Caribbean Conservation Association
One Caribbean, One Vision

NCC
NATIONAL CONSERVATION COMMISSION

Folkestone Marine Reserve, St. James

Barbados

Centre for Resource Management and Environmental Studies

CERMES

University of the West Indies

Barbados

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Community-based Coral Reef Monitoring and Management

REEF WATCHERS INSTRUCTION MANUAL

A Basic Guide to Volunteer Coral Reef Monitoring at Folkestone Marine Reserve, Barbados

June 2008

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1 Introduction

The Community-based Coral Reef Monitoring and Management is a project developed by the Caribbean Conservation Association, in collaboration with the National Conservation Commission and the Centre for Resource Management and Environmental Studies, UWI. It is funded by UNDP, The GEF Small Grants Programme. The project seeks to build capacity at the community level to support identification and analysis of the problems facing coral reefs within the reserve and the development and implementation of community-level strategies to combat the existing impacts. This is hoped to be achieved by:

- The establishment of a local network of stakeholders for collaboration and information exchange; and
- Providing the necessary training to community groups in coral reef education and awareness; management planning; and long-term financing and sustainability.

Through the development of the Reef Watchers programme, local communities will be given the opportunity to move beyond awareness and play an active role in reef research and conservation. The guide has been prepared to provide volunteers with the necessary information required for monitoring coral reefs. This guide has been adapted from Reef Check protocols to suit the needs of the Reef Watchers programme at the Folkestone Marine Reserve.

2 About the Reef Watchers Programme:

2.1 Reef Watchers

Before embarking on an ecological monitoring program, it is important to define the objectives. The monitoring program can then be designed to fulfill those objectives. If the purpose of monitoring is to assist resource managers, then a number of important questions should be considered during the design process. Once these questions have been answered, a useful, cost-effective monitoring program can be set up.

A major goal of any coral reef monitoring program is to provide the data required for management. As more Marine Protected Areas (MPAs) are established, it is becoming increasingly important to monitor whether they are achieving their management goals. MPAs will fail without community support. Involving the community in the coral reef monitoring programme helps to build public support for management initiatives.

The Reef Watchers coral reef survey program will be carried out by volunteers from the community, and will thus be a useful tool in building public support for government and NGO coral reef conservation efforts. The publicity generated from the survey activities can also be useful in raising public awareness.

Barbados already has a long-term monitoring plan - the Barbados Reef Surveys, sponsored by the Barbados Government through the CZMU. The survey is done every five years on 43 reefs, whereas this Folkestone programme is more designed to observe impacts within the island's first marine reserve. We have historical data for a number of reefs within Folkestone Marine Park (Barbados Reef Surveys, CARICOMP, and other scientific surveys within the reserve boundaries). This programme will amalgamate all of the sites into one dataset, and will now look at fringing reefs, patch reefs and bank reefs within the protected area. Eventually, it would be good to monitor reefs just outside the reserve in order to verify that the reserve is doing its job in protecting the reefs and their inhabitants.

In addition to providing timely information to reef managers, a second role of Reef Watchers is to build up community support for a coral reef monitoring and management program. By participating in Reef Watchers training and surveys, community members develop a sense of stewardship towards the reefs they are monitoring. There also are large rewards for scientists who volunteer to help train the survey teams. By taking the time to explain to members of the public why coral reefs are important, scientists are able to show why coral reef science and ecology in general, are important to society.

2.2 Reef Watchers Goals

• educate the local public about local (and global) coral reef status;

• create a local network of volunteers which regularly monitor and report on reef health within and around the Folkestone Marine Reserve;

• stimulate local community action to protect remaining reefs and rehabilitate damaged reefs using ecologically sound and economically sustainable solutions.

2.3 The Monitoring

Reef Watchers has focused on the abundance of particular coral reef organisms that best reflect the condition of the ecosystem and that are easily recognizable. Selection of these organisms was chosen based on their economic and ecological value, their sensitivity to human impacts, and ease of identification.

Reef Watchers will collect four types of data:

1. A description of each reef site based on measures of environmental conditions and ratings of human impacts.
2. A measure of the percentage of the seabed covered by different substrate types, including live and dead coral, along four 20 m sections of a reef.
3. Invertebrate counts over four, 20 m x 2 m belt transects, and
4. Fish counts over four, 20 m x 2 m belt transects.

Monitoring of the decided indicators will be made on transects that run along the top of the spurs in the fringing reef system (perpendicular to shore), and along transects along the spurs of the bank reefs (parallel to shore). This simple but scientifically robust sampling method should provide data on the condition of the chosen reef environments, and as it is close to what Reef Check is doing, it is the same type of monitoring that has been adopted as the standard monitoring protocol globally by marine park managers, national governments, scientific institutions as well as many other volunteer teams. The methods have proven to be an effective learning tool for people wishing to gain more knowledge about coral reefs and the marine environment.

3 Core Methods

To be useful, Reef Watchers monitoring should be carried out every year with sufficient replication to provide a comprehensive view of the reefs of interest (at least once in the dry season and once in the wet season). However, if Reef Watchers surveys are repeated on every reef four times a year instead of just two, they then have the potential to act as an early warning system for major anthropogenic changes such as bleaching, blast or poison fishing, overfishing, eutrophication and sedimentation.

3.1 Site Selection

Sites where previous or ongoing monitoring is happening were chosen for this project. All initial sites are within the Folkestone Marine Reserve. These sites include:

- North Bellairs Fringing Reef
- South Bellairs Fringing Reef
- Fisherman's Bank Reef
- Dottins Bank Reef
- Sandy Lane Bank Reef
- Sandy Lane Patch Reef
- Sandy Lane Fringing Reef

If we are going to think of long-term monitoring of multiple sites, another useful approach is to use a sampling design that includes sites inside and outside of a Marine Protected Area. With sufficient sites (3-5 outside and 3-5 inside), it will be possible to show how effective the protected area is, and distinguish if the MPA improves conditions over time. If improvements in coral reef health as a result of the MPA can be shown, it may serve as a valuable case study of a successful MPA.

1. Site Description. Anecdotal, observational, historical, location and other data should be recorded on the Site Description Sheet.
2. Fish belt transect. Four 2 m wide (centered on the transect line) by 20 m long segments will be sampled for fish species typically targeted by fishermen, aquarium collectors and others. Fish seen up to 5 m above the line are counted. This is the first survey to be performed.

3. Invertebrate belt transect. The same four 2 m wide (centered on the transect line) by 20 m long segments as in the fish belt transect will be sampled for invertebrate species (those targeted as food species or those that impact the health of the reef).
4. Substrate line transect. Uses the same transect line as the fish and invertebrate belt transects, but this time, points sampled at 0.5 m intervals are used to determine the substrate types on the reef.

3.2 Pre-dive Preparation

The training needed for each team will depend on their experience and knowledge level. For experienced divers with ecological survey experience, we recommend a minimum of half a day of training on land prior to the dive, so that the training can be absorbed and there is sufficient time for questions and discussion. All team members must be skilled at identifying all indicator organisms and substrate categories. All team members should be at the very least proficient snorkelers. Divers must be certified to use SCUBA.

The Team Scientist is responsible for making a presentation that includes:

1. An explanation of the three goals of Reef Watchers: education, scientific data collection, and coral reef management within a marine reserve;
2. A review of the sampling design and rationale of the indicator organisms;
3. Field identification training for all organisms and definitions for substrates;
4. An introduction to the data recording format, and preparation of slates/paper;
5. An explanation of the difference between survey diving and pleasure diving and how to avoid damaging reef corals by maintaining proper buoyancy control;
6. Explanation of the post-dive data entry, checking and submission procedures.

The Team Leader is responsible for safety training and will need to assess the abilities of his or her team so that appropriate work assignments can be made. The best person to serve as Team Leader is an experienced SCUBA instructor. The Team Leader may be the same as the Team Scientist, but ideally these are two different people. The Team Leader should complete the three following tasks before the survey:

1. Assign team members to survey tasks

   There are many acceptable ways to divide up the work depending on the skills of the team members and team size. Some team members will feel more comfortable recording fish or invertebrates, and others will just want to watch and serve as buddies.
2. Ensure that every team member understands their assignment and is capable of carrying it out properly.
3. Prepare data sheets

   Prepare the data sheets and ensure that you have sufficient slates or underwater paper for all team members. The number of slates and sheets will depend on the number of people in your team. Basically, every member should have a data sheet to complete his or her portion of the survey.

4. Prepare all necessary equipment
   a. Prepare and distribute all equipment used during a survey as follows:
   b. Indicator organism ID cards and books
   c. Transect Lines: We recommend using a 20-30 m fiberglass measuring tape
   d. Slates/Underwater Paper: Teams may use underwater paper, a flat plastic writing slate or a tube shaped arm-slate. These may be pre-printed with the required template using a permanent felt pen (slates) or laser printer (underwater paper). If you use the flat slates, the team scientist should photocopy each full slate, and keep for their records.
   e. Pencils: To record data on slates or underwater paper (short golf or plastic pencils work best)
   f. Safety Gear: dive flag, sunscreen, a First Aid kit, and plenty of water

3.3 Before You Jump in the Water

1. Record the name of the Team Leader and/or Team Scientist, names of Team Members, as well as the date, site name and depth on all data sheets.
2. Fill in the Site Description Sheet.

3.4 Deploying the Transect

Each buddy pair should lay out a 20 m transect line along the top of the fringing reef spurs, or along the shallowest crest of the bank reefs. The start point should be located such that the transect goes through areas of high coral cover (known-bias survey).

After deployment, the entire length of the transect should be examined to ensure it is not snagged or floating more than 1 m off the bottom.

3.5 Recording Location

GPS readings will be provided for the bank and patch reef sites. However, for the fringing reefs, more than one spur will be used, and these can be recorded on slates by taking triangulation marks to landmarks visible from the site, as well as by identifying the spurs on the aerial photos supplied.

A NOTE ON SAFETY!

Safety of divers is the number one priority. No surveys should be undertaken when weather or sea conditions are unsafe or if a diver does not feel well. In particular, teams should plan work to avoid decompression dives during the surveys. Any diver who is not comfortable diving for any reason should NOT participate in the diving aspects of the survey.

3.6 Data Collection

3.6.1 Site Description Instructions

Only one Site Description is completed per site. Please mark one response for each question.

The following definitions should be used to fill out the remaining portions of the Site Description Sheet.

BLAST FISHING

Low — Known blast fishing in area, but no evidence seen or heard during survey

Med — Blast crater observed anywhere on reef, no blasts heard during survey

High — One or more blasts heard during survey and/or dynamite crater on transect

POISON FISHING

Low — Less than one incident per month

Med — More than one incident per month, but less than one per week

High — One incident a week or more

AQUARIUM FISHING

Low — Less than once per month

Med — More than once per month, but less than once per week

High — Once a week or more

HARVEST INVERTS FOR FOOD

Low — Harvest less than once per week

Med — Harvest more than once per week, but less than daily

High — Daily harvest

HARVEST INVERTEBRATES FOR CURIO SALES

Low — Harvest less than once per week

Med — Harvest more than once per week, but less than daily

High — Daily harvest

TOURIST DIVING/SNORKELING (PEAK SEASON AVERAGE PER DAY WITHIN 100 M OF TRANSECT AREA)

Low — 1-5 individuals per day

Med — 6-20 individuals per day

High — More than 20 individuals per day

SEWAGE POLLUTION (OUTFALL OR BOAT)

Low — Sewage, irregular or rare discharge

Med — Source of discharge > 100 m but < 500m from transect

High — Source of discharge < 100 m from any point on transect

INDUSTRIAL POLLUTION

Low — Source > 0.5 km

Med — Source between 0.1 and 0.5 km

High — Source less than 100 m

COMMERCIAL FISHING (FISH CAUGHT FOR FOOD TO SELL NOT INCLUDING LIVE FISH

RESTAURANT TRADE)

Low — Less than once per month

Med — Less than once a week and more than once a month

High — Once a week or less

FISHING FOR THE LIVE FOOD FISH RESTAURANT TRADE

Low — Less than once per month

Med — Less than once per week and more than once per month

High — Once per week or less

ARTISANAL/RECREATIONAL FISHING (PERSONAL CONSUMPTION)

Low — Less than once per week

Med — More than once per week, but less than daily

High — Daily artisanal fishing

LIST THE NUMBER OF YACHTS TYPICALLY PRESENT WITHIN 1 KM OF REEF

Few — 1-2

Med — 3-5

Many — More than 5

3.6.2 Protection

Indicate if the area has any sort of protection from human usage (legal or otherwise) and if the protection is enforced. Please estimate the level of protection if an area is protected and check the listed activities that are banned at your site.

3.6.3 Team Members

IMPORTANT: Please record the name of the Team Scientist your team works with, even if he or she does not participate in this survey. In addition to the name of the person recording the data and the team leader, please list the names and nationalities of all team members.

3.6.4 Belt Transect Instructions

3.6.4.1 Fish Belt Transect

The fish belt transect should be the first survey completed. Begin the fish transect before 10:00 AM. After deploying the transect tape, the divers should wait a few minutes away from the transect line before starting the survey. This waiting period is needed to allow fish to resume normal behavior after being disturbed by the divers deploying the transect tape. The maximum height above the transect tape (the reef) to record fish is restricted to 5 m.

Each diver assigned to count fish will swim slowly along the transect counting the indicator fish. The diver will stop every 5 m, and then wait one to three minutes for indicator fish to come out of hiding, before proceeding to the next stop point (fish are counted along the entire length of each 20 m transect, in a two metre wide band.

This is a combined timed and area restricted survey: 4 segments x 20 m long x 2 m wide = 160 m^2.

Remember, a note should be made of any sightings of what are now becoming rare animals such as manta rays, sharks and turtles, but if these are off-transect records, they should be written at the bottom of the slate under "Comments".

3.6.4.2 Indicator Fish Survey

The indicator fish have been selected because they are typically fished off the reefs by spearfishing, and caught using hand-lines. A one metre length of PVC pipe can be used to help estimate the 2 m belt transect width. It is easiest for one of the divers to record the fish species by swimming a one metre wide band on each side of the tape (going up the transect on one side, and down the transect on the other). It is imperative that divers communicate with each other and be aware of fish movements in order to avoid double counting fish that may swim across the transect line. There are many other ways to perform this survey, each with its own respective benefits and shortcomings. Feel free to use the method that works best for you and your team. Tally the fish on the slate using a vertical tick mark for each fish observed and after each four fish, draw a horizontal line through the four, thus creating easily counted groups of five next to the correct name and under the appropriate column. It is crucial to remember to keep the counts for each of the four transects separate and to avoid double counting by communicating with your buddy if two people are doing the fish counts.

3.6.4.3 Invertebrate Survey, Coral Disease/Bleaching, Trash and Coral Damage

Each team will note the level of bleaching, presence of coral disease, presence of trash and coral damage in the survey area. If bleaching is present, two estimates will be made. First, teams will estimate the percentage of corals on the transect that are bleached. Second they will estimate the mean percent of each individual colony that is bleached. For example, the estimate might be that 30 out of 100 corals (30%) along the transect are bleached but the mean level of bleaching per colony is 80%. Coral disease will be noted as present or absent and the type of coral disease should be noted in the comment box (if identified). Note that many diseases are difficult to identify without a high level of training. Indicate yes or no in the appropriate box on the data sheet and note the percentage of the segment with disease. Trash is separated into general and fish nets/traps and the number of these items should be recorded for each segment. Coral damage is separated into boat/anchor, dynamite, and other. The number of incidents and estimated size should be recorded per segment. Damage and Trash should be rated as the following: None=0, Low=1, Medium=2, and High=3. It is important to put zeros in these fields if there is no bleaching, disease, trash or coral damage. For the belt transects, team members should be encouraged to look in holes and under overhangs to detect organisms, such as lobster and banded shrimp, that may be hiding.

3.6.4.4 Line Transect Survey Instructions

When the invertebrate belt transect is nearly completed, the next designated diver can begin the line transect. The method chosen for Reef Watchers sampling of substrates is "point sampling." Point sampling was chosen because it is the least ambiguous and fastest method of survey and is easily learned by non-scientists. In use, the diver can simply look at a series of points where the transect tape lies above the reef and note down what lies under those points. Substrate type will be recorded at 0.5 m intervals along the line, i.e. at: 0.0 m, 0.5 m, 1.0 m, 1.5 m etc. up to 19.5 m (40 data points per 20 m transect line). Input the substrate category abbreviations in the appropriate space on the data sheet. Each transect must have a total of 40 entries. There are many cases when the substrate type may be ambiguous. Please use the following guidelines to identify substrate types. Note that these may differ from other definitions with which you are already familiar.

3.6.4.5 Substrate Types

Hard coral (HC): Includes fire coral species (Millepora), as these also help to build the reef.

Soft coral (SC): Include all gorgonians, mat or encrusting soft corals, and zooanthids. Sea anemones go into the "Other" category as they do not occupy much space in the same manner as zooanthids or soft corals.

Recently killed coral (RKC): The aim is to record coral that has died within the past year. The coral may be standing or broken into pieces, but appears fresh, white with corallite structures still recognizable, only partially overgrown by encrusting algae etc.

Sponge (SP): All sponges (but no tunicates) are included; the aim is to detect sponges that cover large areas of reef in response to disturbances.

Nutrient Indicator Algae (NIA): The aim is to record macroalgae which may be responding to high levels of nutrient input. All species of macroalgae will be included in this substrate type. Turf algae and encrusting coralline algae will NOT be included here.

Rock (RC): Any hard substrate whether it is covered in e.g. turf or encrusting coralline algae, barnacles, oysters etc. would be placed in this category. Rock will also include dead coral that is more than about 1 year old, i.e. is worn down so that few corallite structures are visible, and covered with a thick layer of encrusting organisms and/or algae.

Rubble (RB): Includes rocks between 0.5 and 15 cm diameter. If it is larger than 15 cm it is rock, smaller than 0.5 cm and it is sand.

Sand (SD): In the water, sand falls quickly to the bottom after being dropped.

Silt/Clay (SI): Sediment that remains in suspension if disturbed. Note that these are practical definitions not geotechnical. Often, silt is present on top of other indicators such as rock. In these instances, silt is recorded if the silt layer is thicker than 1 mm or covers the underlying substrate such that you cannot observe the color of what is underneath. If the color of the underlying substrate can be discerned, then the contact will be counted as the underlying substrate NOT silt.

Other (OT): Any other sessile organism including sea anemones, tunicates or non-living substrate.

3.7 Post Dive Tasks

3.7.1 Data Checking

The Team Leader (TL)/Team Scientist (TS) are responsible for gathering the slates and data together as soon as the survey is completed and reviewing them immediately with the team members. The purpose is to make a quick assessment of the data to determine if some error has been made that can be corrected while the team is still on site. Typical errors that could be corrected would be "double-counting" of fish, misidentification of organisms or mislabeling on the slate. When an error is suspected, the TS should accompany the data recorder in the water to check on or correct it. Before departing from the site, the TL/TS are responsible for ensuring that all required data have been collected, and that the slates have been filled out properly, in particular with each individual's work identified. This will allow the TL/TS to check with the responsible party if an error is detected later. This is a good time to consolidate data from multiple slates to avoid later confusion.

3.7.2 Photography/video

Documenting the transect location, survey results, and findings using either still photos or videography both on land and in the water is very helpful. We recommend taking several above-water photos in several directions showing the start location lined up against whatever landmarks may be available for future reference. We suggest making a video of the entire transect by swimming over it very slowly. For permanent recording, a complete set of still photos along the transect line, using a digital or 35 mm camera can be great additional knowledge of the site. Video and photographs should also be obtained of as many of the parameters as possible, particularly various types of damage. All of these visuals will be important for future comparison and for presenting the results of your survey.

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5 Appendix

5.1 Site description data sheet

Site name:								
BASIC INFORMATION								
Country:			Parish:			City/town:		
Date:		Time:	Start of survey:			End of survey:		
Latitude (deg. min. sec):			Longitude (deg. min. sec):					
From chart or by GPS? (If GPS, indicate units):			Chart:		GPS:		GPS units:	
Orientation of transect:	N-S:		E-W:		NE-SW:		SE-NW:	
Temperature (ºC):	Air:		surface:		at 3m:		at 10m:	
Distance	from shore (m):				from nearest river (km):			
River mouth width:	<10 m		11-50 m					
Distance to nearest population center (km):					Population size (x1000):			
Weather:	sunny:		cloudy:		raining:			
Visibility (m) :								
Why was this site selected:			Is this best reef in the area?		Yes:		No :	
IMPACTS:								
Is this site sheltered?:	Always:		Sometimes:		Exposed:			
Major coral damaging storms	Yes:		No:				If yes, when was last storm:	
Overall anthropogenic impact	None:		Low:		Med:		High:	
Is siltation a problem	Never:		Occasionally:		Often:		Always:	
Aquarium fishing	None:		Low:		Med:		High:	
Harvest inverts for food	None:		Low:		Med:		High:	
Harvest inverts for curio sales	None:		Low:		Med:		High:	
Tourist diving/snorkeling:	None:		Low:		Med:		High:	
Sewage pollution (outfall or boat)	None:		Low:		Med:		High:	

Industrial pollution	None:	______	Low:	______	Med:	______	High:	______
Commercial fishing (fish caught to sell for food)	None:	______	Low:	______	Med:	______	High:	______
Live food fish trade	None:	______	Low:	______	Med:	______	High:	______
Artisinal/recreational (personal consumption)	None:	______	Low:	______	Med:	______	High:	______
How many yachts are typically present within 1km of this site	None:	______	Few (1-2):	______	Med (3-5):	______	Many (>5):	______

Other impacts: ______________________________

PROTECTION:

Any protection (legal or other) at this site?	Yes: ______	No: ______	If yes, answer questions below		
Is protection enforced	Yes: ______	No: ______			
What is the level of poaching in protected area?	None: ______	Low: ______	Med: ______	High ______	

Check which activities are banned:	Spearfishing	______
	Commercial fishing	______
	Recreational fishing	______
	Invertebrate or shell collecting	______
	Anchoring	______
	Diving	______
	Other (please specify)	______

Other comments ______________________________

TEAM INFORMATION

Submitted by ______________ ______________________________

Team Leader: ______________________________

Team Scientist: ______________________________

Team Members: ______________________________

5.2 Fish field data sheet

Site Name: ________________ **Island:** ________________

Depth: ________________ **Team Leader:** ________________

Date: ________________ **Time:** ________________

Fish

Data recorded by:

	T1	T2	T3	T4
	0-20m	**20-40m**	**40-60m**	**60-80m**
Butterflyfish (Chaetodontidae)				
Grunts/Margates (Haemulidae)				
Snapper (Lutjanidae)				
Parrotfish (Scaridae)				
Moray Eel				
Blue tangs/Surgeonfish				
Groupers/coneys/hinds				
Rare animals sighted (type/#)				

Comments:

5.3 Invertebrates field data sheet:

Site Name: ____________________ Island: ____________________
Depth: ____________________ Team Leader: ____________________
Date: ____________________ Time: ____________________
Data recorded by:

	T1	T2	T3	T4
Invertebrates	**0-20m**	**20-40m**	**40-60m**	**60-80m**
Banded coral shrimp (*Stenopus hispidus*)				
***Diadema* urchins**				
Pencil urchin (*Eucidaris* spp.)				
Sea egg (*Tripneustes* sp.)				
Flamingo tongue (*Cyphoma gibbosum*)				
Gorgonian (sea fan, sea whip)				
Lobster (Palinuridae)				

Impacts: Coral Disease/ Bleaching/Trash/Other	***0 = none, 1 = low, 2 = medium and 3 = high***			
	0-20m	**20-40m**	**40-60m**	**60-80m**
Coral damage: Boat/Anchor				
Coral damage: Dynamite				
Coral damage: Other				
Trash: Fish nets				
Trash: General				
Bleaching (% of coral population)				
Bleaching (% of colony)				
Coral Disease (% of coral affected if yes)				
Rare animals sighted (type/#)				

Comments:

5.4 Benthic field data sheet

Site name: ____________ **Island:** ____________

Depth: ____________ **Date:** ____________

Data recorded by: ____________

Time: ____________

Substrate Code

HC hard coral	**SC** soft coral	**RKC** recently killed coral
NIA nutrient indicator algae	**SP** sponge	**RC** rock
RB rubble	**SD** sand	**SI** silt/clay
OT other		

(For first transect, if start point is 0 m, last point is 19.5 m)

T 1				T 2				T 3				T 4			
0 - 20 m				20 - 40 m				40 - 60 m				60 - 80 m			
0		10		20		30		40		50		60		70	
0.5		10.5		20.5		30.5		40.5		50.5		60.5		70.5	
1		11		21		31		41		51		61		71	
1.5		11.5		21.5		31.5		41.5		51.5		61.5		71.5	
2		12		22		32		42		52		62		72	
2.5		12.5		22.5		32.5		42.5		52.5		62.5		72.5	
3		13		23		33		43		53		63		73	
3.5		13.5		23.5		33.5		43.5		53.5		63.5		73.5	
4		14		24		34		44		54		64		74	
4.5		14.5		24.5		34.5		44.5		54.5		64.5		74.5	
5		15		25		35		45		55		65		75	
5.5		15.5		25.5		35.5		45.5		55.5		65.5		75.5	
6		16		26		36		46		56		66		76	
6.5		16.5		26.5		36.5		46.5		56.5		66.5		76.5	
7		17		27		37		47		57		67		77	
7.5		17.5		27.5		37.5		47.5		57.5		67.5		77.5	
8		18		28		38		48		58		68		78	
8.5		18.5		28.5		38.5		48.5		58.5		68.5		78.5	
9		19		29		39		49		59		69		79	
9.5		19.5		29.5		39.5		49.5		59.5		69.5		79.5	

What percentage of recorded RKC is a result of bleaching?

Comments: