RAF/92/G32 - POLLUTION CONTROL AND OTHER MEASURES TO PROTECT BIODIVERSITY IN LAKE TANGANYIKA

Lake Tanganyika Biodiversity Project: Special Study on 'Pollution and its Effects on Biodiversity'

BTO report on visit to Tanzania 28 November to 17 December 1997 -Tony Bailey-Watts

Friday 28th November: travel (Edinburgh-Amsterdam-Dar es Salaam.

Saturday 29th November: preliminary briefing with Dr Menz and introducing Miss Nicola Wiltshire (NJW) to the project and the region: NJW has an 18-month contract with NRI as Trainer on the PSS, but is answerable to TBW in all aspects of her work. AM reported that the planned visit to Mpulungu (after 3 days in Kigoma) would not be possible due to sequestration of the ferry for movement of refugees).

Sunday 30th November: discussed with Chris Foxall (CF) and NJW (a) their respective roles for this and future visits, and (b) the inclusion of Dr Francis Chale (FC) in this mission - to assess the likelihood and suitability of him being appointed on a permanent basis to the PSS. Note: after visiting the 'New Africa' hotel rather than the 'Kilimanjaro' in which we were staying for most of these discussions, I suggest that the PCU use the former for visiting consultants in the future; it is marginally more expensive but considerably more comfortable and equipped in terms of e.g. fax facilities.

Monday 1st December: flight to Kigoma; early visit to laboratory at TAFIRI. Noted that wet and dry laboratories has been well maintained, although rather few personnel were in evidence! Unpacked equipment brought from UK (lists appended below).

Tuesday 2nd December: further organisation of the laboratories; introduced NJW and FC to the PSS staff and outlined the reasons for my visit:

- to maintain project momentum
- to progress training of nationals in field and laboratory methods (nutrient and phytoplankton analyses)
- to oversee routine sampling commitments - at Gombe and Kigoma
- to progress assessment of the TANESCO oil spillage problem
- to counsel the nationals' views on the current work programme (progress, problems etc)
- to identify outstanding equipment needs
- to analyse data collected so far.

Identified and rectified as far as possible, some irritating problems stemming from a combination of (a) unclear or unambiguous field and laboratory 'standing instructions' prepared by TBW and CF, and (b) nationals ignoring these instructions.
Noted that there had been little evidence of much activity/progress on microscopy since my last visit (October).
Wednesday 3rd December: proposed a major re-design of sampling schedules and use of personnel. This lead to considerable increases in (a) staff performance, (b) the amounts of data gathered and (c) resource use efficiency. A major example was the reduction from 7 to 3 in the number of staff (in addition to the 2 'Echo' crew) involved in sampling trips. Established with Kelly West, arrangements to allow NJW to communicate with the 'outside world' over much of the Christmas and New Year period, when NJW will be the only LTBP international consultant in Kigoma.
Thursday 4th December: previous day's deliberations allowed the following:

- each trainee to take part in at least one sampling expedition, i.e. Kigoma or Gombe over the next 2 days
- Mr Kadula (i/c sampling practices) to contribute to both expeditions
- NJW to experience being solely responsible for the expeditions re-training in, and

    the execution of the assembly of field equipment, sampling practices, sample handling and preservation (in the field and the laboratory as appropriate).

Drafted ideas on sampling schemes aimed at ensuring that the PSS teams 'deliver' on their main objective, i.e. ***to ascertain the nature and (where possible) the extent of pollution on biodiversity***. Drafted (a) Terms of Reference for Francis Chale's possible appointment to the PSS, (b) proposals that would allow NJW to concentrate on skills relevant to her experience, in eutrophication assessment and control and the identification and ecology of the lower biota (œ 1mm), and (c) an outline programme for CF to capitalise more effectively than hitherto, on his experience in more advanced chemistry, i.e. heavy metals, pesticides and hydrocarbons. These changes recognise that the on-going routine work on eutrophication etc., requires constant trainer presence (i.e. NJW) while CF's work can be effectively attended to by way of relatively few visits to the region - and thus more feasible for a visiting consultant. Discussed importance of NJW being in a position to alert CF and myself of any pollution issues at any time, and ensure that samples are collected and sorted in the appropriate manner for later analysis. These deliberations identified priority issues and activities, at a time when attention to broader limnological aspects - however tempting - might have detracted from the main business.

Friday 5th December:

Apart from one of two 'silly' mishaps, the Gombe expedition was very successful with samples for chemical and biological analysis being obtained. Progressed Terms of Reference for the Kigoma team. Good evening with a BBC crew including Doug Allen - the camera-man in Attenborough's '*Trials of Life*' team and responsible particularly the footage of the Killer Whales beaching themselves to catch penguins in Antarctica! The crew are presently filming for a forthcoming (1999 or 2000?) series on 'The Congo Basin'.

Saturday 6th December: Further drafting of nationals' Terms of Reference for nationals. Made plans for AK to join NJW in Mpulungu in January 1998 to (a) set up our second project laboratory - in Mpulungu (and install the equipment that has been sent there), and (b) initiate training in sampling procedures and schedules to parallel those established in Kigoma. Discussed with Kigoma staff and NJW, the work for the forthcoming week (the last in Kigoma for Dr Chale, CF and myself.

Sunday 7th December: drafted further thoughts on the forthcoming week's activities, noting that some staff would be absent for 1 or 2 days' commitments for Independence Day. Otherwise, checked on the following: analytical backlog, recycling of sample bottles, the TANESCO oil issue, more 'standing instructions' for field and laboratory activities, a session on data presentation and interpretation, the routine Kigoma sampling run,Dr Chale's future role (discussion with Kelly West), staff attendance and time-keeping, nationals' lines of management for NJW, and review sampling programmes with the view to increasing the number of sampling stations.

Monday 8th December: addressed the team on all issues listed above. Progressed staff Terms of Reference. Demonstrated methods of displaying frequency distributions (of e.g. phosphorus concentrations, phytoplankton sizes) using ranked normalised scores rather than the conventional histogram method. Outlined some really effective ways of displaying results - making full use of word-processing and graphics packages available.. Discussed ways in which biodiversity arrays can be generated even in the absence of knowledge on 'species' identity (i.e. assign alpha or alpha-numeric codes to the organisms: the 'actual' names being learnt with experience.

Tuesday 9th December (Independence Day): discussed strategies for improving on the accuracy and precision of phosphorus determinations. With CF, sampled oily water for microscopic and chemical analysis.

Wednesday 10th December: the re-designed field sampling strategy outlined above, proved successful during today's Kigoma transect expedition - probe measurements, and collection of samples for nutrient and phytoplankton analysis. On the basis of present progress, decided that NJW will soon not necessarily have to join in every trip. The improved 'division of labour' allowed NJW, Mr Muhoza and

myself to concentrate on microscopy and techniques for assessing the diversity of the microplankton. The national team spent much of the day reviewing data collected so far - and gave regard to possible modifications to the existing sampling programme. All supported a number of amendments that I proposed in order to (a) achieve a better focus on the main job in hand i.e. the effects of pollution on biodiversity - not just chemical analyses, (b) a programme that would provide more, and in some ways, more accurate and precise, information, and (c) more extensive coverage of the lake. (Other improvements have since been, and will continue to be implemented now that NJW is stationed permanently in Kigoma, and in touch with myself by ever-improving telephone, facsimile and E-mail facilities.)

Thursday 11th December: Mr Lyoba and NJW concentrated on chlorophyll$_a$ analyses, while Mr Muhoza and I continued with our deliberations over microscopy and the generation of phytoplankton diversity indices - *in an all-important, simple and repeatable manner*. This highlighted the extremely good value of the Zeiss transmission microscope (lent to the project by IFE). Problems still remain however, over the (accurate) estimation of the extremely low population densities of these organisms (and the corresponding 'limit-of-detection' chlorophyll$_a$ levels) that characterise Lake Tanganyika - and as highlighted in the PSS Baseline Review.

Discussed with Mr Lyoba, NJW, Mr Chitamwebwe and Mr Katonda, the lines of responsibility that should be followed in the event of poor performance, other problems or disputes. This was raised following the 'disappearance' of staff for considerable lengths of time, and this following assertions that the staff normally work from 0730h-1530h or 1600h 'without a break'. TBW suggested that if this were to continue, the PSS programme would essentially stop; an arrangement for maintaining staff presence - and what is more, in harmony with the consultants' working schedules - had to be made. In the event, it was agreed (and subsequently written into each staff person's TOR) that the 'core' work period would be 0800h -1230h and 1300h -1500h. It was also agreed that in the event of Public Holidays falling on a weekend, they would be carried into the following week. It was also agreed, however, that these times could be altered to allow earlier starts for sampling at e.g. Gombe, and later leaving work to attend to immediate treatment of samples on return from the field.

In the absence of the PSS Co-ordinator (TBW), NJW is charged with maintaining good working relationships, sound field and laboratory practice and attention to health and safety issues. Otherwise, Mr Lyoba is in overall charge of the laboratories, with Mr Kadula having particular responsibility for the 'wet laboratory'. Disputes and decisions that cannot be resolved between these persons and the other PSS staff, are to be settled in consultation with Mr Chitamwebwe or (in his absence)

Messrs Katonda and/or Kajelelo. In any event, each person (including NJW) has his/her own Terms of Reference - which may be modified, as appropriate and at the discretion of the PSS Co-ordinator.

We identified the following outstanding and urgent equipment needs (primarily a consequence of bottles and other containers that were lost in the fire in Dar Station):

- 50-ml plastic 'Blue-top' tubes
- 15-ml ditto above
- 6-ml glass centrifuge tubes - length 10cm
- 2.0 litre, 1.0 litre, 0.5 litre, 0.25 litre, 0.1 litre clear (plastic/polythene) sample bottles
- 6v, 15w bulbs (with collar) for Zeiss compound transmission microscope
- 6v, 21w bayonet bulbs for Vickers microscope
- 6v, 20w for Leitz Labovert F.S. microscope '?' halo light
- p/c and printer
- black tiles
- 'bench-coat'
- generator spark plugs
- rolls of absorbent paper
- microscope slides
- plastic Petri dishes
- calculator/s

These will be obtained as soon as possible. NOTE: Alex Kirika took out a considerable amount of these items in January 1998.

This last full day in Kigoma for CF and myself, was taken up with (a) labelling and re-organising drawers and cupboards, (b) further drafting the of the Tanzanian personnel Terms of Reference, and (c) progressing with the drafting of 'standing instructions' for the field and laboratory activities and schedules.

Discussed with Els Bosma (LTR), the availability of LTR and TAFIRI staff for LTBP duties over the period to end March 1998 which might be taken up with the LTR's hydrodynamics cruise and associated zooplankton studies - the latter involving Mr Muhoza. In essence there seems to be enough flexibility and good-will on both sides to ensure satisfactory collaboration and co-operation. In this connection, discussions with senior TAFIRI staff highlighted the fact that new staff - in addition to Dr Chale and Miss Wiltshire - include a Mr Longinus who is

shortly to return to TAFIRI following his M.Sc. studies in Finland (but no details, other than ‘environmental chemistry’ on what his thesis covers).

The following equipment and other items (duplicated for Kigoma and Mpulungu) was brought out by IFE on loan to the project:

Battery charger
Ultrasonic cleaner, instructions and cable
1 tube, Silicone grease
'Ultraclean' formula
6 Packets of microscope lens cleaning tissue
Instructions Deva plug extension leads
2 Gang plugs/surge protector
6 black Pentel pens
1 Photocopy of "Hydrobiologique of Lac Tanganyika" (algal illustrations)
Foil, 90 metres
Centrifuge tubes - 50 ml x 50
ditto 14 ml x 80
Photocopy ‘Le Phytoplancton' by Ludo Van Meel (algal illustrations)
Allen keys x 2/ 1 x 0.028-5/32 AF 1 x 0.7-4 mm
Digimatic caliper (black box) gauge) x 1
Microscope objective spare x 1
Microscope bulbs 6v 15w bayonet fitting x 4
1 dissection kit
10 pipette tips
1 small bottle-brush (*ca* 4 cm diameter)
1 large bottle-brush (*ca* 1-cm diameter)
Vickers microscope base
Laptop computer + battery pack, mouse, adaptor and cable (1 only - for NJW)
Vickers microscope binocular head (grey)
Zeiss microscope stage with substage condenser + stage adjuster
Zeiss binocular head
Zeiss lamp + cable to transformer
Objective head for Zeiss
Oxygen probe fluid
Vickers binocular head + 2, 10x eye pieces
7 Objectives (listed separately) + 2 x 8 ocular eye pieces
Connector for mains -Vickers microscope
Unicam absorption cell (4-cm) cuvettes

Electronic micrometer
Camera lucida drawing instrument
15 Lund phytoplankton counting chambers
Pipette tips
Box of cuvettes
Cover slips assorted
4th Vickers ocular
5 bulbs for Zeiss microscope
haemocytometer (box + other components)
2 short bottle/cylinder brushes
2 surge protectors
2 long bottle/cylinder brushes
1 box no. 0. 220 mm coverslips

Friday 12th December: last day in Kigoma: packing, farewells and flight to Dar es Salaam *via* Tabora - very, very cramped plane! De-briefing in Andy Menz' office.
Saturday 13th December: further attention to staff Terms of Reference and a fuller than hitherto statement regarding changes to the sampling regimes and schedules for the Kigoma-Gombe zone of the lake. These texts were faxed (and E-mailed 15-12-97) to NJW in Kigoma - see below.
Sunday 14th December: worked on the BTO of this trip and gave further attention to the new sampling regimes and schedules. Otherwise a lazy day.
Monday 15th December: meeting with Francis Chale re- his possible appointment to the PSS as a senior researcher and facilitator. Worked on ToR for Francis' post. Completed (a) text on new sampling strategy, and (b) staff ToRs - and faxed these from Andy's office to NJW in Kigoma. The main points in the document concerning sampling, are as follows:
Please attend first to the following, which I view as the main priorities over the next 6 weeks:

1. The establishment of two point (not transect) sampling sites - in the Jacobsen's area and in TAFIRI Bay - in addition to the present Kigoma Port Bay transect (see below); take duplicate 0-10m tube samples for TP, SRP and SiO_2, and duplicate 5-min phyto-net concentrates, and record with probes and Secchi as at present.

2. Think hard about replacing the Kigoma Bay transect with a point sampling site - and analysing the nutrients and recording with probes and Secchi as at present.

I suggest approx. 200m off shore with each of these sites but record the depths at these locations - we may alter later.

3. Gombe - I am not too enamoured with the present exercise - a long (and expensive) trip for so little. I suggested to Francis that we would learn much more if we operate point sampling sites - say a total of 10 more or less equally spaced between TAFIRI and Gombe (or just north of the stream) - again ca. 200m offshore (record co-ordinates as always) - and analysing the nutrients and duplicate 5-min phyto-net concentrates, and recording with probes and Secchi as at present.
4. Could you give some thought to preliminary forays in Kigoma Port, TAFIRI, Jacobsen's and Gombe 'Bays' with regard to the sampling of underwater substrata and their 'Aufwuchs'/ epilithics or whatever, PLUS associated water - for TP, SRP and general pH, conductivity etc.

5. In relation to 4 above, Francis met and introduced to me a pal (in the airport) who is someone high up in the Kigoma Port Authority. There is no reason why we cannot go right into the polluted zone once we've arranged a meeting with him - I'll send his full address in due course.

6. I stress, give thought to these changes and developments over a number of weeks - I am not expecting changes overnight; indeed, I am hoping to send AK out to Mpulungu with you to set up the laboratory there fairly early in the new year - i.e. at least set off before the end of January. So, decide the best chronology for the various tasks. At the very least, this prioritisation should ease things somewhat. We cannot afford to do everything that is 'interesting' or 'exciting' - let's settle on the things that are feasible, and above all 'to the point' i.e. some measure of pollutant status linked to some measure of biodiversity - at two sites to all intents and purposes similar (the same?) in all respects except the pollution stress. For both of us, I suggest phosphorus fractions along with the probe readings and Secchi, alongside plankton arrays might be the simplest - followed by phosphorus or some visual measure of oil (for example) and stuff scraped off of stones or other substrate beyond the splash zone.
Tuesday 16th December: further discussion with Francis and development of the ToR for his planned post. Drafted diary notes. Packed and taxied to airport for departure at 0055h (Wednesday 17th December).

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5 February 1998