



DST/NRF Centre of Excellence
at the
Percy FitzPatrick Institute

The 3rd Biodiversity Conservation Academy, 19 – 23 January 2009

The 3rd Biodiversity Conservation Academy, a joint venture between the DST/NRF Centres of Excellence for Invasion Biology (CIB) and for Birds as Keys to Biodiversity Conservation at the Percy FitzPatrick Institute, was held at Potberg Environmental Education Centre in De Hoop Nature Reserve from 19 – 23 January 2009.



The Academy was attended by 14 students selected from across South African universities, three of whom were interns from the South African National Biodiversity Institute. Of the 14 students who attended the academy, 9 were from historically disadvantaged backgrounds.

Eight academic and support-staff from the two centres, and two volunteers, helped with the management and running of the academy. Included in the staff were the Directors of the two centres, Profs Steven Chown and Phil Hockey. The 5-day programme of the Academy immersed students in an intensive series of theoretical, practical and philosophical discussion and field-work sessions on biodiversity conservation. The main aim of these sessions was to improve student appreciation for the complexity of biodiversity, sharpen their knowledge and skills required to assess it, and broaden their knowledge of the theory and practice of conservation in a South African context.



There were no formal lectures. Instead, after a brief introduction to a topic, Academy staff led informal discussions, guiding the discussions with questions, and actively encouraging questions and answers from all participating students. The students were split into two study groups; one group examined the influence of alien vegetation at different scales in Potberg and the other looked at issues surrounding the conservation of long-lived species, using the African Black Oystercatcher *Haematopus moquini* as a model. The two groups then switched roles and later convened for a general report-back of the two topics and for further discussions. Students were also given a number of relevant articles for reading to help guide their thinking.



Day 1 – Monday

After travelling from Cape Town and Stellenbosch, the programme started mid-morning with a session on getting to know the various levels of biodiversity, to tackle the question “What is Biodiversity”. An introductory session on issues surrounding

the conservation of long-lived species followed. The final session of the day focused on approaches to measuring biodiversity, with the students prompted to think critically about the influence of scale and experimental design on measuring biodiversity. These sessions laid a foundation for the main activities of the next two days.



Day 2 – Tuesday

After breakfast, 50% of the students (Group A) departed for the oystercatcher field surveys. These activities included a) a survey of the breeding and non-breeding oystercatcher population in de Hoop Nature Reserve (for comparison with historical data going back to 1980); b) collection of mussels from the shore and the driftline (to assess the extent of invasion by the alien species *Mytilus galloprovincialis*); and c) collection of chick middens (shells that accumulate where adults feed their chicks) – these could also be compared with historical diet. Students were also exposed to the art of locating and capturing oystercatcher

chicks, which were subsequently measured, ringed and bled for genetic analyses.



The other 50% of the students (Group B) stayed behind, and with assistance from academy staff, discussed and settled on an appropriate sampling design for measuring the influence of alien vegetation on plant diversity at several spatial scales in Potberg. After a short lunch, the group gathered the required equipment and went to the field for the rest of the day to conduct their vegetation surveys. This involved identifying and counting all plants within a standardised series of sampling plots. The evening was spent identifying samples from the plant surveys and entering data into a computer spreadsheet.

Day 3 – Wednesday

On this day the two groups switched roles. In the late afternoon, back at the centre, lines of mist-nets that were set to capture birds around the education centre were

opened. Students were given hands-on experience of handling birds, as they learned how to remove the birds from the nests, measure and ring the birds, record their moult and take a blood sample before release. The evening was again spent processing samples and entering data from the plant surveys.



Day 4 – Thursday

After completion of the field sampling by both groups, staff and students convened to discuss lessons learnt from the two-day field exercises and to identify questions to be addressed with the data. The groups then split up to analyse their data independently in Excel spreadsheets and graphs and to prepare PowerPoint presentations. After an early lunch, we visited the limestone fynbos to view and discuss the dramatic species turnover between the adjoining mountain fynbos and limestone fynbos. On our return to the Centre, the students continued working on their presentations and the rest of the

evening was spent relaxing around a campfire.



Day 5 – Friday

The last day of the academy started with an early morning bird ringing and final preparations for the PowerPoint presentations. We paused for breakfast and thereafter convened for a lively student PowerPoint presentations of the key findings of the bird and vegetation surveys. The oystercatcher project was geared at testing two main hypotheses:

- Protection of de Hoop as a nature reserve in 1990 (leading to less disturbance) increased the carrying capacity of the area for oystercatchers; as a result, numbers of breeders increased.
- Ten years later, following invasion of the shore by an alien mussel species, food supply ostensibly increased and carrying capacity increased once again. This in turn led to a second increase in the size

of the oystercatcher breeding population.

The key findings of the student project were as follows:

- Oystercatcher numbers at de Hoop did increase following protection in 1990, implying an increase in carrying capacity. This increase happened too rapidly to be explained by intrinsic reproduction of the de Hoop population and could only be explained by the absorption of floaters (sexually mature non-breeders into the population). Our surveys revealed that there were several floaters present in the Reserve.
- Unlike at many sites on the (more productive) west coast, oystercatcher numbers did not increase further following invasion of the area by *Mytilus* in the 1990s, implying that (again, unlike the west coast) invasion by *Mytilus* did not increase carrying capacity.
- Unlike the west coast, *Mytilus* did not dominate the intertidal invertebrate community at de Hoop. Relative to the native Brown Mussel *Perna perna*, *Mytilus* were uncommon on the shore and, on average, individuals were smaller than *Perna*.

- The diet of oystercatchers has changed since the 1980s/90s, with a greater prevalence of mussels in 2009. However, the mussels in the diet were almost all *Perna*, implying that oystercatchers were avoiding *Mytilus* (probably because most were too small to be profitable).
- The failure of *Mytilus* to dominate the de Hoop shoreline probably results from the area experiencing regular siltation events. Unlike the native mussels, *Mytilus* is intolerant of siltation and the population is thus regularly ‘knocked back’ before it can achieve dominance.
- This highlights the fact that not all alien species will invariably behave in the same way in terms of their interactions with native fauna. For example, the west coast paradigm that *Mytilus* will increase the carrying capacity of the shore for oystercatchers may not hold true on the south coast (with concomitantly different conservation implications).



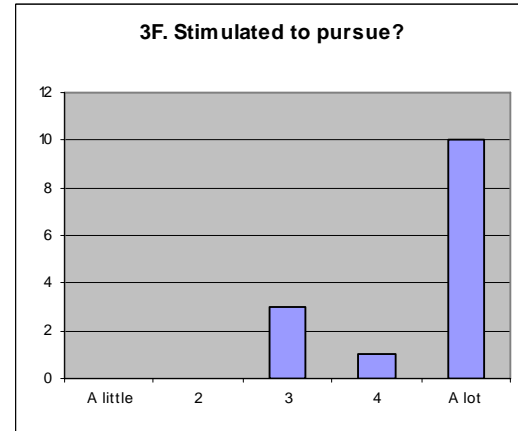
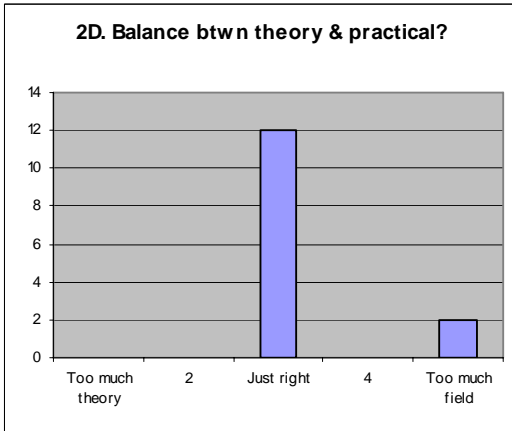
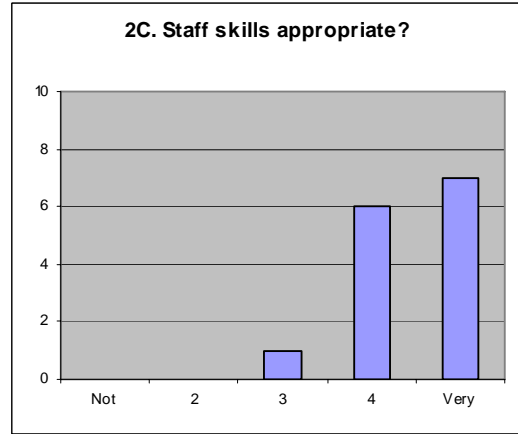
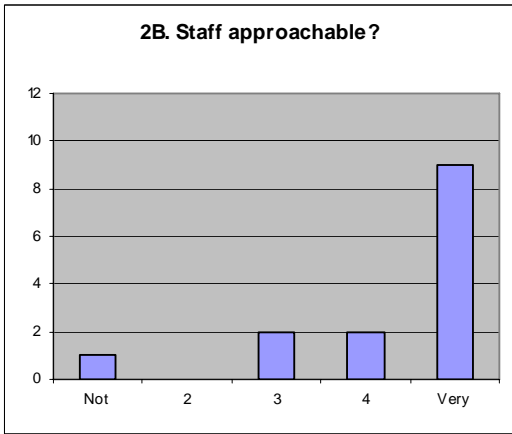
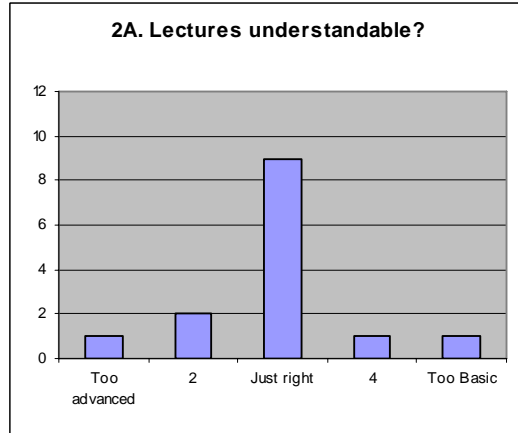
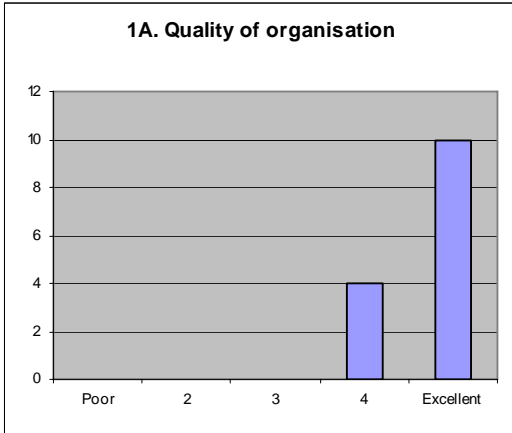
The students provided an excellent PowerPoint presentation of the above, indicating that they understood not only the patterns displayed by the data, but also the biological processes underlying these patterns.

After an early lunch break, we all packed our luggage and were ready to hit the road back to our normal work and study routines.

Student evaluation of the course

Before departure on the last day, the students were asked to evaluate their experience of the academy. The response was overwhelmingly positive (see graphed responses to coded questions below). The students really liked being involved and learning about project planning, design, and presentation skills. They also particularly enjoyed the close interaction and discussions with experienced scientists and peers.





Appendix 1: Biodiversity and Conservation Academy Student Participant Details

	First name	Surname	R/G	University
Ms.	Jessica	Dawson	WF	UCT
Ms.	Minette	Karstens	WF	U. Stellenbosch
Ms.	Gina	Louw	WF	UCT
Ms.	Catherine	Browne	WF	UCT
Ms.	Esme	Kruger	WF	NWU
Mr.	Divhani	Mulaudzi	BM	U. Venda
Ms.	Rabelani	Munyai	BF	U. Venda
Mr.	Tshepo	Sebake	BM	U. Limpopo
Mr.	Matabaro	Ziganira	BM	UKZN
Mr.	Tshililo	Ramaswiela	BM	U. Stellenbosch
Mr.	Fulufhelo	Mukhadi	BM	U. Stellenbosch
Ms.	Ntombifikile	Phaliso	BF	SANBI
Mr.	Caswell	Mavimbela	BM	SANBI
Ms.	Innocentia	Mahlabegwane	BF	SANBI

Appendix 2: Biodiversity and Conservation Academy Programme

Introduction

Welcome to the Biodiversity and Conservation Academy. You have been selected to join the Academy for an intensive series of theoretical, practical and philosophical sessions on biodiversity and conservation. The major aim of these sessions is to improve your appreciation for the complexity of biodiversity, your scientific knowledge and skills required to assess it, and your knowledge of the theory and practice of conservation in a South African context.

Modern science can be done in several ways, but all of them require careful thought by individuals, clear communication between them, and a willingness to participate, at least occasionally, in team-based research. Modern conservation biology and biodiversity science are no exceptions. In consequence, we will be expecting you to undertake work in groups, discuss matters based on your own, informed views, influence group decision-making by clear and quiet argument, and present your views or those of your group to the Academy as a whole.

The Academy does not operate in the same, formal way as a University. You will be expected to deliver excellent quality work and to be diligent about the tasks you perform. However, you will have virtually round-the-clock guidance and mentoring and on-going interactions with a unique group of skilled scientists. In addition, you will have the opportunity to raise questions about any aspects of biology and conservation in South Africa and elsewhere. What you gain from the Academy will depend as much on how you make use of this unique opportunity as it will on the theoretical and practical work you will be doing.

An important point that we must make from the beginning is that this course is not about hands-on conservation management. That is, we are not going to teach you how to mend fences, capture game for auction, or clear an area for a tourist camp. Rather, this course is about the science of biodiversity and the science that underpins sound conservation management. Therefore, the emphasis is on the science and how that science can inform conservation planning and implementation. It is this scientific understanding that is in such short supply in South Africa. The Centres of Excellence Programme is about improving the pool of skilled scientists in South Africa, and of the eight Centres of Excellence that have been established and funded by the Department of Science and Technology, with management help from the National Research Foundation, four are concerned with biodiversity and the scientific basis for its management. This Academy is a joint venture between two of them: the Centre of Excellence in Birds as Keys to Biodiversity Conservation (University of Cape Town), and the Centre of Excellence for Invasion Biology (Stellenbosch University).

Academy Staff

Steven Chown. Steven works in the fields of macroecology, community ecology, biogeography, conservation ecology, evolutionary physiology, invasion biology and global change biology. Much of his work has been on insects and plants on Southern Ocean Islands and in South Africa, but he has also worked on marine and terrestrial vertebrates, and at global scales.

Phil Hockey. Phil works in the fields of general ornithology, coastal and estuarine bird ecology, bird migration, life-history evolution, and conservation biology. Much of his work has focused on coastal shorebirds and their interactions with food supplies at scales from the local to the global. He also runs the highly successful Oystercatcher Conservation Programme, developing a conservation strategy for the African Black Oystercatcher and other coastal species.

Brigitte Braschler is a postdoctoral fellow at the C-I-B. Her research to date focused on biodiversity patterns at small to large scales and the effects of different drivers of environmental change (climate change, habitat fragmentation) on biodiversity and interactions between species. She works mostly with insects, often ants, in Europe and South Africa.

Douglas Loewenthal is a postdoctoral fellow at the CoE at the Percy FitzPatrick Institute. Doug coordinates the Oystercatcher Conservation Programme, and examines how the interaction between life history and the environment influences oystercatcher survival, breeding success and dispersal under differing conditions around the coast of South Africa.

Peter le Roux. Peter is interested in community ecology and global change biology. His research has mostly focused on the biological consequences of climate change on sub-Antarctic Marion Island and on spatial variability in plant interactions. He is currently a Post-doctoral fellow at the C-I-B.

Suzaan Kritzinger. Suzaan has managed several Working for Water programmes, responsible for removal of invasive alien vegetation, on private land and in provincial parks and national reserves. She is responsible for the management of field surveys and field work for the C-I-B. Her main area of interest is in fynbos botanical diversity.

Mawethu Nyakatya is the Research Management Intern of the C-I-B and has a Master of Science in sub-Antarctic ecology. He assists with management of the C-I-B's research programme, including field sampling programmes, reporting and liaison with funding bodies and higher education institutions.

Graeme Oatley is a PhD student at the CoE at the Percy FitzPatrick Institute, studying the phylogeography of Cape and Orange River White-eyes.

Tshililo Ramaswiela is an MSc student at the C-I-B. His study focuses mainly on mapping the geographical distribution of alien vascular plants on sub-Antarctic Marion Island.

Fulufhelo Mukhadi is an MSc student at the C-I-B. His study focuses on the phenology of indigenous and alien flowering vascular plants on sub-Antarctic Marion Island.

Academy Session Layout

Day 1, Monday 19th

10:30: Arrive at Potberg Environmental Education Centre (breakfast on the road); settle in to accommodation; tea/coffee will be available

11:30: Assemble in main discussion area for a short discussion of house rules and expectations (30 minutes); division into study groups

Session 1

A. Getting to know biodiversity

12:00: Concepts

1. Biodiversity – a biology of numbers and difference.
2. The genealogical (information) and ecological (energy) hierarchies.
3. Surrogacy and complementarity.
4. Threats to biodiversity.

13:00 -14:00: Lunch break (1 hour)

14:00: Questions

1. What levels to focus on and why?
2. What is an individual, a population, a species, and a family?
3. Make a list of 10 species in the immediate (c. 250 m radius) vicinity of the Centre.

15:00: Report-back

Each group to select one rapporteur for each of the questions. Five minutes initial report-back each and then open discussion.

16:00: Tea/coffee break for 30 minutes

16:30: Introduction to issues surrounding the conservation of long-lived species: background to the oystercatcher project.

Session 2

B. Getting the measure of biodiversity

17:30: Concepts

1. Thinking about scale in ecology and conservation biology.
2. What you do determines what you get – scale again.
3. Pilot studies, sampling and replication.
4. Quantifying biodiversity – pitfalls and procedures.

18:00: Questions

19:00: Dinner break

20:00: Backgrounds and interests – an informal discussion.

Day 2, Tuesday 20th

Session 1

C. Avian population dynamics and the oystercatcher field trip 1 (50% of students – Group A)

06:00: Breakfast (1 hour)

07:00 – 14:00: Oystercatcher surveys

D. Measuring diversity (other 50% - Group B)

08:00 – 13h00: In conjunction with academy staff, design a sampling programme to assess the influence of alien vegetation on plant diversity at several scales at Potberg. To answer this question the group will drive out to view the sampling areas that will be used.

14:00: Lunch break (1 hour)

Session 2

E. Invasive alien plants, climate change and conservation

15:00: Groups to prepare positions for and against non-indigenous species use

17:30: Bird ringing demonstration

19:00: Dinner

Day 3, Wednesday 21st

Session 1

F. Avian population dynamics and the oystercatcher field trip 1 (Group B)

06:00: Breakfast (1 hour)

07:00 – 13:00: Oystercatcher surveys

G. Measuring diversity (50% of students – Group A)

08:00 – 13h00: In conjunction with academy staff, design a sampling programme to assess the influence of alien vegetation on plant diversity at several scales at Potberg. To answer this question the group will drive out to view the sampling areas that will be used.

13:00: Lunch break (1.5 hour)

Session 2

H. Quantifying diversity and difference (Groups A & B)

14h00: Commence alien plant field sampling.

18h00: Return and start sample processing

19h00: Dinner

Day 4, Thursday 22nd

Session 1

I. Quantifying diversity and difference II (Groups A & B)

08:00: Return to field for sampling if necessary (both groups)

Or continue identifications

11:00 Data analysis and questions (coffee and tea available)

1. List the species for each habitat by families.
2. Produce accumulation curves for each habitat.
3. Compare the diversity of the habitats.
4. What effect does scale have?
5. What were the problems?

13:00: Lunch break (1 hour)

Session 2

14:00: Report-back

Each group to select one rapporteur for each question. Five minutes per rapporteur and then general discussion

Session 3

J. Field-discussion on Limestone Fynbos

16:00: Depart for limestone site (snacks in field)

1. How close did we get to estimating biodiversity?
2. Structure, function and identity – where to start?
3. What are impacts of the alien plants on other species?
4. What other aspects of biodiversity quantification exist?
5. How would you census birds in the same environments?

18:00: Return to Centre

19:00: Dinner break (1 hour)

Session 4

K. Conservation in South Africa: Science, policy and opportunities

20:00: Informal discussion

Day 5, Friday 23rd

Session 1 Avian population work

06:00: Mist-netting and bird-ringing

07:00: Breakfast (1 hour)

08:00: Analysis and discussion of oystercatcher population dynamics study

11:00: Early lunch

12:00: Pack and depart for Stellenbosch/Cape Town

Further Reading Provided

Primary Literature

- Chown, S.L., Sinclair, B.J., Leinaas, H.P. & Gaston, K.J. 2004. Hemispheric asymmetries in biodiversity – a serious matter for ecology. *PLoS Biology* 2, e406, 1701-1707.
- Chown, S.L., van Rensburg, B.J., Gaston, K.J., Rodrigues, A.S.L. & van Jaarsveld, A.S. 2003. Energy, species richness, and human population size: conservation implications at a national scale. *Ecological Applications* 13, 1233-1241.
- Gaston, K. J. 2000. Global patterns in biodiversity. *Nature* 405, 220-227.
- Gewin, V. 2005. Eco-defense against invasions. *PLoS Biology* 3, 2055-2071.
- Gotelli, J.N. & Colwell, R.K. 2001. Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. *Ecology Letters* 4, 379 - 391.
- He, F. & Gaston, K.J. 2000. Occupancy-abundance relationships and sampling scales. *Ecography* 23, 503-511.
- Hockey, P.A.R. *Haematopus ostralegus* in perspective: comparisons with other Oystercatchers.
- Naeem, S. & Wright, J.P. 2003. Disentangling biodiversity effects on ecosystem functioning: deriving solutions to a seemingly insurmountable problem. *Ecology Letters* 6, 567-579.
- Purvis, A. & Hector, A. 2000. Getting the measures of biodiversity. *Nature* 405, 212-219.