Department of Ichthyology and Fisheries Science

Honours 2017

RHODES UNIVERSITY
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Appendix 1a: Honours Projects 2017

This document includes a summary of the honours projects that are on offer this year. Some supervisors have offered numerous projects; however, a single supervisor is unlikely to accept more than two honours students onto his/her program. It is up to the supervisor to select which students they want on their program and which projects they will run with this year. Some supervisors prefer to work on a first-come-first-serve basis, but this is NOT a rule. The supervisor may interview all students interested in their project/s and is at liberty to select the most appropriate student/project combination based on the interviews. This process is not too different from a job interview process.

Students must please contact the supervisors for the projects that they are interested in and arrange a time to meet with the supervisor to discuss the project during the first week of the course. Students must have been allocated a project by the start of the second week of the course if possible.

1) Can farmed fish be used to remove microalgae in water treatment facilities?

Supervisor: Cliff Jones (DIFS) – c.jones@ru.ac.za

Co-supervisor: Richard Laubscher (EBRU) – r.laubscher@ru.ac.za

This project will contribute towards developing more environmentally sustainable methods of industrial water reuse. High rate algal ponds (HRAP) are an alternative, environmentally sustainable technology used to treat various effluents ranging from domestic and light industry wastewater (e.g. aquaculture, breweries and food processing plants) to domestic and heavy industry effluent (e.g. acid mine waste). However, the microalgae in the water after treatment in the HRAP contribute to the pollution of the water and these algae needs to be removed before the water can be released into the environment, reused or used in other downstream activities. Conventional methods of removing algae from treated wastewater require hi-tech equipment, are expensive, include unsustainable methods of chemical dosing or require lots of space and are often ineffective. This project will investigate the use of filter-feeding fish to remove micro-algae from HRAP effluent used to treat brewery effluent. The student will from part of a team that is working at our research facility at SAB Ltd in Port Elizabeth, so she/he will spend some the project weeks on site. Transport and costs associated with moving to PE will be covered by the project.

2) The effect of selected dietary fiber sources on growth, feed utilisation and the digestive physiology of juvenile South African abalone (*Haliotis midae*) fed formulated feeds

Supervisor: Dr Aldi Nel (aldipieterse1@gmail.com)

Co-supervisor: Dr Cliff Jones (c.jones@ru.ac.za)

Abalone *Haliotis midae* is a high-value culture species and optimising its nutrition and growth continues to be a research priority to ensure that the abalone industry in South Africa remains a world leader. Most of South Africa's cultured abalone is produced using artificial feed for which supplements have only recently been developed. The inclusion of macroalgae, which are rich in complex polysaccharides (Mabeau & Fleurence 1993), in the diet or dietary regime of formulated feed-fed abalone can improve feed utilisation in abalone (Nel et al., in review; O'Mahoney et al. 2014; Kemp et al. 2015). Similarly, the inclusion of cellulose in the formulated diet of *Haliotis fulgens* resulted in favourable feed conversion efficiencies in recent research (Monje & Viana 1998). The reason for increases in abalone feed utilisation when macroalgae is included in their diet is not known. In addition, very little is known about the fibre requirement of abalone fed formulated feeds. Since formulated feed include proteins of animal and plant sources and grain-derived storage carbohydrates, it has a relatively low fibre content.

The objective of the study would be to compare the effect of abalone growth, feed utilisation and digestive physiology when (1) non-soluble fibre cellulose, (2) fermentable fibre fructooligosaccharides (FOS) and (3) kelp meal is added to the diets of juvenile (20 mm) South African abalone, to those fed (4) a non-supplemented control diet. The study will be conducted over four to six months under commercial farming conditions. Characterisation of abalone digestive system parameters will include testing the effect of diet treatments on gut pH and the gut-bacterial communities.

The project offers the opportunity to network with the abalone industry's stakeholders and to gain experience in aquaculture practices. Although a growth trial can be maintained by staff on the farm, the project would require that the student spend a sufficient amount of time on the farm for data collection. The work must result in a publication.

References

Kemp, J., Britz, P. & Toledo Agüero, P., 2015. The effect of macroalgal, formulated and combination diets on growth, survival and feed utilisation in the red abalone *Haliotis rufescens*. Aquaculture, 448, pp.306–314.

Mabeau, S. & Fleurence, J., 1993. Seaweed in food products: biochemical and nutritional aspects. Trends in Food Science & Technology, 4, pp.103–107.

Monje, H. & Viana, M.T., 1998. The effect of cellulose on the growth and cellulolytic activity of abalone *Haliotis fulgens* when used as an ingredient in formulated artificial diets. Journal of Shellfish Research, 17, pp.567–671.

O'Mahoney, M. et al., 2014. Towards sustainable feeds for abalone culture: Evaluating the use of mixed species seaweed meal in formulated feeds for the Japanese abalone, *Haliotis discus hannai*. Aquaculture, 430, pp.9–16.

3) Preference of juvenile abalone (spat) for shelter type in the weaning section of a hatchery

Supervisor: Prof. H Kaiser (h.kaiser@ru.ac.za)

Co-supervisors: Dr CLW Jones (c.jones@ru.a.za); Matthew Naylor (matt@hik.co.za); Devin Ayres (devin@hik.co.za)

Motivation: HIK Abalone hatchery (Hermanus) keeps small abalone in large shallow tanks with inverted plastic cones, which they abalone use as shelter during the day. At night, the abalone move between cones, while they stay under them during the day. Farmers have observed an uneven distribution of abalone, whereby some cones are used more frequently than others. However, it remains unclear which cues attract the abalone to specific cones. We will design an experiment on the farm to offer the abalone a wide range of options and quantify their preference by counting the number of abalone and their size distribution under the cones. Results will be very beneficial for hatchery management because an uneven distribution of abalone reduces their access to food.

Work plan: The experiment will be done on the farm in Hermanus. It is expected that the student will travel to visit the farm twice during the times assigned as project periods in the honours lecturing schedule. During the first visit, the study will be conceptualised and the experimental design will be prepared. In the course of the second visit, the study will be conducted.

Supervision: Horst Kaiser will be the primary supervisor with Cliff Jones as co-supervisor. In addition, Matt Naylor and Devin Ayres, both hatchery managers with experience in experimental research will be available on the farm to supervise the experiments.

4) Distribution of abalone in baskets during grow-out in a hatchery

Supervisor: Prof. H Kaiser (h.kaiser@ru.ac.za)

Co-supervisors: Dr CLW Jones (c.jones@ru.a.za); Matthew Naylor (matt@hik.co.za); Devin Ayres (devin@hik.co.za)

Motivation: Results from experiments conducted on HIK Abalone Farm in Hermanus suggest that abalone are not evenly distributed in a basket, i.e., the unit in which they are being kept on the farm. A basket vertically arranged plates to provide surface area for the abalone. The plates are surrounded by mesh. Ideally the abalone should be distributed equally across plates, but they tend to spend more time at the outer plates. When that happens, the available surface area is not used efficiently. We would like to test methods that will cause a more even distribution of abalone.

Work plan: The experiment will be done on the farm in Hermanus. It is expected that the student will travel to visit the farm twice during the times assigned as project periods in the honours lecturing schedule. During the first visit, the study will be conceptualised and the experimental design will be prepared. During the second visit, the study will be conducted.

5) An investigation of accidental artificial reef structures in Algoa Bay

Supervisor: Prof Sauer (w.sauer@ru.ac.za)

Co-supervisor: Dr Shirley Parker-Nance

The increased utilization of the marine environment; shipping, infrastructure development (e.g. breakwaters, harbours and ports), harvesting (e.g. fishing) and exploitation (e.g. oil, gas, minerals and sand) of our natural resources increase the incidence of accidental loss or regulated discard of man-made structures into the marine environment. These submerged man-made structures, frequently perceived as artificial reefs or potential artificial reefs, may alter the ecological organization and impact the environmental integrity and function (Dafforn et al., 2012). Several factors play a role in the development of artificial reefs, the composition of the new substrate, location, depth and the distance from land or other natural reef systems (Jimenez et al. 2016). Artificial reefs may function as extensions of sub-tidal reef communities, increase ichthyofaunal diversity (Amaral et al. 2010; Jimenez et al. 2016), but may also provide refuge for invasive species (Airildi et al. 2015, Dafforn et al. 2012). Artificial reef can differ significantly in the composition of biota supported (Bulleri and Chapman 2010; Van der Stap, 2016) and may support smaller genetic diversity (Fauvelot et al., 2012; Street and Montagna 1996); than their natural counter parts.

In better understanding the process of biotic colonisation a number of recently submerged structures will be studied: e.g. submerged cargo container and fishing vessel, e.g.the crayfish vessel the Baratz. Comparison will be made with established artificial reefs or submerged structures, e.g. the SAS Haerlem and natural reef communities within Algoa Bay. Using both an ROV and divers, photo quadrate analysis of images taken of various fouling surface will be used to quantify community structure, and succession. The position and distance of the submerged structures from land and other natural environment or habitats that might influence the species composition and diversity will be assessed. Analysis will investigate the possibility that these structures may provide space for invasive species settlement and establishment and a source of distribution.

Referecnes

Airoldi, Laura, et al. "Corridors for aliens but not for natives: effects of marine urban sprawl at a regional scale." Diversity and Distributions 21.7 (2015): 755-768.

Amaral, F.M.D.; Farrapeira, C.M.R.; Lira, S.M.A.; Ramos, C.A.C.; Dom, R. 2010. Benthic macrofauna inventory of two shipwrecks from Pernambuco coast, northeastern of Brazil. Rev. Nordeste Zool.: 4, 24–41.).

Photos of the Baraz
https://www.youtube.com/watch?v=V9kUJl28a34
http://mype.co.za/new/who-will-take-ownership-of-the-baratz-wreck-when-it-becomes-a-major-disaster/59201/2016/01

6) Using the Arrhenius breakpoint temperature to determine the optimum and upper pejus temperature of the eurythermal, philopatric, South African linefish species; *Chrysoblephus laticeps*

Supervisor: Prof. Warren Potts (w.potts@ru.ac.za)

Co-supervisors: Murray Duncan (muzz.duncan@gmail.com); Alex Winkler (alexwinkrsa@gmail.com)

Rates of physiological processes are temperature dependant and as fish are ectotherms these rates are determined by ambient water temperatures. The temperature at which physiological rates are maximised is termed the optimum temperature (T_{opt}), beyond which rates begin to fall (T_{pejus}). The rate of physiological processes is partly responsible for the energy available to a fish to perform daily tasks such as growth, foraging, adaption…etc. Due to the current accelerated rate of sea surface temperature (SST) change and its influence on fish physiology it is important to determine species specific T_{opt} and T_{pejus} to ascertain vulnerabilities to global change. The Fry (1947) aerobic scope model has historically been used in the field of conservation physiology where maximum aerobic scope (difference between standard and maximum metabolic rate) is assumed to occur at T_{opt}. Developing aerobic scope curves is experimentally intensive and often unfeasible. Recently; Casselman et al. (2012) proposed a quick throughput method to determine T_{opt} and T_{pejus} using the Arrenhius breakpoint temperature (ABT). The aim of this study is to use ABT analysis to determine T_{opt} and T_{pejus} of *Chrysoblephus laticeps* which will be compared to the results of aerobic scope curves developed by Duncan (in prep) to look for similarities. This will be the first time this technique has been used on a eurythermal marine species and will go towards determining whether ABT is an appropriate quick screening tool to determine T_{opt} and T_{pejus} for a number of similar species along the South African coast. *C. laticeps* that have been acclimated at 16 °C will have heart rate monitors surgically implanted and allowed to recover. Maximum heart rate will subsequently be measured after anaesthetising the fish and stimulating maximum heart rate through injections with atropine and isoproterenol following the methods of Casselman et al. (2012). Maximum heart rate will be measured during a temperature ramp until the ABT is found.

Suggested reading:

Casselman MT, Antilla K, Farrell AP. 2012. Using maximum heart rate as a rapid screening tool to determine optimum temperature for aerobic scope in Pacific salmon *Oncorhynchus* ssp. *Journal of fish biology.* **80:** 358-377.

Chen Z, Snow M, Lawrence CS, Church AR, Narum SR, Devlin RH, Farrell AP. 2015. Selection of upper thermal tolerance in rainbow trout (*Oncorhynchus mykiss* Walbaum). *The journal of experimental biology.* **218:** 803-812

7) Assessment of the efficacy of rule changes on the catch and release practices in a competitive rock and surf fishery.

Supervisor: Warren Potts (w.potts@ru.ac.za)

Co-supervisor: Matthew Parkinson (mattc.parkinson@gmail.com)

The Rock and Surf Super Pro League is a growing and recently recognised facet of competitive angling. Competitions are catch and release only and organisers have realised the importance of good handling practices. The DIFS has established a research partnership with the RASSPL and aims to use scientific research to develop best practice for catch and release. Every component (fight time, hooking, landing, air exposure, handling, release) of the catch and release event has the potential to negatively influence the health of a fish. This project aims to examine the impact of rule changes on the different components and

on the overall health of the fish. Baseline information (including fight time, air exposure, health and stress indices) will be measured for each catch and release event under the current rule structure during the first two days of the national tournament in Knysna. The rules will be modified to improve the handling practices on the third day of the competition and the impact of the change will be examined by comparing the baseline data with similar data collected on the third day. This dataset will be augmented by collecting additional data during local RASSPL competitions between May and August. The honours class will participate in the field data collection at the national fishing competition in Knysna. The student may be required to attend some of the monthly local rock and surf fishing competitions in and around Port Alfred between May and August. The results of this project should be suitable for publication in the international literature.

8) Rapid assessment of the impact of catch and release on selected estuaries fishes

Supervisor: Dr Amber Childs (DIFS) (a.childs@ru.ac.za)

Co-supervisor: Prof. Warren Potts (DIFS) (w.potts@ru.ac.za)

Estuaries around the world provide nursery habitats for many important fishery species. Unfortunately estuaries are also some of the most exploited ecosystems and juvenile fishes make up the majority of the fishes captured in these environments. Recreational fisheries in South Africa are regulated by traditional regulations such as size limits. These regulations require anglers to return undersize fish to the water after capture and in estuaries, depending on the species, this means that the majority of individuals captured must be released. Size limit regulations are however only effective if the survival rate of the released fishes is high, however, we currently have no information on the health and survival of fishes subject to catch and release in these environments. Therefore, this project aims to quantify the health and survival of released estuarine fishes. This study will take place on the West Kleinemonde Estuary. Fish will be captured using conventional recreational fishing techniques. Baseline information (including fight time, air exposure, health and stress indices) will be measured for each catch and release event and a representative sample of each species will also be retained in portapools for 48 hours to examine medium term health and survival. The results of this study will be published in the international literature, will provide the first South African knowledge of survival in estuarine recreational fisheries and will add to our global knowledge of the impacts of catch and release fishing.

9) Age and growth of the cassava croaker, *Pseudotolithus senegalensis* in West Africa

Supervisor: Prof. Warren Potts (w.potts@ru.ac.za)

Co-supervisor: Rhett Bennett (rhettroman@gmail.com)

Pseudotolithus senegalensis (cassava croaker) is an eastern Atlantic coastal sciaenid, distributed from Angola to Morocco. It is the most economically important demersal fish species in West African fisheries. However, the species is classified as Endangered (A2bd) on the IUCN red list. While several studies have assessed the growth rate of this species, many are considered questionable, and there is little agreement among them. This project will use an existing set of otoliths, from fish caught in Angola and Gabon, to estimate the growth rate of P. senegalensis. The project will use a marginal zone analysis to assess the rate of deposition of growth bands and validate the growth rate.

10) Ecomorphological variation and resource partitioning between two newly identified sympatric lineages of Afromontane stream catfishes

Supervisor: Wilbert T. Kadye (w.kadye@ru.ac.za)

Co-supervisor: Albert Chakona (a.chakona@saiab.ac.za)

Catfishes (Siluriformes) are an important component of Afromontane streams where they occupy a wide range of habitats such as sand patches (*Zaireichthys*), riffles and rapids (*Amphilius* and *Chiloglanis*). However, knowledge of the ecology and biology of catfishes in Afromontane streams remains limited mainly because these regions have not been well explored and the taxonomy of many of these taxa is unresolved. Recent expeditions and use of DNA-based approaches have uncovered hidden diversity and taxonomic conflicts in catfishes within the largely co-distributed genera *Amphilius*, *Chiloglanis* and *Zaireichthys* in the Eastern Highlands of Zimbabwe. Coexistence of taxa with broadly similar morphological adaptations is driven by resource partitioning. The aim of this study is to compare the trophic ecology and ecomorphology of two recently discovered sympatric lineages of *Chiloglanis* and *Amphilius* to assess the degree of resource partitioning between them. Trophic ecology of these lineages will be examined through stomach content analysis using museum specimens that were recently collected from in the Pungwe River system in the EHZ. Ecomorphological analyses will be done using the same specimens. This study will explore the mechanisms that drive the coexistence of these lineages in the headwater streams of the Pungwe River system.

11) Does the Orange-Great Fish-Sundays River Inter-Basin Water Transfer Scheme facilitate dispersal of and gene-flow in freshwater crabs?

Supervisor: Dr Gavin Gouws (g.gouws@saiab.ac.za)

Co-supervisor: Dr Albert Chakona (a.chakona@saiab.ac.za)

Inter-Basin Water Transfer Schemes (IBWTs) are used globally to address water demand for agriculture, industry and human consumption, in arid and semi-arid regions. Among the IBWTs constructed in South Africa, the scheme connecting the Orange, Great Fish and Sundays Rivers, supplementing the flow of the latter is the largest/longest and most extensive. As these schemes link historically, geologically and biologically separated and distinct systems, there is the potential for the invasion of catchments by non-native organisms. Indeed, several freshwater fishes have been shown to use the tunnels and connections as pathways to invade the Great Fish and Sundays systems.

The present study will assess whether freshwater crabs have used these connections as conduits for dispersal and have migrated between these systems. Of the approximately 18 freshwater crab species known from South Africa (all of the genus *Potamonautes*), a robust, wide-bodied species *P. perlatus sensu stricto* is known to occur in these systems. This species is one of the most widespread potamonautid in South Africa. However, studies of such widespread freshwater crab species have revealed cryptic species diversity or unique genetic lineages occurring in separate drainages. There is this a possibility that introductions mediated by the IBWTs can lead to the homogenization of local gene pools, the loss of local adaption or hybridization among separate species. This study will require sampling from these systems and will employ DNA sequence data and a newly-developed microsatellite marker set to ascertain: (1) whether freshwater crabs have been introduced to novel systems via migration through the tunnels, and (2) the extent to which crabs migrate between systems.

12) The phylogeographic structure of the freshwater crab *Potamonautes sidneyi* in South Africa?

Supervisor: Dr Gavin Gouws (g.gouws@saiab.ac.za)

Co-supervisor: Dr Albert Chakona (a.chakona@saiab.ac.za)

The South African freshwater crab fauna is represented by around 18 species, all belonging to the genus *Potamonautes*. One of the most widespread of these is *Potamonautes sidneyi*, which occurs in the eastern parts of South Africa, from the Eastern Cape, through KwaZulu-Natal (KZN), Mpumalanga and the central provinces (North West, Gauteng and the Free State), towards Limpopo. The species' range extends into Zimbabwe and, possibly, Malawi. Studies of similarly widespread species (such as *P. perlatus*) have revealed cryptic species diversity, with complexes of more narrowly-distributed species. The situation is likely to be similar for *P. sidneyi*. A preliminary study, focusing on the phylogeographic structure of the species in KZN, revealed two new, morphologically-similar species. One has been described as *P. isimangaliso*, while the description of the second (*Potamonautes* sp. 2) is under review. The latter is particularly difficult to distinguish from *P. sidneyi* based on morphology.

As this initial study focused only on KZN, the phylogeographic structure of *P. sidneyi* across the remainder of the distribution is still to be examined. The present study will use samples collected from KwaZulu-Natal, Mpumalanga and the Eastern Cape (as well as data and samples sourced from elsewhere) to accomplish this. Additional field work will be required in the Eastern Cape. Mitochondrial and nuclear DNA sequence data will be generated and analysed, in order to detect genetic structure and identify unique lineages. Moreover, the distributions of *P. sidneyi* and *Potamonautes* sp. 2 will be more accurately mapped, with identifications based on genetic data.

13) Movement behaviour of river snapper in the Kosi Bay lake system, KwaZulu-Natal

Supervisor: Prof. Paul Cowley (p.cowley@saiab.ac.za)

The Kosi Lake system comprises a series of three interconnected lakes, and serves a major ecological function as a nursey area, particularly since the closing of the nearby St Lucia Estuary. However, little is known about how estuary-dependent fish use this lake system.

Seven river snapper *Lutjanus argentimaculatus* were tagged and movements were tracked by an array of stationary acoustic receivers. This project will use pre-existing data to describe the spatio-temporal movements of tagged river snapper over a period of one year.

14) Assessing a novel acoustic telemetry technique: bridging the passive-mobile divide

Supervisor: Prof. Paul Cowley (p.cowley@saiab.ac.za)

Co-supervisor: Dr Enrico Gennari; Matt Parkinson

Passive acoustic telemetry is a proven technique with which to assess animal movement behaviour. However, the passive nature of this method can be limiting in that the detection range of a receiver only covers a certain area. An acoustic receiver (VR2W) was attached to the bottom of charter boats in Mossel Bay, South Africa, in order to record any active transmitters in the water. At the same time, the boat tracks were recorded. The boat track (date and time stamps) can then be matched to the receiver's date and time stamps of detected animal's.

The aim of this study was to assess the efficacy of this method by comparing detections of the boat-based receiver to those of passive receivers placed throughout Mossel Bay. Should this method be reliable, the amount of additional information that could be collected would greatly benefit movement studies.

15) Effects of acoustic tag implantation on mullet species (Pisces: Mugilidae)

Supervisor: Prof. Paul Cowley (p.cowley@saiab.ac.za)

Co-supervisor name: Dr Amber Childs (DIFS)(a.childs@ru.ac.za); Dr Taryn Murray
Acoustic telemetry has been used globally to study a variety of movement behaviours in fishes. Although this method has many advantages, one major disadvantage is the battery life to tag size ratio, where longer studies require larger tags. The general rule-of-thumb in telemetry studies for tag mass versus fish body mass is that the tag mass should not exceed 2% of the fish body mass in air. Tagging can also adversely affect the behaviour or welfare of fish.

Telemetry has identified the movement behaviour of a number of estuary-dependent fishery species in South Africa, for example, dusky kob *Argyrosomus japonicus*, leervis *Lichia amia*, white steenbras *Lithognathus lithognathus* and spotted grunter *Pomadasys commersonnii*. Tags were found to have no significant effect on the movement behaviour of these species, however tag-effect experiments are very species-specific. To date, no telemetry study in South Africa has been conducted on mullet species. As such, this study proposes to test the effects of surgical implantation of tags in mullet species in the Kowie Estuary, Eastern Cape.

16) Testing the effects of various environmental parameters on the detection range of passive acoustic receivers in an estuary

Supervisor name: Dr Rhett Bennett

Co-supervisor name: Matt Parkinson

Passive acoustic telemetry has been successfully used to determine movement patterns of many estuary-dependent fishery species, globally and in South Africa. However, estuaries are characterised by marked temporal and spatial fluctuations in abiotic factors, such as temperature, dissolved oxygen, salinity and turbidity. These fluctuations can be substantial, and may influence not only the distribution of fish within these environments, but also the detection range of passive acoustic receivers.

Range-testing can play an important role in determining the suitability of a location where your receivers will be placed. It can be used to quantify the detection distance of an acoustic receiver and transmitter pair under varying environmental conditions and can be used to set receiver spacing. Limited information exists on the detection range of receivers in South African estuaries, and as such, this project aims to address this knowledge gap by undertaking range-testing in at least one Eastern Cape estuary.

17) Bacterial respiration in estuarine systems: a tool towards an understanding of primary productivity

Supervisor: Dr Morgana Tagliarolo (SAIAB)

Co-Supervosor: Dr Francesca Porri (SAIAB)

Primary productivity is key to sustaining fisheries. An understanding of the composition, functioning and carbon fluxes of aquatic systems if therefore core to the management of fisheries. Heterotrophic bacteria are ubiquitous and abundant in marine and estuarine systems . They contribute significantly to the food web and biogeochemical cycles and can even exceed phytoplankton production. Very little is known about

bacterial respiration and most aquatic carbon models just assume a standard growth efficiency, which is mostly based on laboratory uptake experiments. Previous studies underline the importance of estimating bacterial respiration from estuarine systems in order to assess how these rates vary and how they contribute to carbon fluxes. This project will investigate the spatial and temporal variability of bacterial community respiration in two different estuaries on the KZN coast.

This project will ultimately contribute towards a quantitative assessment of primary productivity in estuaries which are widely known as important nursery areas for several commercial, recreational and subsistence fisheries.

References:
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Schapira M, Pollet T, Mitchell JG, Seuront L (2009) Respiration rates in marine heterotrophic bacteria relate to the cytometric characteristics of bacterioplankton communities. J Mar Biol Assoc U K 89:1161–1169. doi: 10.1017/S0025315409000617

18) Evaluating fisheries strategies for the horse mackerel fishery in the southern Benguela using the Atlantis modelling framework

Supervisors: Prof. Kevern Cochrane (k.cochrane@ru.ac.za)

Co-supervisor: Dr Kelly Ortega-Cisneros (k.ortegacisneros@ru.ac.za)

Horse mackerel is a semi-pelagic species with shoals with both pelagic and demersal species, thus, horse mackerel accounts for a high proportion of the bycatch of the small pelagics and demersal trawl fisheries. Horse mackerel is also targeted by the directed mid-water trawl fishery. This species has shown a decrease in biomass in recent years, resulting in economic repercussions for the stakeholders in this fishery. The Atlantis in the southern Benguela and Agulhas currents model (ABACuS), which has been calibrated and validated against time series of biomass and catch from 1990-2013, will be used to test relevant fisheries scenarios for this species and evaluate the role of the species in the ecosystem and the impact of changes in biomass on ecosystem functioning.

The aim of this project is to review the available data for horse mackerel and the horse mackerel fishery to (1) implement the horse mackerel components in the ABACuS model at a higher level of detail, (2) use the model to test management scenarios for the horse mackerel fishery and (3) conduct sensitivity tests to determine the effects of updating the horse mackerel component on the ABACuS model. The results of this study will directly contribute to an ecosystem model used to identify adaptive management strategies for selected South African fisheries.