers and snorkelers to get involved.



Make your dives count with CoralWatch

TOOLS & TECHNIQUES

How does CoralWatch work?

CoralWatch distributes Coral Health Charts and a Reef Education package; flexible tools that you can adapt to suit your reef monitoring and education needs. It provides an accessible alternative to current expensive and/or invasive techniques and provides additional resources that complement other monitoring programs including remote sensing surveys like Coral Reef Watch, and *in situ* surveys such as BleachWatch and Reef Check.

Project AWARE's CoralWatch Kit developed specifically for divers and snorkelers is distributed to AWARE CoralWatch Operators. The Kit includes CoralWatch



Reef Education Package

Health Charts, monitoring guidelines and information, educational materials for divers and a CD ROM containing helpful resources to establish monitoring activities. Individuals interested in monitoring can also obtain a Diver Kit that contains the Coral Health Chart, monitoring guidelines and information, and educational materials.

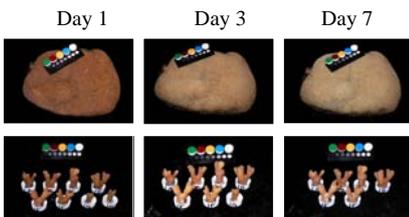


CoralWatch Operator Kit

What does the coral health chart measure?

The CoralWatch Coral Health Chart consists of a series of coloured areas representing common coral colours. Within each area, the brightness of the colours is varied systematically to represent different stages of bleaching and recovery, corresponding to varying concentrations of symbiotic algae and chlorophyll within coral tissues.

The brightness of the colours range from 1 (pale or bleached corals) to 6 (dark corals with high quantities of algae and chlorophyll in their tissues). This range is repeated on the four sides of the chart, each side coloured in different hues representing the most common coral colours. In the field, you simply compare the colour of a coral with the colours on the chart and record matching codes. It is the brightness, or colour number scores, that provide an indication of coral bleaching state. The hues just make it easy for our eyes to make an accurate match.



Controlled bleaching experiments show a shift in coral colour brightness as corals became stressed in elevated temperatures.



CoralWatch Coral Health Chart

The chart is based on the predictable relationship between temperature and coral symbionts and provides a measure of coral bleaching state. Blue-purple coloured corals cannot be assessed using the chart because the colour of purple corals is influenced more strongly by coral pigments, not symbionts, and the relationship between pigments and temperature is different to that of symbionts and temperature.

Why measure lightest and darkest parts of the coral?

The lightest and darkest measurements for each coral allow an average to be calculated, thereby reducing variation for corals such as brain corals that often have a light ridge and dark trough.

Can I use different sides of the chart when recording lightest and darkest colour scores for a single coral colony?

Yes - you should rotate the chart and find the closest match of colours for a single coral colony. For example, the lightest part of the colony may be "C2" and the darkest part can be "D4". The letters represent different colour hues, which allow us to more easily match the colour of a coral to the Chart.

Why can't I just print out my own Chart?

The Coral Health Chart is printed on a special type of plastic with specific inks and colours that are consistent in all supplied charts. Due to the variation between printers, we supply the charts in hard copy and not electronically. Please do not reproduce the chart as using a copy invalidates the data you worked so hard to collect.

I have troubles determining the coral type? What should I do?

'Coral type' is a general morphological key that includes branching, boulder, plate and soft. Due to the dynamic nature of coral morphology some corals do not fit clearly into one category, so please pick the closest form. Our aim is to keep the chart and surveys as simple as possible. Please record coral species if you are able to do so with confidence.

The coral colour I am looking at does not fit the colours on the chart?

It's ok if the colour of the coral you are looking at does not match exactly what is on the chart. Remember, it is the brightness of the coral colour (the code number) that indicates the degree of bleaching. Please try to pick the closest colour, paying particular attention to brightness rather than hue (letter code), and avoid the blue-purple coloured corals. Studies indicate that corals from different geographic regions have similar reflectance patterns, and that

colours of corals should be comparable from different parts of the world. This means that CoralWatch can be used to measure corals in the Caribbean and data compared to results from reefs in Australia or Africa.

During what activities can I use the Chart?

The Chart is an easy tool to use whilst walking alongside the corals, snorkelling and scuba diving.

Can I use CoralWatch in the classroom?

You don't need access to the reef to get involved. With the CoralWatch Reef Education Package you can improve your own, and your students', ability to contribute to reef protection by following the Virtual Reef Transect and working through Virtual Reef and Virtual Lab. They can be used to prepare for a fieldtrip or as a valuable alternative. As a class, you can follow the colour changes in various corals over time (Virtual Reef) and investigate the range of scores you get from multiple observers. You also gain a better understanding of the relationship between coral colour and symbiont density / chlorophyll a using Virtual Lab.

The Reef Education Package is neither exhaustive nor exclusive with regard to activities that can be undertaken using the Chart, and we encourage you to design your own additional activities. If you do develop any new activities we would be very interested to hear about them!

What methods should I use when using a Coral Health Chart?

Studying species at the surface

If snorkelling or walking alongside the coral, ensure all movements avoid contact with live coral. The chart may be used with any living coral, remembering to avoid blue-purple varieties.

Survey methods (depending on experience and location) include:

- A) Random Survey - select corals randomly, such as every third step or fin kick.
- B) Quadrant or Transect Survey - select your corals by marking a square area or following a transect line. Make sure your markings have no affect on marine life in the area, then assess corals within the quadrant or along the transect line.



Walking with CoralWatch

Determining symbiont density at depth

If the chart is being used for SCUBA surveys below five meters (15 feet) please use a flashlight or torch to illuminate both the chart and coral. Illumination is

necessary to counteract the changing spectral properties of water with depth. Be an AWARE diver. Be sure to secure your equipment, be properly weighted, maintain neutral buoyancy and move slowly through the water. Dive carefully to avoid any contact with the reef as reefs are extremely fragile to even the slightest touch.

Matching Satellite with Surface data

Coral Health Charts can also be used to ground truth satellite images with on-the-ground colour scores.

What are some CoralWatch monitoring tips?

1. Get to know your reef, fix a baseline for your area or species and monitor over a period of time. Assess at least 20 corals per trip (100+ corals are better).
2. Use the Chart as a data collection tool to best suit your needs. We would suggest two survey techniques (to be used depending on experience and location):

Reef Fingerprint. Select corals randomly or along a transect. If you choose random corals, ensure they are truly random and not a collection of bleached corals. For example, take three steps or fin kicks and measure the coral closest to you. This is useful for a once-off visit to a reef or if you are not returning to exactly the same site or corals each time.

Individual Corals. Select a certain number of corals and monitor these specific individuals over time. Corals can be labelled or tagged using materials such as cattle tags and cable-ties but you must check with your local managing authority, regarding permits, before undertaking any tagging. A marked map or GPS device is also useful to help relocate corals.

3. The reaction of corals to various stressors may be influenced by coral type, species and/or depth and location. To address these potential differences you can:
 - Select multiple types (ie. equal ratios of branching, boulder, plate and or soft corals) to provide a more detailed picture of reef health.
 - Select particular species for assessment and comparison within set areas.
 - Conduct a depth comparison at say 3, 6 & 9 metres. Remember, a torch must be used below 5 metres (15 feet) to illuminate the chart and corals.

DATA & RESULTS

We continually need more data to measure trends and improve our understanding and capacity to conserve reefs. Please remember to enter all of your *real* data onto the CoralWatch website www.coralwatch.org. Alternatively, you can mail your raw data sheets or email your completed spreadsheets to us and we'll upload them for you. Please do not enter any of the *virtual* data, i.e. from the Virtual Reef, Virtual Lab or Virtual Transect, onto the website.

How is the data used?

All the data collected is available online and can be used for scientific analysis as well as being valuable in an educational and social context. At the end of 2009, over 20,000 samples from 244 different reef sites had been input into the database. Some data collected from

CoralWatch have been used in a number of papers and reports. The entire dataset has been analysed to assess the extent of monitoring occurring as part of the program. Detailed analysis of the full data in relation to the health of reefs around the world is yet to take place. More data is desirable to make this kind of analysis more robust.

Who can use the data?

The CoralWatch Health Chart is being used by many different groups at various levels of training and involvement and the data from each group is used in different ways. The scale varies from scientific use (see Fabricius 2006) to school projects (field work, reports & DVD's). Also included are environmental monitoring groups. The system is adaptable and groups are encouraged to design their own protocols to best suit their needs.



What kind of questions can be answered?

There are many questions that will have to be answered in order to try and save the reefs. This is where you can help! If many people around the world, like you, participate in the monitoring program we will be able to answer questions such as:

Large- and small-scale patterns of coral bleaching

Do all reefs bleach during every El Niño event, or are there some reefs or zones of reef that never bleach? Do the same areas bleach every time?

Duration and severity of coral bleaching

For what period of time are different reefs affected by bleaching events? How severely are different reefs around the world affected? Is the severity and duration dependent on previous bleaching events? Does the overall health of the reef deteriorate from one bleaching event to another?

Large- and small-scale pattern of recovery

How long after the drop in water temperature does it take for a coral or reef to recover? Is recovery variable between different reefs and different coral types?

Some other questions such as "how does a reef differ in bleaching state from crest to shore and 0 to 10m?" may be something only an environmental monitoring group can tackle with some transect sampling training. Other questions, such as the comparison of bleaching rates in the same species in different locations (outer vs inner reef, top of coral vs underside of coral and in different circumstances such as over sand and over algae) may be something only an expert can answer. All such questions can be answered using the technique that CoralWatch provides and results will be scientifically valid.

What is the difference between the data collected and reported by untrained volunteers and expert scientific teams?

Statistically speaking, there is no difference in terms of colour scores of data collected by untrained volunteers and the expert scientists. The difference comes in the identification of species, the application of the data (for instance understanding differences in coral location and morphology) and other specific protocols.

Of course, any data is only useful in the context of the questions being asked. The accessibility of CoralWatch data means that a multitude of questions can be answered. General questions about which reefs are monitored and their bleaching status can be answered fairly straightforwardly. For people seeking more specific answers, data can be differentiated by country, location, date and time, group name and type, sampling

activity (walking, snorkelling or diving), weather and coral type. Monitoring groups can also be contacted for extra information if required.

Is data from around the world standardised and comparable?

Coral health data is comparable depending on the question you are asking. Data from any person can be used to add to our understanding of the trends and changes of the world's coral reefs. It is possible for volunteer data from reefs in Florida and reefs in Australia to be compared over time and space. This real online data is also valuable as a resource to be used by students for class projects.

What are the known limitations of the data?

It is important to understand the limitations of any data set. Recognised limitations include the knowledge that species may not be well identified and that there may be trends towards collecting more visible corals than cryptic ones. If you have specific questions that you want to answer, you may have to design a particular monitoring protocol or contact other data collecting groups to obtain the information you require.

EXTRA INFORMATION

Reid, C., Marshall, J., Logan, D. and Kleine, D. (2009) Coral Reefs and Climate Change: the guide for education and awareness. CoralWatch. Brisbane, Australia.

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Fabricius, K.E. (2006) Effects of irradiance, flow and coral pigmentation on the temperature microenvironments around corals: Implications for coral bleaching? *Limnology and Oceanography* 51(1):30-37

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs. *Marine & Freshwater Research*, 50:839-866.

If you require more information or CoralWatch materials please email info@coralwatch.org. We look forward to receiving your data and expanding our growing web site www.coralwatch.org.

All the best with your monitoring activities and thank you for your participation.

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