

# Building and maintaining the capacity for biological monitoring.

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## Abstract

In the last decade capacity building programmes have trained a considerable number of people to monitor the benthic fauna of the Andaman Sea coast of Thailand but yet when the Boxing Day Tsunami struck there were no data available by which the impact on offshore sediments could be assessed. This paper draws on experience of some of these training programmes and concludes that if a capacity to monitor and manage sediments is to be developed:

- 1) Scientists need to make greater efforts to engage policy makers
- 2) Training must be ongoing and locally or regionally driven
- 3) Documentation must be delivered via a diversity of media
- 4) Once trained, staff should be able to develop a career without changing speciality

When the Boxing Day tsunami hit the Andaman Sea coast of Thailand millions of tonnes of sand were picked up from the ocean floor and deposited on coastal land. Satellite images taken shortly afterwards also showed that vast quantities of mud from the seafloor had been raised into suspension and redeposited. The seafloor invertebrate communities, whose composition and productivity is closely linked to the granulometry of the sediment, must have been massive but nobody has been able to quantify the extent of the damage to them. Even though much of the coast of Thailand is sedimentary and the sediment-dwelling biota underpins all local fisheries little information on the biology of sand and mud habitats offshore was available. On the other hand, information on some of the local coral reefs and seagrass beds was readily to hand.

The situation following the tsunami is symptomatic of a lack of basic information that strongly limits the region's ability to track the biological effects of climate change and undertake routine monitoring and surveillance of the condition of the sea. Taking the specific example of the Andaman Sea coast of Thailand we have to ask why no information on the seafloor biota was available when we set out to assess the offshore effects of the tsunami. The reasons for the lack of information might result from a lack of perception of the ecological importance of benthic habitats or a shortage of trained staff, infrastructure or finance but more probably it relates to a combination of all four factors.

In the years before the tsunami there were a number of efforts undertaken to build the capacity for biological monitoring of sediment habitats on the Andaman Coast of Thailand. DANIDA has supported the Phuket Marine Biology Centre for many years and has assisted the training of many Thai scientists [1] and in the last decade the present authors have undertaken a series of training programmes (with funding from both UK and European Union sources) specifically designed to increase awareness and knowledge of sediments. In the light of these earlier capacity building efforts we need to re-examine the knowledge gap concerning the offshore biota of the sandy and muddy sea floor. As the problems that may have contributed to poor understanding do not appear to be unique to Thailand, the discussion should have regional significance. Indeed, a regional approach to building capacity may be the most appropriate and most sustainable route.

**1. Did previous capacity building foster a will to monitor sediment habitats before the tsunami? Did it educate the right people?**

All previous capacity building programmes for the management and monitoring of sediments had concentrated their efforts on the education and research sector. In retrospect it is unlikely that enough effort went into educating policy-makers and politicians. No matter how many people are trained they must have a setting in which they can use their new-found skills.

If monitoring is to be put in place, first and foremost there must be a will among politicians and government policy makers to initiate, fund and staff the monitoring programmes. Without long term commitment from such people, any capacity building initiative has no effective context will find it difficult to succeed. These people control

the finance and for a monitoring programme to be a success there must be an investment in equipment, infrastructure and people. The sums of money concerned are not trivial and before funds are committed the budget holders must be convinced that the reasons for spending are valid and must be aware that if scientific monitoring is to be useful funding must be sustained. A long-term financial commitment can only come from the conviction that monitoring underpins any attempt at coastal management and to get to this level of buy-in effective communication between scientists and policy makers is vital. Achieving successful communication between practitioners and policy makers is not simply a matter of holding an occasional meeting but of making a concerted and well-targeted effort to educate. In Europe it has become increasingly common to invite policy makers to join the advisory groups that commonly oversee the management and development of strategic research projects. This inclusive approach, while once uncommon, has now become part of the day to day operations of a post-tsunami monitoring capacity building project operated by the present authors in Thailand. The project staff hold regular meetings with provincial governors and their key advisors to brief them on progress, to involve them in shaping the project and to persuade them that not only are project outputs useful to them, but that some elements of coastal monitoring should eventually become their responsibility.

The interests of the policy maker will be far better focussed if the concern for the health of the ocean that he or she hears is not just from scientists but from coastal zone stakeholders. In one recent and one ongoing EU funded project in Thailand the authors have put considerable emphasis on educating people in local villages about the sea, the way it functions and its biodiversity. But while we have held meetings

with fishermen and village elders, by far the greatest enthusiasm for this new information has come from school teachers. In Thailand the responsibility for the content of a significant proportion of the school curriculum has been devolved to the provincial level and our projects have been very happy to help teachers develop lessons with a marine environmental focus. Our hope is that lessons learned at school will be carried home by the children and repeated to parents.

In all probability, before the tsunami few people, outside the local NGOs saw the need to monitor the biological resources of the Andaman Coast of Thailand. People saw immediate problems such as disputes among fishermen exploiting common resources but there was little evidence that there was any commitment to a long-term strategic view of management. Although fish catches were seen to change there was little connection with environmental variability. Interviews that we conducted after the tsunami in villages that had suffered damage and loss of life suggested that, at least locally, attitudes had changed and surveillance was generally thought to be necessary.

## **2. Did the right skills exist to monitor coastal biodiversity?**

There were a small number of well-trained people but they were not necessarily in the right job for their skills to be put to good use, nor were there mechanisms in place to foster skill development.

The ability to undertake biological monitoring and surveillance calls upon a wide variety of specialist skills and these skills need to be developed and maintained if a critical mass of capable people is to emerge. To monitor the coastline impacted by the tsunami would require biological identification skills across a range of phyla,

mapping skills and data synthesis, interpretation and analysis skills. While all of these skills existed in Thailand at the time of the tsunami, they were in short supply and there is no evidence that the small number of experts had ever come together to examine the offshore biota or to monitor it. At the time of the tsunami there was a lack of effective capacity that could only be remedied by training new specialists. However, training or re-training is a lengthy process with a number of steps.

### **2.1 Developing and disseminating skills.**

The first level of skill development occurs during formal education in universities and colleges. Where there are enthusiastic specialists on the teaching staff, students will be exposed to experiences in both field and laboratory that will stimulate and interest them. Unfortunately experts are in short-supply across the universities and it is difficult to be sure that all monitoring skills that capacity building workshops had conveyed to teachers were widely taught. It cannot be easy to teach a subject where until recently the only relevant specialist text books for students were expensive foreign imports. Nevertheless in the last few years the quality and range of locally produced books has increased partly, at least, as the result of international capacity building efforts.

It is unclear however how extensively these locally written texts and their associated classroom teaching material are used within their country of origin but certainly language barriers prevent them being adopted in neighbouring states. It is pointless to write the same text twice but it appears that there has been little call for the exchange and translation of specialist texts and teaching material even between adjacent countries. This is a clear area where regional coordination of capacity development

would be to the advantage of all. A regional centre might have a role in identifying key teaching material, dealing with associated intellectual property issues, translating literature, identifying a user community and dissemination.

The experience of the authors and the consideration of many capacity building efforts would suggest that the first and most important route for the dissemination of information is the Internet (Kendall et al [2]). Certainly for those who have access, this is the most immediate and economical way of exchanging information. Attractive documents can be created quickly and cheaply and they can be made fully interactive. Furthermore, provided that there is somebody with the time and skills to assess and enter new information, the documents provided on websites never need be out of date. Finally, with a well designed website translation is a relatively straightforward process.

The web is already used extensively for the dissemination of information that is relevant to monitoring and surveillance; there are sites setting out sampling methods, sites with identification guides and sites for data analysis. In countries such as the UK some government departments and large companies have used the web to display surveillance information. Elsewhere, many collaborative partnerships exchange project data over password-protected web pages and use webcams to give face to face contact between partners. Some of these websites appear to work well but on others a lack of appreciation of the full potential of the medium appears to be lacking. One field where recent developments have great potential is distance learning.

There are many advantages to web-based dissemination but there are disadvantages too. There are many parts of South Asia where both telephone and electrical services often fail and hence the Internet can never be fully relied upon. Furthermore, many places still use dial-up services that are far too slow to deliver the full potential of web pages designed for broadband. In higher education establishments computer student access to internet- capable computers can be limited and restricted to university premises and so students do not always have ready access web-based information. In short, the web isn't ideal for everybody and parallel means of information dissemination must be considered. While compact disks lack the immediacy of the Internet they are easy to produce and disseminate and will preserve most of the functionality of a website without the need for reliable high bandwidth phone lines. For use with teaching material that does not quickly become out of date they are a useful and cheap way to disseminate specialist knowledge. Inevitably information does become outdated a second or third edition of a CD is far cheaper to produce than a new edition of a text book. However, books, leaflets etc still have a strong role to play, particularly in the earlier stages of learning at university level and in all outreach activities whether to policy makers or stakeholders.

Communication is a two way process and while during training much of the information flows from instructor to student as expertise grows there may well be a need for the developing researcher to contribute data or information to a common website or database. This can be a difficult process, particularly with older researchers; when the present authors set up an interactive website to trap information for polychaete identification in Thailand (Kendall et al [2] we found that while many people were happy to use the information synthesised by the project team, very few

people, even after a week-long training course were willing to add new information to our website. We cannot be sure if this reluctance was due to lack of confidence in their technical ability, an unwillingness to share information, unfamiliarity with the internet or some other reason. We have to conclude that provision of information alone is not enough if new efforts to collect synthesise and disseminate biological information are to be undertaken than effort must go into all areas of training and not just simply concentrate on technical content

## **2.2 Maintaining the skill base.**

Once a student has graduated with either a first degree or a research degree and found a job if they are to work within marine monitoring and management they must find a way to refine their skills. In the first instance this generally means locating a local expert who has the time to train them. As has already been indicated, national experts are in short supply and to develop their career students must call in foreign experts or travel abroad.

Travel and subsistence is expensive but with organisation at a regional level much can be done to use the limited funds for learning rather than travel. Regional training workshops in other fields they have proved a success; they bring together the specialists and those willing to learn. These meetings have a further advantage in that, if well- managed they form the basis for a knowledge transfer network with students and teachers maintaining electronic communication with each other after the course finishes.

Inevitably the specialist nature of their training will dictate that the monitoring specialists within a country will belong to small and select group. For example, we know of only three people in Thailand who are highly skilled in the identification of the polychaete worms that dominate the fauna of the sediment seafloor. It is very difficult maintain the level of skill needed for consistent and reliable work with such a small number of people and once again, regular communication between regional specialists is called for. While day to day contact electronic contact is vital, there is little substitute for regular face-to-face encounters at workshops or other meetings.

As the number of experts within a country is inevitably small, the function of monitoring teams is easily disrupted by the loss of a single member and it is unfortunate that when national resources are limited even trained experts are moved to new jobs that call for other expertise. If a monitoring function is to be maintained it is vitally important that these specialists are offered a career path along which advancement does not have to mean a major shift of job. Unless that is accepted, continuity of monitoring will be lost and the responsibility for training replacement specialists will revert to expensive international experts.

Following the tsunami the coastal resources of the Andaman Sea were surveyed by many people, many of whom were visiting Thailand for the first time. In country experts were able to repeat surveys of coral and seagrass beds. Intertidal ecological changes were recorded by a joint team of expatriate scientists and Thai colleagues but as only a single data set on the distribution of offshore sediments of a very restricted part of the coast existed there was little research done offshore; hence the gap in our knowledge.

### **2.3 Exchanging knowledge**

Monitoring the shallow water ecosystems of the Andaman Sea Coast of Thailand requires an extensive knowledge of the local biota but in a recently completed PhD study (Barrio-Frojan et al [3]) it was found that around 75% of the polychaete species encountered were new to science. Similar conclusions would undoubtedly be reached for other taxa.

While the lack of a scientific name for a species does not necessarily impede monitoring or management it highlights poor communication of scientific information. It is highly improbable that scientists have never encountered these species before but our lack of knowledge of them more likely reflects failures in scientific communication. People found animals that couldn't be recognised because there were no texts, they couldn't turn to an expert to help them because there was nobody local and they had no foreign contacts. As a consequence of the lack of accessible resources, the animal was not recorded and was effectively forgotten.

The attempts of the present authors to address the inability to trap knowledge by creating a website for the online exchange of taxonomic information were referred to above (Kendall et al [3]). While our website had low regional take-up for many of the reasons detailed above, we believe that this approach to building capacity should not be abandoned. However to make online exchange of knowledge work our experience suggests that the following must be taken account of:

- There must be a critical mass of users who actively want to use the information. This user group must meet together often sufficiently often to

develop a commitment to each other as well as the common purpose.

Enthusiasm is critical to success.

- It is unlikely that in a field such as the development of taxonomic skills the critical mass will ever develop in a single country and hence a regional approach is called for.
- If a website is developed on which information can be shared it must be designed to a lowest common denominator in web performance. Until there is greater access to broadband facilities it will be necessary to keep the website simple.
- If the come group of users is ever to expand it will be necessary to translate the site into local languages. It is difficult enough to cope with new scientific without having to struggle with a foreign language as well. The same is true for supporting literature and other project documentation.

#### **2.4 Conclusions on training**

It is unlikely that a shortage of capacity of the type made evident in Thailand at the time of the tsunami is unique to the country. Staff are both difficult and expensive to train and once trained a critical mass of active specialists is difficult to maintain. With restricted levels of within-country funding unlikely to be relaxed it is suggested that internationally sharing resources might be a cost effective approach to building and maintaining the skill base needed to monitor and manage regional coastlines. The establishment of cooperation of this kind could only come about with the backing of governments and international agencies.

## References

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