Corals through the light: phylogenetics, functional diversity and adaptive strategies of coral-symbiont associations over a large depth range

Rodrigues Frade, P.

Citation for published version (APA):
Acknowledgements

Finally here I am, writing this long-waited last bit of my thesis. Surely it is the most difficult part to accomplish as I owe the fact of being here now to the help and contribution of many. I fear I will not be able to mention them all, and that some may be unfairly forgotten in the rush of the moment.

First of all I have to thank my supervisor and PhD promoter Rolf Bak, who I first met in the year 2000 as Prof. Bak. For the last 5 years Rolf has guided me through the process of starting this research, helping me define questions and methods, deal with fieldwork and students, cope with writing and presentations. Rolf offered me a great balance between keeping me on track and giving me scientific freedom. I was lucky to have worked closely with Rolf and enjoyed his enthusiasm, experience and knowledge on coral reefs. We did not always agree but with a sufficient dose of respect and comprehension we always found ways of moving on and “keeping the flag up”. It was a pleasure to learn (or confirm) that there should always be time for other aspects of life besides work, and that one can actually be successful at both. I am sure we will collaborate in the future in this multidisciplinary approach to life in coral reef science.

I am also grateful to Jef Huisman, second promoter of this PhD. Even if we did not work on the same topic I felt my project was backed-up as much as possible in the Aquatic Microbiology group at the UvA. In the last writing period of this thesis, Jef contributed with comments and revisions which really improved my thesis.

I am grateful to the Portuguese Science and Technology Foundation for granting me with the PhD scholarship that paid my salary and supported most of the research described in this thesis.

Next I have to thank some people whose names should be in the front page of this thesis. The eight students I had the pleasure of working with. Floris de Jongh, Pim Bongaerts, Annemarie Winkelhagen, Francisca Vermeulen, Norbert Englebert, João Faria, Gloria Iglesias-Martín and Catalina Reyes-Nívia. I know things were not always paradise, even when working on a tropical island. We went through a lot of troubles, especially in the early beginning of this study, probably also related with the fact that I was an inexperienced PhD student. We really got loads of work done, both in the field and in the lab. I really appreciate all the effort you put, all those extra hours and days, and want to tell you that I would not have made it without you! I hope you had as much fun as I had and I am sure that the learning process was bidirectional! You were the best students I could have wished for and I am especially happy as I got to become good friends with all of you. Hope to see you all again underwater, or most likely, in a nearby lab (sorry for this!). Still I want to write some words about each of these guys in my team! Sorry if it will get boring for other readers...

Pim and Floris were with me during that first “messy” fieldwork of 2004. Thank you for coping with my doubts, trials, perfectionism attempts, hyperactivity, and some emotional instability! And also for turning me into a strict vegan for a few months!

Floris, your previous experience was a great help in the field. It is a pity you moved away from science, but I am happy you are now a doctor in the art of making babies!

Pim, your diving simulations, technique and air mixes are the best! I will never forget the time, creativity and enthusiasm you put into this project. You turned into an excellent PhD
student yourself and I am sure we will work further together! Besides, I have learned how to enjoy “augurken” thanks to you, and will never forgive you for that!

In the fieldwork of 2005, Annemarie and Francisca made my life miserable! I had to carry all the diving tanks and the boat engine every morning! Just kidding… Actually these girls made quite a good combination and had a major contribution to this thesis.

Francisca is a real sports woman, practical and always ready to put her hands at work. It was great to do all that dusk diving in the twilight with you!

Annemarie was perhaps the most methodical and foreseeing student I had to supervise. We went through the pain of thinking and re-thinking lots of methods and results over and over and over. Believe me, your contribution really improved my science. I know we collided sometimes in details but besides that tiny little part, you know I do like your style!

In 2006, João and Norbert joined me for a short fieldtrip. We had the most efficient field season ever, thanks to the experience and ease these guys (and perhaps me?) showed whilst diving and working for long hours in the lab.

With João I could practice my mother language and remembered the good times spent in the Azores a couple of years before. Your dedication to science, autonomy and enthusiasm are greatly appreciated. Grande João!

Norbert is the perfect dive buddy! I remember well the 3-tank-each dives we did and the long lasting decos we spent in the shallows of Buoy One. Your calm and tranquillity are contagious and helped in several critical situations, such as when at 60 m with another diver nearly passing out!

We were always in a busy schedule in the CARMABI lab those days, but always found time in-between for the deserved beer at sunset!

I did not actually have the opportunity of working with Catalina and Gloria when they were in Curaçao. The project of Gloria was not a success due to external reasons, but I have to say she was the easiest person to teach. On my trips to the lab in Amsterdam I never had to repeat myself and she did a great deal in autonomously moving on with the culturing work we developed there. Gloria, I think you can make an excellent researcher if you would like to!

Catalina, que decir?, working with you was a pleasure and it was also great to have you in our small research group in the NIOZ. I know that for a Colombian the adaptation to the Netherlands and to Texel was not easy in the beginning, but once that was past, your experience, skills and independence really made all the research just go smooth! Besides becoming a great friend you were sometimes like a sister to me. I had a great time improving my Spanish and my latin dancing “skills” and sharing an apartment with you in Amsterdam for a month. I am sure we will meet more often! I will come to visit you and Beto in Brisbane!

I am grateful to Gerard Nieuwland for his unconditional support throughout these 5 years, for being a fun office mate and a friend. You are a dedicated hard working colleague and you always seem to be able to solve the most difficult unsolvable problems. Besides, you are a ridiculously cool guy! It was a pleasure to share the underwater world with you!

Linda Tonk wrote the original proposal that culminated in this PhD project. Linda, I want to thank you for being the “mother” of this project, but even more for all the effort you put in helping me establishing field and lab methods, sometimes throughout long nights. It was also a pleasure to share the dance floor with you. I will never forgive myself for missing your PhD
promotion but I will pay you a visit in Brisbane!

I am also grateful to Petra Visser for all the effort and enthusiasm she put in this project. It was great to share student supervisions with you and that you always had an open door for discussing work whenever I would show up at the Aquatic Microbiology lab in Amsterdam. It was a pleasure to have you with us in Curaçao in 2006 and bringing you back to the coral reef. I am looking forward to continue the collaboration of the last years!

In total I have probably spent two years of my life at CARMABI, in Curaçao. There I have grown a lot as a scientist but also as a person. I want to thank Dolfi Debrot for always welcoming me and all the staff for being friendly and making my stays as efficient as possible, and also a pleasure. I am grateful to Brian Leysner and Carlos Winterdaal for great efforts in logistic support and for some crazy events, such as hunting introduced caimans in Curaçao. Ella and Ragedi always welcomed me in the administration even when I came in wearing my wetsuit. Sislyn and Louise, thank you for being two real mammas! Lately it was a pleasure to work again with Mark Vermeij, who taught me a lot in the past. Mark, thanks for being a really enthusiastic and creative scientist and for all the nice dives and BBQs!

In the NIOZ, I have spend a long time in the Molecular Lab. Judith van Bleijswijk pushed me on the good direction since the beginning of this project. She has had her office door open all the time, sometimes to get to answer the most ridiculous of my questions. Thanks for being so friendly!

Harry Witte, my lab guru, was a great teacher of many techniques since the first days. He also took care of my students whenever I was not there. Harry, thank you sincerely for all your help and for being a really cool lab mate!

Anneke Bol, I cannot thank you enough! Anneke did a lot of work for my project, especially during this last year, and even when I had told her that the last set of samples was really the last, but I would still show up with yet another set. Thanks thanks thanks! You are a very sweet person!

Pietermella Luttikhuizen, thanks for always pushing me forward and being so supportive, I have a Molecular Ecology paper thanks to your advice, and soon a new paper will come!

I want to thank all the colleagues with whom I worked with in the lab, for making it a pleasant place to work, even during the most boring never-ending pipetting hours. Sorry if sometimes I was a bit out of my mind. Elda Panoto, Ben Abbas, Maayke Brink, Arjan Boere, Thomas Reinthaler, Hélène Agogué, Angela Pitcher, Joana Cardoso, Teresa Amaro, Taichi Yokokawa, Eva Sintes, Daniele de Corte and many others, thanks!

To the people working in the NIOZ administration and helpdesk I want to thank for always being helpful and for always trying to cope with my lousy dutch. “We” tend to forget this, but research like this piece of work is not only the result of team work, but it is only possible thanks to the work of a large, very large team. This includes staff members at all levels. I was lucky that my research was underpinned by the supportive framework of the NIOZ. To Francis and Cenélia I also owe the best chats whilst circulating through the long corridors of the institute. To the colleagues within the MEE department, thanks for the great parties in the bird wing! There were some NIOZ colleagues that really contributed to my research. Marcel Veldhuis generously allowed me to run hundreds of samples in the flow cytometer. Marcel Wernand helped me through the spectroradiometer details. Eilke Berghuis spent hours with me and Annemarie next to the HPLC system. Eric Meesters, from Imares, was the best
Acknowledgements

In the UvA, the culturing work developed by my students and me would not have been possible without the fantastic efforts of Pieter Slot and Corrien Signon. Robert Poutsma thanks for early and pleasant discussions on the zoon! Hans Matthijs, for being a friendly and wise advisor on photosynthesis and photopigments. I further want to show gratitude to Pedro Branco, Maayke Stomp, Jolanda Verspaken, Elisa Beninca, Dedmer van der Wal, Verena Brauer, Fleur Visser, and many other students, for always keeping a cool atmosphere during my working days in the Aquatic Microbiology lab. The same goes to my colleagues at the Computational Science, Max, Carlos, Shan, Yves, Alfredo, Maarten.

The weekly visits to the Analytisch Diagnostisch Centrum (ADC) in Curaçao for the use of their freeze-drier were only possible thanks to the generosity of Osric Wanga and Jeandra de Palm. Jeandra, thanks for always cheering me up with a nice smile!

To Joerg Wiedenmann, Laurent Delvoye and Jens Zinke I want to thank for sharing their scientifique experience and for being really friendly colleagues. I am looking forward to future collaborations!

Richard Hill and Jake Gunn were great working mates for a week in Curaçao! Dick, thanks for inviting me to this nice collaborative research and for introducing me to the amazing world of betaines and their properties!

The month I spent in 2005 in Puerto Morelos, Mexico, really made a difference with respect to my knowledge on photosynthesis in aquatic systems and definitely enhanced my research. Roberto Iglesias-Prieto, Susana Enriquez, Anya Banaszak, Luisa Falcon, Xavier Pech, Helmut Maske, Ernesto García Mendoza, and all the students attending the course, thanks a lot for the amazing experience! Roberto, I am grateful for your invitation to the course and I am excited and looking forward to future research!

To all my previous teachers, from primary school to the University (and to some more than to others), I want to express my respect for your dedication to education. Teaching is a very demanding task! Besides, I would never have achieved this PhD without all the structure and background knowledge I received from you. Especially to Graça Vieira from the Faculty of Sciences in Lisbon, I want to thank for following my research from the distance and for being supportive!

To Berber van Beek there is too much I would have to thank for… too many good memories! Berber, thanks for all your support, for always filling me up with that joy and energy of yours after long working days and for coming up with the funniest ways to spend the free-time! Those three years were full with love, life and were never ever boring. I will never forget all the amazing moments!

There is a very special person I got to become friends with… starting under a 3000 watt-power speaker, discussing the beautiful coincidences of life, or otherwise challenging the waves of devastating hurricanes! Jasper de Goeij, it was great to have someone near who understood the positive and negative sides of working and living long parts of the year in places separated by many hours in a plane. Discussing these “double-life” issues with you made me feel I was not alone. Jasperzito, thanks for being a great friend! Ah, and for generating the “Samenvatting” of this thesis!

In Curaçao I had the best moments and met really cool people I can surely call friends. Terry Chocolaad you are an inspiration! Thanks for showing me your world of fantasy! Michelle,
Imrat, Timo, it was great to share party vibes and funny adventures. Tineke, thanks for always receiving me with a hug! Johny, Iris and Tio, thanks for your generosity and for one of the best days of my life! Michael Brown has always been around and cheered me up with his nice reggae tunes! It was cool to remember the good times of 2001 with Rita Jahcinto! Tuki was also around for a nice chat and some of the toughest swearing words I have ever heard! Rosa always had a warm Dominican hug waiting for me in Piscaderabaai, cooled off by Presidente beers. Otmar and his singing skills were a good surrounding in some nights of insomnia, but a terrible one when I could actually manage to get some sleep.

Also in CARMABI I have met loads of other students and scientist I cannot count. Some of this people got to become good friends… Eefke, Chantal, Noam, Judith, Miriam, Ruben, Martijn, Monique, Arjan, Suzanne… Natascha got to be the craziest one and that is why I like her so much! Ah, and you have got the sexiest lips! Sorry mentioning it here! I also want to thank all the researchers showing up in Curaçao for the nice after-work discussions and for sharing their passion for science. Ben and Ron, you are among these! On Curaçao I had amazing diving trips to the North Coast and to Klein Curaçao. I cannot recall all the funny people I met in such events!

There were a couple of cats, dogs and chicken I have to thank for listening to me when no-one else did… Tigra was probably the only cat I have established a friendship with!

The CARMABI boats have a life of their own, and I want to thank them for not disappearing more often than was necessary. Birdy and his crew always made sure we breathed the best air available underwater! I am grateful to all the (now) anonymous dive buddies that accompanied me in working dives. Or otherwise to the fish that were my comrades in a few, very few, solo dives. One of the best feelings of my life was given by being all alone in the deep during dusk dives.

Ton and Marjan, thanks for all the good moments and for showing me that love can live on for such a long time!

In the NIOZ I have made good friends since the early beginning! Euro’04 was a particularly good moment to start and integrate. I want to thank all the students in the old Potvis, impressive how there was always someone up for a party, at any time of the day or night! Benjamin, Luis, Yann, Phil, Furu, Khalid, Denis, Ines, Kirsten, Renske, Maarten B., Joana, Ben, Micha, Tania, Konrad, Thomas, thanks a lot for the nice times! Teresa, it was great to have you around! We shared many crazy moments on the island. I know we will meet again somewhere around the world.

Anne-Claire, thank you for sharing so many fascinating moments together! You are a lot of fun in all kinds of subjects, an inspiration really! You showed me the Jonathan Livingston Seagull living inside of me. Le vent nous portera…

I have been through several NIOZ PhD and Postdoc “generations”. With Cees, Ulrike, Francien, Thorsten, Lucas, Maarten K., Joost, Andrea, Isla, Adam, Oscar, Thomas, Maggy, Hawke, Marjan, Pieter, Rachel, Angela, Veronica W., Allert, Jenny, John, Babette, Tina, Frank, I always had great fun! Joakin, thanks for some andalucian nights! Alina, thanks for teaching me everything about herbal infusions! There were always loads of other Portuguese students around! Thank you Joana, Vânia, Sílvia, Sofia, Catarina L., Catarina C. and Catarina G. (why do portuguese always have the same names?), Carlos, for the nice chats in the canteen and for some typical nights! Raquel, thanks for teaching me criolo! Jeremy, nice you are around!
I also had great fun with the Spanish speaking community, Marta, Itziar, Veronica, Eva, great BBQs in Den Helder! With some of the students in the new Potvis I got some youth-feeling back! Thanks Amrid, Rowan, Iris, Merel, Clara and many more! Masha, thanks for reminding me to keep smiling! I want to thank Tim S. for being a nice partner when it came to knocking on doors after parties! Sissi, you are my greek fairy! There are some new people around with whom I still had the pleasure of spending time with. Kristin, thanks for your pleasant and mysterious presence. Darci, Lesley, Sabine, thanks for being great fun and for your baking skills. Pity I have to leave!

To the NIOZ football team I want to thank for keeping the spirit up even in the worst moments. I used to spend full weeks waiting for that moment on Wednesday or Thursday evening when we finally got to kick the football. Taking showers with beers in my hand was always a pleasant thing to do! I wish you success for next season; I know you will do better!

To Conny Maier, thanks for the nice coral discussions and the fun nights! Gerard Herndl was a friendly companion whenever we met! Santiago and Isabel for preparing the best BBQ parties ever! Birthe Bak thank you for being a really sweet host. My boat trips to and from Den Helder would not have been any fun without the presence of Antje! Margot, thanks for your unique energy and the nice painting! I got to learn the NIOZ philosophy thanks to Edward! Roel and Yolande, thanks for revealing this once unknown world of finding lost treasures! I did not know there were so many hidden in Portugal!

To Jessica Fox I want to thank for all the drawing work and for being the best designer I could have wished for! My thesis really improved thanks to you! Besides, it was a pleasure to get to know you are a daemon on the dance floor! Jessica is a Fox!

There were some friends that did not loose the opportunity of visiting me! Rita, Vanessa, Dário, Paulo, Chico, Luisa, Eduardo, Maria, Joana, thanks for bringing with you the home feeling. Els and Perrie, thank you for being such good friends for so long! The few times we meet are always unforgettable! But please stop making babies!!! I also want your attention! Ana and Ramiro shared many weekend moments. They know how it is for a Portuguese to live in Holland… and still enjoy! I love you guys!

Natalia “missing piece”, thanks for being the girl who lives two doors down and for naming a river turtle with my name and releasing it into the wild! That Radiohead concert we spent together was probably the best concert of my life. Unforgettable! Tim van Nus was one of the coolest guys I met in the NIOZ. Thank you for all the nice evenings of nonsense and for a few weekends of total disaster! With Lucas I had to dress up really smart during Jasper’s graduation ceremony. It was my first time. Was it as good for you as it was for me?

To the latin dancing club of Amsterdam, Catalina R., Catalina G., Nadia, Sara, Thomas, Zaire, Carolina, thank you for teaching me new moves!

I also had some tough times during these 5 years. I want to thank Jasper, Pim, Norbert and Catalina for taking care of me when I was passing out in pain because of a small but nasty kidney stone. This happened in Florida, the day after my presentation in the International Coral Reef Symposium. Guys, sorry I got you scared, I was too! Fortunately, dr. Jazz, dr. LuJo, dr. Mienis, dr. Peterse and their “proefkonijn” patient van der Land, sorted it all out for me!

Margarita Marymar, who lives on the other side of the ocean, was my soulmate, listened to my secrets and stretched my imagination beyond explanation, mostly after nights of heavy
writing work behind the computer. Gracias por estar tan lejos y tan cerca! Y por enseñarme los secretos de los volcanes submarinos, los que están a puntos de explotar!

I have lived in about 10 different houses during this PhD, from Willemstad to Den Burg, from Diemen to Den Helder (including a super luxurious modified shipping container, for 5 winter months, my “hibernation capsule”, as I used to call it). Besides, I temporarily slept in all CARMABI rooms and a few of the old Potvis rooms. Also in the Potvis I shared a bungalow with Itziar! Thanks for being the best housemate ever! We both had south European schedules, coming home late from work, and still time to have great fun! My neighbours in the Bergwijkdreef in Diemen Zuid; sorry I was so busy all the time writing my thesis and could not join the parties! I also shared apartments with Jasper, Catalina, and more recently, with Craig and Julie. This last period of writing was extremely tough, but thanks to you two I managed to still have a life! I actually owe you my life, as you fed me when I had to lie on the sofa with cast around my leg for a week. Julie, thanks for teaching me the art of hanging things in bathroom walls and for preparing the best “kerrie-kas” toasts ever!

I will not forget the people that helped me in difficult times: Joakin, Cees, Matthijs and Craig, thanks for letting me stay over at your place for long stays! To Craig and Matthijs my words will not be enough to express how grateful I am! These guys were my fathers, my mothers and brothers when I most needed. I will never forget that! Anyways, friendships never die!

Matthijs, I remember we dived together in places with a wide range of conditions, from > 50 m in Curaçao to the craziest < 5 cm visibility in the Wadden-Zee, in the last case hand in hand so we would not get lost! Thanks for knowing me so good, for being like a brother to me and such an example of what a man should be! And for making the best mojitos at 3 am. Tamar, you are a sweetie, a complete woman really, I am always amazed with how much you can do! Hugging you both and your little one Veerle is always a relaxing experience!

Craig, my mate, I will never forget all the conversations we had in extremely high and extremely low moments! You actually kept me going on in decisive moments. Not always straight and sober though, and I also thank you for that, even when you got us kicked out of that bar in Den Helder! Thanks for sharing the passions for football, reggae, tropics and women!

Now some words in Portuguese. Hope I can still do it properly!

Aos meus pais quero agradecer por uma coisa que talvez pareça um pormenor, mas não é… Obrigado por sempre me terem transmitido a plena liberdade e as ferramentas necessárias para que eu pudesse escolher o meu futuro por mim mesmo… As minhas escolhas (e alguns acasos) trouxeram-me até “aqui” e estou a desfrutar o melhor possível desta vida que só se vive uma vez.

Sobre a minha mãe só posso dizer que faz tudo por mim! Por vezes demasiado! Mãe, para descrever as inúmeras situações durante estes 5 anos em que foste incansável, ajudando-me, por vezes à distância de um oceano e muitas saudades, seriam necessárias muito mais folhas do que para esta tese de doutoramento. Obrigado por tudo!

A minha avó foi incansável em ter a certeza que eu me alimento bem no estrangeiro sem a comida portuguesa! Ao meu irmão João, que teimosamente seguiu o meu percurso académico e é hoje, também, biólogo, quero agradecer por ter usado e dado uma nova vida a todos esses livros, roupas, CDs, etc, que deixei para trás! Sempre óptimo encontrar-te e partilhar esta
simplicidade e frontalidade que existe entre irmãos!
À minha irmã Maria quero agradecer ter-me sempre recebido com aquele sorriso e abraço calorosos. Apesar de eu estar quase sempre ausente e de não acompanhar o teu crescimento tenho a certeza de que vamos um dia ser ainda mais amigos!
Ao meu pai e à Lurdes, um grande abraço por sempre terem uma boa disposição contagiantes e me receberem com os melhores almoços e jantares que podia imaginar! Pai, obrigado por termos brincado tanto durante a minha infância!
À minha tia Anabela um abraço muito especial por sempre ter apoiado estas aventuras em que me meti. E ao resto da família agradeço por compreenderem que estou ausente e por nunca se esquecerem de mim. Os bolinhos da tua Irene são o melhor exemplo!
Aos meus amigos dos tempos da FCUL, que estão hoje espalhados pelo mundo, obrigado por manterem o contacto e partilharem momentos necessariamente curtos mas muito intensos, onde quer que nos encontremos. Rui, Moscosita, Joaninha, Laires, Nídia, Mafalda, Luísa, Zi, Rabanete, Barata, Silveirinha, Catarina, Migalha, Goulart… Rita, tenho saudades, vou-te visitar e à tua Negestat!
Chris, obrigado pela tua tranquilidade! Você é um anjo, e ao mesmo tempo a melhor sambista que eu conheço! Jóia mesmo!
Aos meus amigos do Faial, obrigado por não me esquecerem, eu também recordo com enorme saudade os tempos que aí vivi. A todo o pessoal do DOP, espero um dia poder voltar a trabalhar convosco. João, Inês, Baratil, encontrar-vos-ei outra vez! Vanessa Bébé, obrigado pelo teu sorriso e boa disposição contagiantes! Sofia, sempre terás um cantinho no meu coração! Hugo, Vera, Ana, os malucos lisboetas do Faial!
Durante as minhas curtas visitas a Lisboa os meus melhores amigos sempre lá estiveram para me receber, mesmo quando eu só avisei “na hora”. Paulinho, Chico, Ritinha, Aninhas, Lídia. A vossa amizade ficará para sempre e isto é só um até já!
Andreia, és tu quem me conhece melhor… cada um seguiu o seu caminho mas no fundo continuamos ligados por uma amizade enorme! Apesar de estares longe, ajudaste-me em alturas cruciais. Espero ter conseguido fazer o mesmo por ti. Estes 5 anos serviram para aprofundar esta ligação que é tão forte e que irá ficar para sempre...

This last year I happened to spend quite a lot of time with myself. Although many times I asked where my mind was, I am grateful to this thesis for helping me to get to know myself a bit better! It was all worth!
Finally, there are a few entities I have to thank for having a major contribution to the way I enjoy my life. To the sun, for shining on me whenever the dutch clouds cleared the way, and of course, for providing the main source of energy to coral reefs and to most forms of life on this planet! To the moon, for sharing some of my long nights of loneliness. To the rain, for washing away some sorrows and clearing up my mind. To the wind, for bringing me the smells of remote places and the voices of distant friends. To the sea, for always welcoming me and revealing fascinating secrets…

Texel, 17th May 2009