

International Workshop

Interdisciplinary Approaches to the Study of Human and Mollusc Interactions: from Prehistory to Present





MUSÉUM

NATIONAL D'HISTOIRE NATURELLE



Workshop Organizer

Ariadna Burgos Muséum national d'Histoire naturelle

Co-Organizers

Philippe Bouchet Muséum national d'Histoire naturelle

Jeff Kinch National Fisheries College (Papua New Guinea)

Scientific Committee

Hélène Artaud Muséum national d'Histoire naturelle

Philippe Béarez Muséum national d'Histoire naturelle

Marie-Christine Cormier-Salem Institut de recherche pour le développement

Pierre Lozouet Muséum national d'Histoire naturelle

Jean-Maurice Poutiers Muséum national d'Histoire naturelle

Logistics Assistant

Claudia Ratti



International Workshop

Interdisciplinary Approaches to the Study of Human and Mollusc Interactions: from Prehistory to Present

31st of January – 2nd of February 2018

Muséum national d'Histoire naturelle
[French National Museum of Natural History]

Grande Galerie de l'Évolution Auditorium
Paris, France

<http://human-mollusc-interactions.com>



Main disciplines concerned

Archaeology, anthropology, fisheries, malacology, ecology and biology

Location

Muséum national d'Histoire naturelle (Jardin des Plantes and Musée de l'Homme), Paris

Dates

January 31st to February 1st, 2018

from 10 am to 5:30 pm at the Grand Galerie de l'Evolution, Jardin des Plantes: public conference

February 2nd, 2018

from 9:30 am to 5:30 pm at the Musée de l'Homme

reserved for workshop invitees

Funders & partners



«Séminaires internationaux de recherche de Sorbonne Universités»

Scientific domain

Shell deposits scattered along the coasts of the world testify to the selective use of molluscs by humans for at least 150,000 years. Molluscs are still a source of nutrient-rich food, raw material for tool-making and home building, and an object of worship carrying beliefs and symbolic values for many coastal and island societies. Some species are now cultivated on a large scale for food, or are collected for the tourist industry or for private malacological collections. Molluscs are also important indicators for environmental health, but can also be deadly when they accumulate various pathogens and pollutants.

Interaction between humans and molluscs offers multiple areas of study and disciplinary approaches. Today, theoretical and methodological approaches for the study of human-mollusc interactions include archaeology, anthropology, fisheries, ecology and biology. However, the nature of the relationship between humans and molluscs is increasingly becoming more challenging due to globalization, climate change, development of coasts and it calls for further interdisciplinary coordination.



Objectives and expectations

The 'Interdisciplinary Approaches to the Study of Human and Mollusc Interactions from Prehistory to Present' workshop has two objectives:

- to provide a comparative analysis of the diversity of interactions between humans and molluscs, and their evolution in time and space; and
- to provide a space to meet, exchange ideas and construct knowledge between researchers from various fields.

The workshop will therefore present different research methods and case studies dealing with:

- the diversity, associations and life history of bivalves and gastropods;
- the cultural and symbolic value of molluscs and shells;
- the formation, nature and interpretation of contemporary and ancient shellfish deposits;
- the uses, local knowledge, and strategies and dynamics of collection, production and management of shellfish; and
- the health, ecological, socio-economic and political issues affecting shellfish resources and the societies that depend on them.





Summary

Information	4
Funders & partners	5
Scientific domain	6
Objectives and expectations	7
Programme	13
Abstracts	23
> Molluscs and human behaviour in ancient environments	25
• Fit for purpose: shells as tools in early <i>Homo sapiens</i> ' history	27
Kat Szabó	
• Marine molluscs indicate sustainable harvesting, food choice, and trade in Pacific Islands prehistory	29
Marshall I. Weisler, Ashleigh Rogers	
• Do not mix up shells with seashells: a concept applied from prehistory	31
Catherine Dupont	
• Sustainable extractive strategies in the pre-European contact Pacific: evidence from mollusc resources	33
Frank R. Thomas	
> Time and Complexity in the Ethnoarchaeological Research	35
• The marsh clam almejeros of Costa Rica: an ethno-archaeological study of a Costa Rican artisanal clam fishery	37
Barbara Voorhies, Natalia Martínez-Tagüeña	

• Perceptions of the Atlantic Moroccan coastal occupation by prehistoric populations: contribution of current mussel gatherer ethnographic observation	39
Roland Nespoulet, Agnès Jeanjean, Émilie Campmas	
• On the use of natural, experimental and ethnographical malacological reference collections for the interpretation of prehistoric shell beads	41
Marian Vanhaeren, Wulf Schiefenhövel	
> Local knowledge, Identity and Shellfishing Dynamics	43
• “The giants ate them”: changes in mollusc consumption by the Seris of Sonora, Mexico, during their transition from nomadic to sedentary life in the 20 th century	45
Cathy Moser Marlett	
• Ethnomalacology in the Asia-Pacific region: local knowledge, gathering behaviours and shellfish management	47
Ariadna Burgos	
• Identity and molluscs: how gender, ethnicity, and class shape mangrove oyster harvesting in the Gambia	49
Jacqueline Lau	
> Models and Approaches for the Sustainable Management of Shellfish Resources	51
• Roviana women’s intermediate disturbance of shell beds: do they enhance harvesting returns?	53
Shankar Aswani	
• Sustainability in mollusc exploitation in French Polynesia: from traditional uses to fisheries and aquaculture ..	55
Georges Remoissenet	
• Modelling of <i>Cerastoderma edule</i> L. fishing grounds for sustainable harvesting in the Bay of Saint-Brieuc	57
Anthony Sturbois	

> Human-Mollusc interactions in a Changing World	59
• Structural modification of aquatic environments by shells: implications for human-mollusc interactions	61
Jorge L. Gutiérrez	
• Selection of human viruses by oyster: when specific ligands come into play	63
Soizick F. le Guyader, Jacques Le Pendu	
• Social adaptation to climate change in Galician (NW Spain) shellfisheries	65
Sebastian Villasante, G. Macho, N. Calvo, D. Wetthey, S. Woodin, E. Vázquez Otero	
• Ecological and socio-economic implications of environmental change on French shellfisheries	67
Sylvie Lapègue	
> Human-Mollusc interactions in a Changing World (continued)	69
• Monitoring trade in large marine shells in and from Indonesia	71
Vincent Nijman	
• Molluscs in a Globalising world: experiences from the mangrove forests of southwestern Madagascar	73
Ivan Scales	
• The opportunities and challenges for a transition from the gleaning to the farming of shellfish in the Pacific region	75
Michel Bermudes	
Mollusc Appendix	77
Acknowledgements	93
Maps	94
Notes	95





Programme

10:00 – 10:30 Registration

10:30 – 11:00 Welcome and Workshop

Ariadna Burgos

(Workshop Organizer, Muséum national d'Histoire naturelle)

Philippe Bouchet

(Professor, Muséum national d'Histoire naturelle)

Frédérique Chlous

(Head of the Man and Environment Department, Muséum national d'Histoire naturelle)

Jean-Denis Vigne

(General Director for Research, Expertise, Valorisation and Teaching, Muséum national d'Histoire naturelle)

11:00 – 12:00 Introduction to Human-Mollusc Interactions

- Introduction to molluscan diversity and biogeography

Philippe Bouchet (Muséum national d'Histoire naturelle)

- Introduction to human-mollusc interactions

Serge Bahuchet (Muséum national d'Histoire naturelle)

- Worldwide edible, commercial and symbolic molluscs

Jean-Maurice Poutiers (Muséum national d'Histoire naturelle, FAO associate)

12:00 – 14:00 Lunch break



14:00 – 15:20 Molluscs and human behaviour in ancient environments

Chairperson: Dr. Philippe Béarez

- Fit for purpose: shells as tools in early *Homo sapiens*' history
Kat Szabó (University of Wollongong)
- Marine molluscs indicate sustainable harvesting, food choice, and trade in Pacific Islands prehistory
Marshall I. Weisler (University of Queensland)
Ashleigh Rogers (University of Queensland)
- Do not mix up shells with seashells: a concept applied from prehistory
Catherine Dupont (Université de Rennes)
- Sustainable extractive strategies in the pre-European contact Pacific: evidence from mollusc resources
Frank Thomas (University of the South Pacific)

15:20 – 15:50 Coffee break



15:50 – 16:50 Time and Complexity in the Ethnoarchaeological Research

Chairperson: Dr. Philippe Béarez

- The marsh clam almejeros of Costa Rica: an ethno-archaeological study of a Costa Rican artisanal clam fishery

Barbara Voorhies (Santa Barbara University)

- Perceptions of the Atlantic Moroccan coastal occupation by prehistoric populations: contribution of current mussel gatherer ethnographic observation

Roland Nespoulet (Muséum national d'Histoire naturelle)

- On the use of natural, experimental and ethnographical malacological reference collections for the interpretation of prehistoric shell beads

Marian Vanhaeren (Université de Bordeaux)

Wulf Schiefenhövel (Max Planck Institut)

16:50 – 17:20 Plenary

10:00 – 11:00 Local knowledge, Identity and Shellfishing Dynamics

Chairperson: Dr. Marie-Christine Cormier-Salem

- “The giants ate them”: changes in mollusc consumption by the Seris of Sonora, Mexico, during their transition from nomadic to sedentary life in the 20th century

Cathy Moser Marlett (NGO: SIL International)

- Ethnomalacology in the Asia-Pacific region: local knowledge, gathering behaviours and shellfish management

Ariadna Burgos (Muséum national d'Histoire naturelle)

- Identity and molluscs: how gender, ethnicity, and class shape mangrove oyster harvesting in the Gambia

Jacqueline Lau (James Cook University)

11:00 – 12:00 Models and Approaches for the Sustainable Management of Shellfish Resources

Chairperson: Dr. Marie-Christine Cormier-Salem

- Roviana women's intermediate disturbance of shell beds: do they enhance harvesting returns?

Shankar Aswani (Rhodes University)

- Sustainability in mollusc exploitation in French Polynesia: from traditional uses to fisheries and aquaculture

George Remoissenet (French Polynesia Ministry of Marine Resources)

- Modelling of *Cerastoderma edule* L. fishing grounds for sustainable harvesting in the Bay of Saint-Brieuc

Anthony Sturbois (Nature Reserves of Saint-Brieuc)

12:00 – 12:30 Plenary

12:30 – 14:00 Lunch break



14:00 – 15:20 Human-Mollusc Interactions in a Changing World

Chairperson: Dr. Denis Couvet

- Structural modification of aquatic environments by shells: implications for human-mollusc interactions

Jorge L. Gutiérrez (University of Mar del Plata)

- Selection of human viruses by oysters: when specific ligands come into play

Soizick Le Guyader (Ifremer)

Jacques Le Pendu (Université de Nantes)

- Social adaptation to climate change in Galician (NW Spain) shellfisheries

Sebastian Villasante (Universidad de Santiago de Compostela)

- Ecological and socio-economic implications of environmental change on French shellfisheries

Sylvie Lapegue (Ifremer)

15:20 – 15:50 Coffee break



15:50 – 16:50 Human-Mollusc Interactions in a Changing World (continued)

Chairperson : Dr. Denis Couvet

- Monitoring trade in large marine shells in and from Indonesia
Vincent Nijman (Oxford Brooks University)
- Molluscs in a Globalising world:
experiences from the mangrove forests of southwestern Madagascar
Ivan Scales (University of Cambridge)
- The opportunities and challenges for a transition from the gleaning
to the farming of shellfish in the Pacific region
Michel Bermudes (Secretariat of the Pacific Community)

16:50 – 17:20 Plenary

17:30 – 20:00 Cocktail



Reserved for Workshop Invitees

9:30 – 13:00 Plenary

Workshop invitees' discussion: bring your ideas!

Working groups, interdisciplinary research, project funding, international collaborations, publications, human-mollusc exhibitions ...

13:00 – 14:30 Lunch break



14:30 – 16:30 Visit to the French Museum of Man [Musée de l'Homme]





Abstracts

Molluscs and human behaviour in ancient environments





Tools made from the opercula of *Turbo marmoratus* shells from Golo Cave, Gebe Island, eastern Indonesia.
© Kat Szabó

Fit for purpose: shells as tools in early *Homo sapiens*' history

Kat Szabó

Centre for Archaeological Science, University of Wollongong, Australia

kat@uow.edu.au

Unlike stone cobbles and fragments which required some degree of shaping to be functional tools, the variety of edges, shapes and textures found in molluscan shells meant that they could be used with little to no modification. The key appears to have been in selecting the right sort of shell for the required purpose. Recent research in Asia and Africa reveals that the use of particular shell species and types by early *Homo sapiens* is highly patterned. Very specific types of shells are being selected as tools or raw material for tools, and these species do not necessarily coincide with those being selected for consumption. In some instances, they derive from entirely different coastal habitats. Exactly how common the use of unmodified shells as tools is in early human history is unclear, as our methods for recognising these objects has been limited and under-developed. If we are to gain a true appreciation of the role and relative importance of shells as tools in the distant past, we must work towards enhancing our analytical techniques. I shall discuss various new directions that are allowing us to distinguish shell tools from the shell midden deposits in which they are often found.

Keywords:

shell tools, shell artefacts, early modern humans, Southeast Asia, North Africa



North Beach, Henderson Island, a raised limestone (makatea) island in the Pitcairn Group, southeast Polynesia. Occupied for at least four centuries since AD 1200, black-lipped pearlshell (*Pinctada margaritifera*), used for fishhook manufacture, was imported here from Mangareva located 400 km west.
© Marshall Weisler

Marine molluscs indicate sustainable harvesting, food choice, and trade in Pacific Islands prehistory

Marshall I. Weisler, Ashleigh Rogers

Department of Archaeology, University of Queensland

m.weisler@uq.edu.au

Marine molluscs are ubiquitous in coastal Pacific Island archaeological sites and assemblages have been used for routinely addressing human impacts or foraging pressure and less often for documenting long-term sustainability of resources. Shellfish can also indicate prehistoric food choice or preferential selection of one of several closely related species. In rare circumstances, shellfish provide evidence of prehistoric interaction or so-called trade and exchange. These topics are examined by using data from the atoll archipelago of the Marshall Islands (eastern Micronesia), the raised limestone or makatea island of Henderson in the Pitcairn Group, and the high volcanic island of Moloka'i in the Hawaiian Islands. A 1500-year record from Utrök Atoll in the northern Marshall Islands documents sustainable use of marine shellfish probably due to low human populations living on a small island with a huge expanse of ocean-facing and lagoonal reef. In Hawaii, the late prehistoric record and contemporary practice both point to preferential selection of the yellowfoot limpet or 'alinalina (*Cellana sandwicensis*) despite the close proximity of two other species in the same genus. Six centuries of prehistoric interaction was documented for Henderson Island by charting the frequency of black-lipped pearlshell (*Pinctada margaritifera*) imported from neighbouring Mangareva — some 400 km distant. Despite the contrasting island types and their unique inshore environments, prehistoric fishers collected a broad range of taxa, yet targeted only one or two species that represented the majority of the assemblages by weight.

Keywords:

sustainability, prehistoric trade, food choice, Marshall Islands, Pitcairn Group, Moloka'i (Hawaiian Islands)



Shells used to decorate walls of maritime villas are not species that are eaten, the example from Saint-Cast-le-Guildo (France) during the 3rd century AD.
© Catherine Dupont

Do not mix up shells with seashells: a concept applied from prehistory

Catherine Dupont

Centre de Recherche en Archéologie Archéosciences Histoire, Université de Rennes, France

catherine.dupont@univ-rennes1.fr

Humans have been interacting with things from the oceans since Paleolithic times. Archaeological sites that include molluscs that are used both as ornamental shells and for food, show that many molluscs that are eaten are rarely recycled or made into adornments. Thus, the selection of the raw material used to make objects since prehistoric times can be regarded as a separate activity than the one involving the search of food. This dichotomy in the use of the molluscs is readable in the archaeology from prehistory to today. During the Neolithic, coastal populations favoured huge beach bivalves to make tools with some of these traded inland. Later, during the 3rd Century AD, it was fashionable for rich owners of coastal villas to decorate walls with seashells, as is also fashionable in Italy today. Under such cultural influences, during the 17th Century, certain fountains were also decorated with shells to imitate nature. Throughout history, the knowledge of the processes linked to the thanatocoenosis and to the taphonomy allows us to differentiate which shells were valued as raw materials.

Keywords:

archaeology, archaeomalacology, seashell, shell, raw material



Giant clam garden, Abemama Atoll, Kiribati.
© Frank R. Thomas

Sustainable extractive strategies in the pre-European contact Pacific: evidence from mollusc resources

Frank R. Thomas

Oceania Centre for Arts, Culture & Pacific Studies, University of the South Pacific, Fiji

frank.thomas@usp.ac.fj

Mollusc remains from archaeological and more recent historical contexts provide good proxies to assess environmental change, as well as human impact, both negative and positive, as reflected, for example, by sustainable resource management practices. Testing the various hypotheses to explain change in mollusc distribution in various archaeological assemblages requires an understanding of ecological and biological characteristics of each species, as well as access to detailed ethnographic and ethnoarchaeological data on the interaction between people and molluscs. A growing interest in indigenous resource management among Pacific Island communities has led some archaeologists to seek tangible evidence of sustainable use of resources in the past, to complement the more widespread research conclusions that depict mollusc resource depression and/or shifts in species composition as a consequence of (negative) human impact. This paper will draw from selected case studies in the Pacific Islands Region.

Keywords:

archaeology, ethnographic and ethnoarchaeological data, mollusc ecological and biological characteristics, sustainable resource management, Pacific Islands



Time and Complexity in the Ethnoarchaeological Research



Natalia Martínez-Tagüeña interviewing Don Gaspar and Fredi at the El Torno clam processing site.
© Barbara Voorhies

The marsh clam almejeros of Costa Rica: an ethno-archaeological study of a Costa Rican artisanal clam fishery

Barbara Voorhies¹, Natalia Martínez-Tagüeña²

¹ Department of Anthropology, University of California, Santa Barbara, U.S.A.

² CONACyT-Instituto Potosino de Investigación Científica y Tecnológica

voorhies@anth.ucsb.edu

Between approximately 3000 - 7000 years ago the ancient Chantuto people of Chiapas formed massive shell mounds at clam processing sites. These logistical sites likely were positioned at the edges of coastal lagoons where the clams, fish and probably shrimp once were procured. Archaeological evidence at the shell mounds has revealed diachronic patterns in technology, seasonality of site use, human-plant interactions, and fishing practices over a 4,000 year duration of site formation but questions remain about the impacts of human predation on the clam populations.

Our ethnoarchaeological investigations of a contemporary clam fishery in Costa Rica provide an opportunity to explore further the relationship between human predators and populations of marsh clams. These investigations focus on the Almejeros' procurement strategies, the spatial arrangement of their procurement and processing locations, site formation processes, and the economics of the modern industry. Despite the fact that the Costa Rican fishery is embedded in a commercial economy we note that certain of its attributes conform to expectations derived from Optimal Foraging theory.

Keywords:

artisanal clam industry, ethnoarchaeology, Costa Rica, *Polymesoda* sp.



Current mussel gatherers of Témara, Rabat, Morocco.
© Emilie Campmas

Perceptions of the Atlantic Moroccan coastal occupation by prehistoric populations: contribution of current mussel gatherer ethnographic observation

Roland Nespoulet¹, Agnès Jeanjean², Émilie Campmas³

¹ HNHP-UMR 7194 du CNRS, MNHN, France

² LAPCOS-EA 7278, Université de Nice Sophia-Antipolis, France

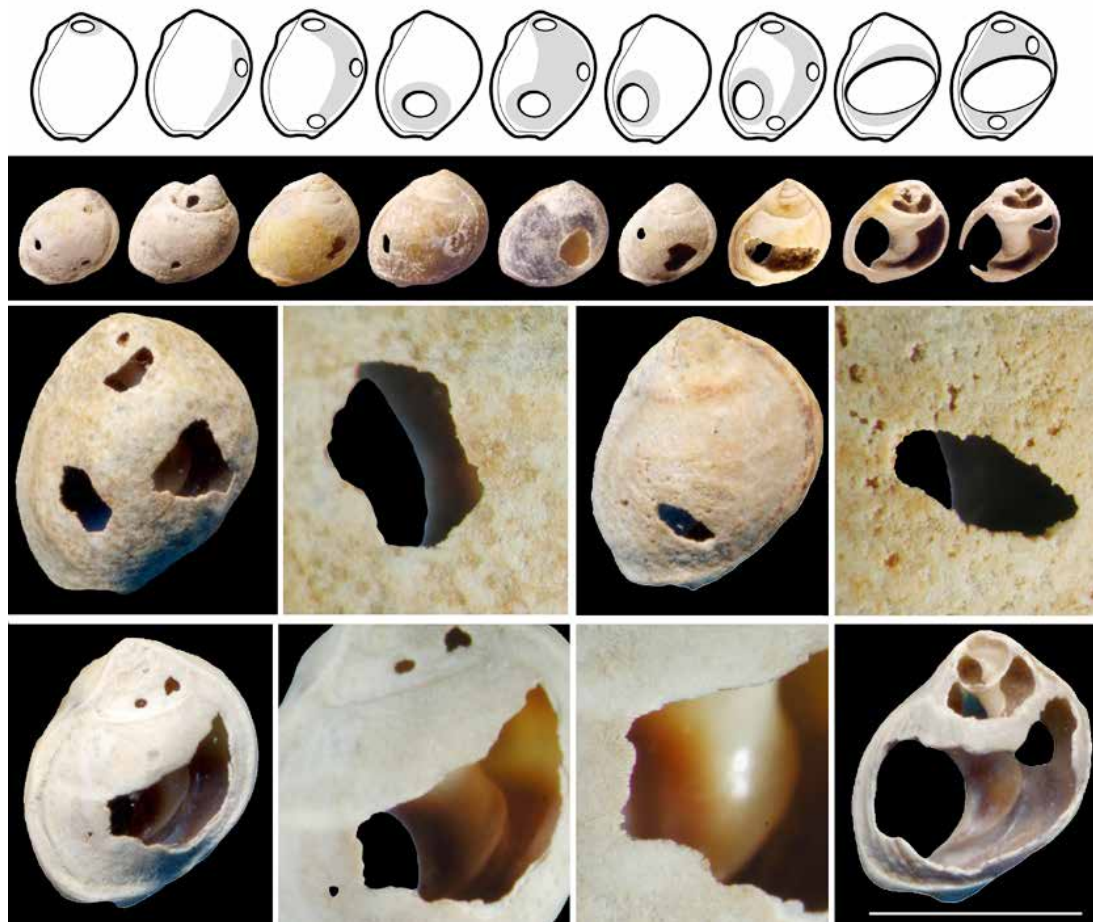
³ TRACES-UMR 5608 du CNRS, Université Toulouse Jean Jaurès, France

roland.nespoulet@mnhn.fr

Two main periods in the archaeological record both in Africa and Europe highlight past coastal occupations across these regions. The two periods involve episodes of high sea levels, 130,000-75,000 BP approximately 12,000 BP respectively. These periods differ completely in terms of population densities and socio-economic organization and subsequently generate different kinds of coastal occupation records. In the Témara-Rabat region which is located along the Moroccan Atlantic coast, both Pleistocene and Holocene coastal occupation records show differences in mollusc usage. Today, the presence of mussel gatherers provides a window to observe the techniques of gathering and treatment of the molluscs that are also evident in the archaeological record even with different behaviour and organization observations (e.g. archaeologists concentrate on environmental constraints and ethnological observations focus on societal aspects). Ethnological investigations therefore also provide fruitful avenues of reflection for archaeological interpretations and we have performed a preliminary field project that utilise both ethnologists and archaeologists. The observations recorded raise many questions and provides reflection on prehistoric coastal occupations and behaviours, such as the 'site of aggregation linked to one activity' model, the duration of site occupation and the duration of coastal occupation.

Keywords:

ethnology, current mussel gatherers, archaeology, Northwest Africa, Moroccan Atlantic coast, Témara-Rabat



Typology (top) and macrophotographs (bottom) of natural perforations present on *Nassarius kraussianus* shells collected in the Duiwenhoks estuary, Western Cape Province, South Africa.
Modified after d'Errico *et al.* 2005

On the use of natural, experimental and ethnographical malacological reference collections for the interpretation of prehistoric shell beads

Marian Vanhaeren¹, Wulf Schiefenhövel²

¹ UMR 5199 PACEA, Université de Bordeaux, France

² Human Ethnology Group, Max Planck Institute for Ornithology, Germany

marian.vanhaeren@u-bordeaux.fr

Prehistoric shell beads, the oldest of which are ca. 100 000 years old, are an important element of the archaeological record. Their interpretation is however not always straightforward. First, the anthropogenic nature of purported beads must be verified; secondly, the way in which they were made, assembled and worn reconstructed and lastly, their social function and significance in the evolutionary history of the species utilised also needs to be understood. Application of taphonomic, microscopic, morphometric and elemental analyses as well as GIS and statistical tools on natural, experimental and ethnographical malacological reference collections is instrumental for finding answers to these questions. Here we present some firsthand case studies to assess the strengths and weaknesses of the applied approach and to draw some lines of inquiry for the future. These include: 1) analysis of the earliest known shell beads from Africa, Europe, Western and Eastern Asia; 2) attempts to reconstruct prehistoric beadwork that investigates perceptions of beauty as a primary function of personal ornaments; and 3) exchange networks, social structures and ethno-cultural diversity of prehistoric populations. We also used fieldwork results of research conducted in mainland and island New Guinea, culturally one of the most diverse regions of the world, to exemplify the potential of ethnoarchaeology.

Keywords:

taphonomy, morphometry, microscopy, perforation, wear, colouration



Local knowledge, Identity and Shellfishing Dynamics





Juanita Herrera Casanova holding the shell of an oyster, recalling the abundant shellfish she ate while living at the camp as a girl. Estero Santa Cruz, 2014.
© Cathy Moser Marlett

“The giants ate them”: changes in mollusc consumption by the Seris of Sonora, Mexico, during their transition from nomadic to sedentary life in the 20th century

Cathy Moser Marlett

SIL International, U.S.A.

cathymarlett@me.com

The Seris (or Comcaac) were traditionally a nomadic hunting, gathering and fishing people of northwestern Mexico whose ancestral territory lies along the eastern shore of the Gulf of California. Oral tradition and extensive archaeological remains attest to their previously heavy consumption of molluscs and other seafood. During the early to mid- twentieth century the Seris became almost entirely sedentary, a process documented by oral history and ethnographic accounts. An important part of this documentation consists of photographs and a short film showing shell use toward the end of the period when the people depended almost entirely on food obtained by traditional methods. The transition to sedentism brought easy access to commercial foods, including lard, and introduced new ways of food preparation. Although considerable consumption of fish and sea turtles continued, harvesting molluscs and other food for personal consumption has declined significantly since the mid-twentieth century, resulting in loss of knowledge of mollusc names and marine-related terminology among younger people today. Present-day harvesting primarily focuses on pen shells, taken by divers using a hookah apparatus, and the adductor muscles are sold to commercial buyers from outside the Seri community. This presentation draws on oral tradition, historical records, and ongoing investigation to look at changes in harvesting and consumption of molluscs during the past century.

Keywords:

Seri, Mexico, Gulf of California, mollusc consumption, historic changes



Gathering of *Geloina erosa* in the mangrove forest of Siberut Island, Indonesia.
© Ariadna Burgos

Ethnomalacology in the Asia-Pacific region: local knowledge, gathering behaviours and shellfish management

Ariadna Burgos

Ecoanthropologie and ethnobiologie, Muséum national d'Histoire naturelle, France

ariadna.burgos@mnhn.fr

Malacological resources have been exploited since prehistoric times for different alimentary, practical and symbolic purposes. Nowadays, the gathering of bivalves and gastropods remains an activity of economic importance to many island and coastal communities worldwide. This paper draws contrasts and patterns on local knowledge, shell fishing behaviours, and shellfish management of two different cultural and socio-economic contexts in Indonesia (Siberut Island) and Papua New Guinea (the Tigak Group of Islands), and proposes methodological tools to integrate local malacological knowledge in coastal change assessments. Through an ethno-ecological approach it was found that gathering techniques, prey choice and preparation methods of shelled molluscs varied significantly within the two localities. Local knowledge on shells included knowledge on species habitat and behaviour, trophic chains, stock abundance/distribution and ecological processes. Decisions regarding shell fishing choices involved reassessment of climatic and tidal conditions, household alimentary and gustative preferences, fisheries dynamics and trends, and availability of non-malacological resources (agricultural and other fishery products). Access to shell fishing grounds was highly restricted in the Tigak Group of Islands while on Siberut Island, access to malacological resources was regulated primarily by geophysical and biological constraints. Nowadays, bivalves and gastropods are considered reliable indicators of environmental conditions and change. Therefore, it is argued that there is a need to articulate local and scientific knowledge on malacological resources to interpret and assess coastal change and socio-ecological vulnerability.

Keywords:

local knowledge, molluscs, socio-ecological systems, coastal change, co-construction of knowledge



Oyster harvesters paddle home after a morning harvesting oysters in the mangroves, Tanbi Wetlands National Park, The Gambia.
© Jacqueline Lau

Identity and molluscs: how gender, ethnicity, and class shape mangrove oyster harvesting in the Gambia

Jacqueline Lau

ARC Centre of Excellence for Coral Reef Studies, James Cook University, Australia

jacqueline.lau@my.jcu.edu.au

To address the failures of previous ‘top-down’ rules and regulations that ignored local beliefs and customs, environmental policies increasingly emphasize the socio-cultural dimensions of human–environment interactions. More specifically, research has recognised that identities play a key role in shaping resource use, including in human-mollusc interactions. For instance, the notion that ‘shells are for women, fish are for men’, and subsequent gendered division of labour in fisheries, is common in many coastal communities. However, although a useful first step, treating forms of social difference (such as gender, ethnicity and class) as separate dimensions that produce distinct inequalities and patterns of resource use misses key insights from theories of intersectionality. In this talk, I investigate how multiple identities influence human-mollusc interactions among a group of women oyster harvesters in The Gambia. Oyster harvesting is shaped by the confluence of an aversion to stigmatized waged labour; gendered expectations of providing for one’s family; and a historically informed and spatially bounded sense of ethnicity. Drawing on the concept of contact zones, I then show how new interactions between previously isolated groups of oyster harvesters have broadened understandings of ethnicity. However, these new subjectivities overlay rather than replace old clan alliances, leading to tensions. New contact zones and emerging subjectivities can thus be at once uniting and divisive, with important implications for managing molluscs, and artisanal fisheries more broadly.

Keywords:

gender, ethnicity, oyster harvesting, intersectionality, political ecology



Models and Approaches for the Sustainable Management of Shellfish Resources



Roviana women shell gatherers helping
with ecological research
– mud compactness and shell
abundance and size distribution.
© Shankar Aswani

Roviana women's intermediate disturbance of shell beds: do they enhance harvesting returns?

Shankar Aswani

Department of Anthropology, Rhodes University, South Africa

s.aswani@ru.ac.za

A number of papers have taunted the relationship between indigenous ecological knowledge and resource management, yet little empirical evidence exists to show that such relationship actually comes to fruition in the daily lives of coastal peoples. In this paper, I test two hypotheses drawn from Roviana (Solomon Islands) women's indigenous ecological knowledge: (H1) That moderate human disturbance of shell beds, particularly for *Polymesoda* spp., enhances their habitat and increases their numbers; and (H2) Even if an area is permanently closed (as in a 'no take' reserve) abundance and size distribution of *Polymesoda* spp. is not significantly greater than temporal closures. Essentially, Roviana women claim that in the absence of human foraging, the mud substrate hardens making the permanent closures a less suitable habitat for shells.

Keywords:

ecological disturbance, woman foraging, MPAs, shellfish, ecological impacts, Solomon Islands



Reao island council policeman checking size of giant clam collected spats before packaging and airfreight shipment to Tahiti for ornamentals export.
© Colette WABNITZ

Sustainability in mollusc exploitation in French Polynesia: from traditional uses to fisheries and aquaculture

Georges Remoissenet

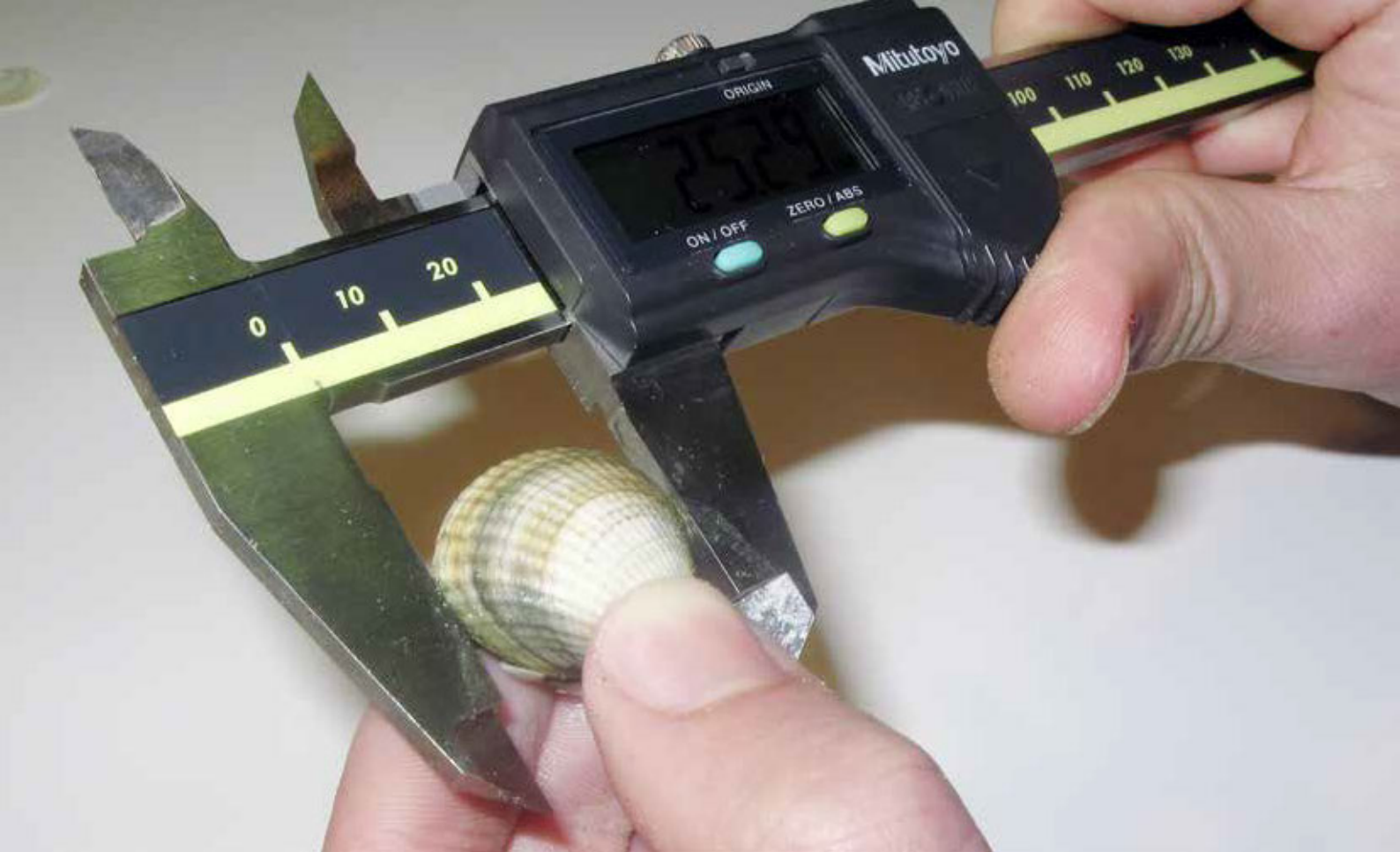
*Cellule Innovation et Valorisation, Direction des ressources marines et minières,
French Polynesia*

georges.remoissenet@drm.gov.pf

Throughout French Polynesia, molluscs have been traditionally used for food, tools, ornaments and even as money; often playing a significant role in islanders' belief systems and symbolic values. Currently, a few species in French Polynesia are sustainably harvested, including *Trochus* (*Tectus niloticus*), which was successfully introduced from Vanuatu and giant clams (*Tridacna* spp.). While Tahitian pearl culture is by far the most advanced aquaculture industry in French Polynesia, its success story is mostly based on ecological niche environments where pearl oyster spat collection is easily achieved. Giant clam spat collection also has had some successes in some of the more remote atolls in French Polynesia. Low-cost techniques for which targeted management measures have been developed have led to the competitive production of spats compared to high-tech hatchery techniques, with additional benefits for wild stocks. However, evidence from pearl oyster and giant clam culture activities in French Polynesia also reveals their vulnerability to environmental variability, particularly with the projected impacts of climate change. This paper aims to weave together the contemporary forms of exploitation, stock enhancement and aquaculture of key molluscs in French Polynesia, and synthesise lessons learned for the sustainable development of specific mollusc aquaculture in French Polynesia, but also the wider Pacific Islands Region.

Keywords:

giant clams, pearl oyster, spat collection, trochus, fisheries, aquaculture management, sustainable development



At each site, cockles are harvested within a square of 0.25 m² and measured in a laboratory. The shell length of each cockle is measured to the nearest 0.1 mm with a vernier calliper.
© Anthony Sturbois

Modelling of *Cerastoderma edule* L. fishing grounds for sustainable harvesting in the Bay of Saint-Brieuc

Anthony Sturbois

Réserve Naturelle de la Baie de Saint-Brieuc, France

anthony.sturbois@espaces-naturels.fr

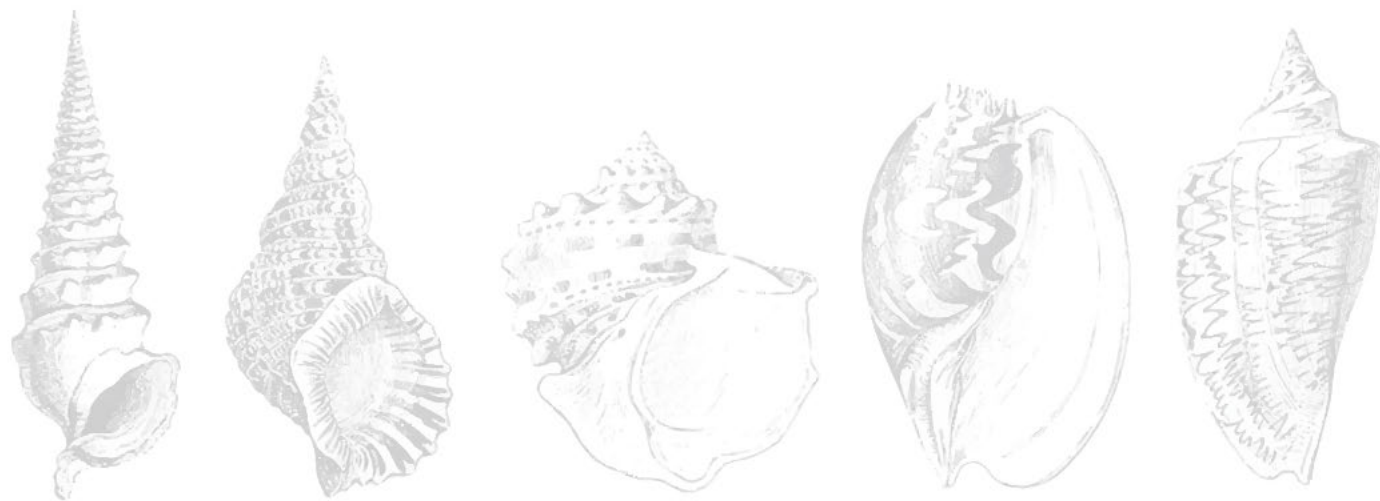
The cockle *Cerastoderma edule* has been collected by traditional fishing methods for many centuries in the Bay of Saint-Brieuc. Since 2001, the National Natural Reserve of the Bay of Saint-Brieuc has carried out annual stock assessments and mapping of cockle harvesting grounds. This assessment takes place between the end of July and middle of August at 131 stations that are located 500 m apart covering an area of 2,900 ha along the intertidal foreshore. At each site, cockles are harvested within a square of 0.25 m² and measured in a laboratory. This assessment process has led to the development of a predictive model of the harvesting grounds using the growth stages of each individual. The model provides benefits for managers and local authorities by: 1) allowing mid-term predictions (1-2 years) on harvesting in the cockle grounds which allows professionals and scientists to rule on the next fishing season; 2) assessing quickly the impact of any change to the minimum legal fishing size on the fishable part of the cockle harvesting ground; and 3) estimating the potential impact of a management project which could interfere with the way of the fishing ground functions. This approach can be easily transferred to other co-management schemes of cockle fishing grounds.

Keywords:

cockle, traditional harvesting, management, modelling, fishing ground, nature reserve

A horizontal row of seven small, detailed illustrations of various mollusk shells, including gastropods and nautilus-like forms, positioned above the title banner.

Human-Mollusc interactions in a Changing World





Mussel (*Brachidontes rodriguezii*) bed in a Patagonian rocky intertidal platform, El Espigón, Río Negro Province, Argentina; 41° 07' S, 63° 00' W.
© María Bagur

Structural modification of aquatic environments by shells: implications for human-mollusc interactions

Jorge L. Gutiérrez

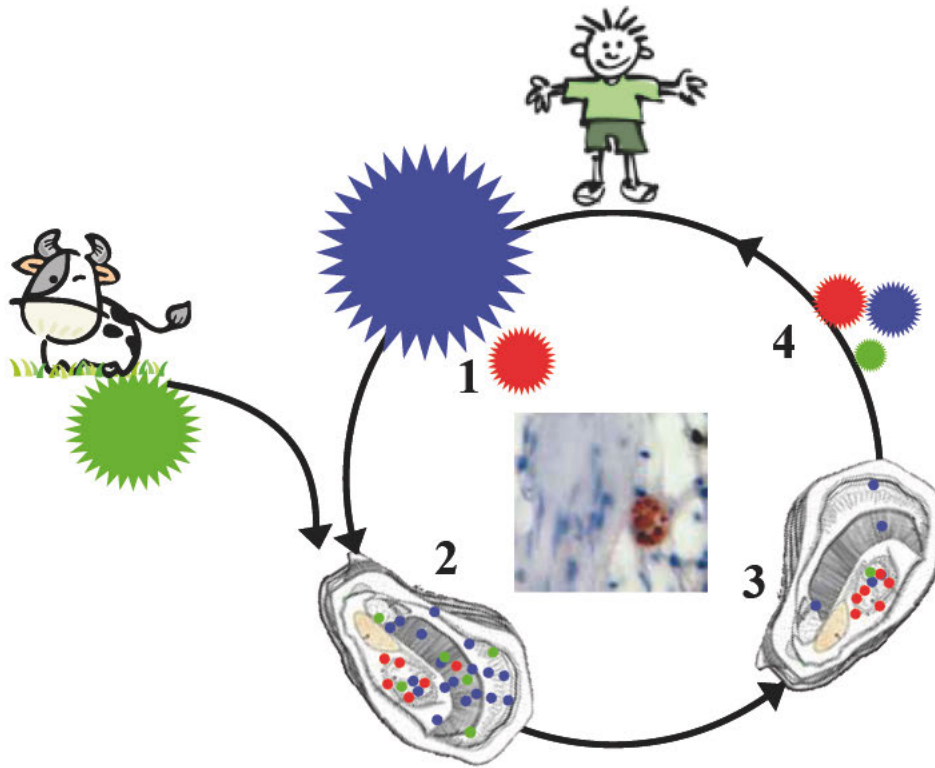
Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Argentina

jgutierrez@grieta.org.ar

Physical ecosystem engineering is the structural modification of environments by organisms. Many mollusc species are noticeable physical ecosystem engineers, not least because of their ability to produce shells. Here I postulate three general structural roles of mollusc shells in aquatic ecosystems, namely: (1) substrata for organismal attachment, (2) refuges from predation, physical or physiological stress, and (3) controllers of near-bed flows and material transport in the benthic environment. Then, I illustrate (a) that changes in resource availability or abiotic conditions caused by shell production have important consequences for other organisms, (b) that colonization of shelled habitat depends on individual shell traits and spatial arrangement of shells, which determine access of organisms to resources and the degree to which biotic or abiotic forces are modulated, (c) that shell production will increase species richness at the landscape level if shells create resources that are not otherwise available and species are present that use these resources, and (d) that changes in the availability of resources caused by shells and the resulting effects on other organisms have both positive and negative feedbacks to the engineer in question. Last, I exemplify how ongoing changes in shell production and distribution resulting from human activities (e.g., exploitation, introduction and invasion of shelled molluscs; use of mollusc shells in habitat restoration) can affect the structure of benthic environments as well as the composition and functioning of aquatic ecosystems.

Keywords:

physical ecosystem engineering, shell and mollusc beds, substrata, refugia, fluid transport, feedbacks to engineers



Influence of oyster in the selection of norovirus transmission.

- 1) Shedding in the environment of large amounts of GII norovirus (blue) and much lower amounts of GI strains (red) due to the overwhelming predominance of NoV GII in human disease. Shedding of NoV GIII (green) in cattle is also shown;
- 2) Viruses present in seawater are ingested by oysters;
- 3) NoV GI are more efficiently accumulated and persist longer than NoV GII or GIII via specific ligand;
- 4) Upon consumption of a NoV-contaminated oyster, infection caused by GI and GII strains occur with similar frequency because of the selective accumulation and retention of GI viral particles. GIII NoV transmission is unlikely to happen as few particles persist in oysters.

© Soizick F. le Guyader

Selection of human viruses by oyster: when specific ligands come into play

Soizick F. le Guyader¹, Jacques Le Pendu²

¹ Laboratoire Santé Environnement et Microbiologie, Ifremer, France

² Centre de Recherche en Cancérologie Nantes-Angers, Université de Nantes, France

soizick.le.guyader@ifremer.fr

Pollution of coastal waters by human sewage can result in the contamination of shellfish with a variety of microbial pathogens, including human enteric viruses. Shellfish have been known as vectors for human pathogens for a long time and despite regulation based on enteric bacteria, they are still implicated in viral outbreaks. Among shellfish, oysters are the most common vector of contamination worldwide and the pathogens most frequently involved in these outbreaks are noroviruses which are responsible for acute gastroenteritis in humans. For a long time, oysters were believed to act as filters or ionic traps, passively concentrating particles. However long-term persistence of some viral strains and failure of depuration now suggest that viruses do not behave like bacteria. Through in vitro, in vivo experiments and the study of naturally contaminated samples in the environment, we have demonstrated that oysters, *Crassostrea gigas* are able to select some noroviruses based on a carbohydrate ligand that is shared with humans. This observation has also been confirmed in other oyster species such as *C. virginica* or *sikamea*, but not in *Ostrea edulis* which suggests that oysters not only act as a vector of norovirus transmissions, but can also serve as a reservoir of human norovirus. Further biochemical characterization of these ligands and more precise quantification of their impact on the preservation of viral infectivity are now under study.

Keywords:

oysters, human viruses, sewage, norovirus, glycan, outbreaks



N PORTONOVO (1960 CA)
A MARTÍNEZ

Galician redeira in Portonovo (1960 ca).
© Bea Martínez / Galician Fisherman Guild Federation

Social adaptation to climate change in Galician (NW Spain) shellfisheries

Sebastian Villasante ^{1,2}, G. Macho ^{2,3}, N. Calvo^{2,4}, D. Wetthey ⁵, S. Woodin ⁵,
E. Vázquez Otero ^{2,3}

¹ *Departamento de Economía Aplicada I ECOMAR Network, Universidade de Santiago de Compostela, Spain.*

² *Campus do Mar - International Campus of Excellence, Spain.*

³ *Universidade de Vigo, Spain.*

⁴ *Universidade da Coruña, Spain.*

⁵ *University of South Carolina, U.S.A.*

sebastian.villasante@usc.es

The gender dimensions in European Union fisheries are frequently not taken into account, especially in coastal areas where small-scale fisheries are highly important, such as Galicia (Northwest Spain).

This paper provides the first comprehensive analysis of how climate change may have an impact on European fishery that involves women: intertidal shellfish gathering in Galicia. This paper uses quantitative and qualitative data collected through questionnaires and interviews to: 1) analyse the perceptions of women about the climate change impacts on shellfish species that they harvest; 2) investigate possible adaptive strategies developed by women to cope with expected impacts of climate change on shellfish species; and to 3) understand how the development of shell-fisherwomen organizations have helped to resist the current crisis and how they may help to shape new transformations needed toward sustainable paths in this sector.

Keywords:

small-scale fisheries, Galicia (Northwest Spain), women, adaptive capacity, global change



Shellfisheries activities in Marennes-Oléron Bay.
© Ifremer / J. Prou

Ecological and socio-economic implications of environmental change on French shellfisheries

Sylvie Lapègue

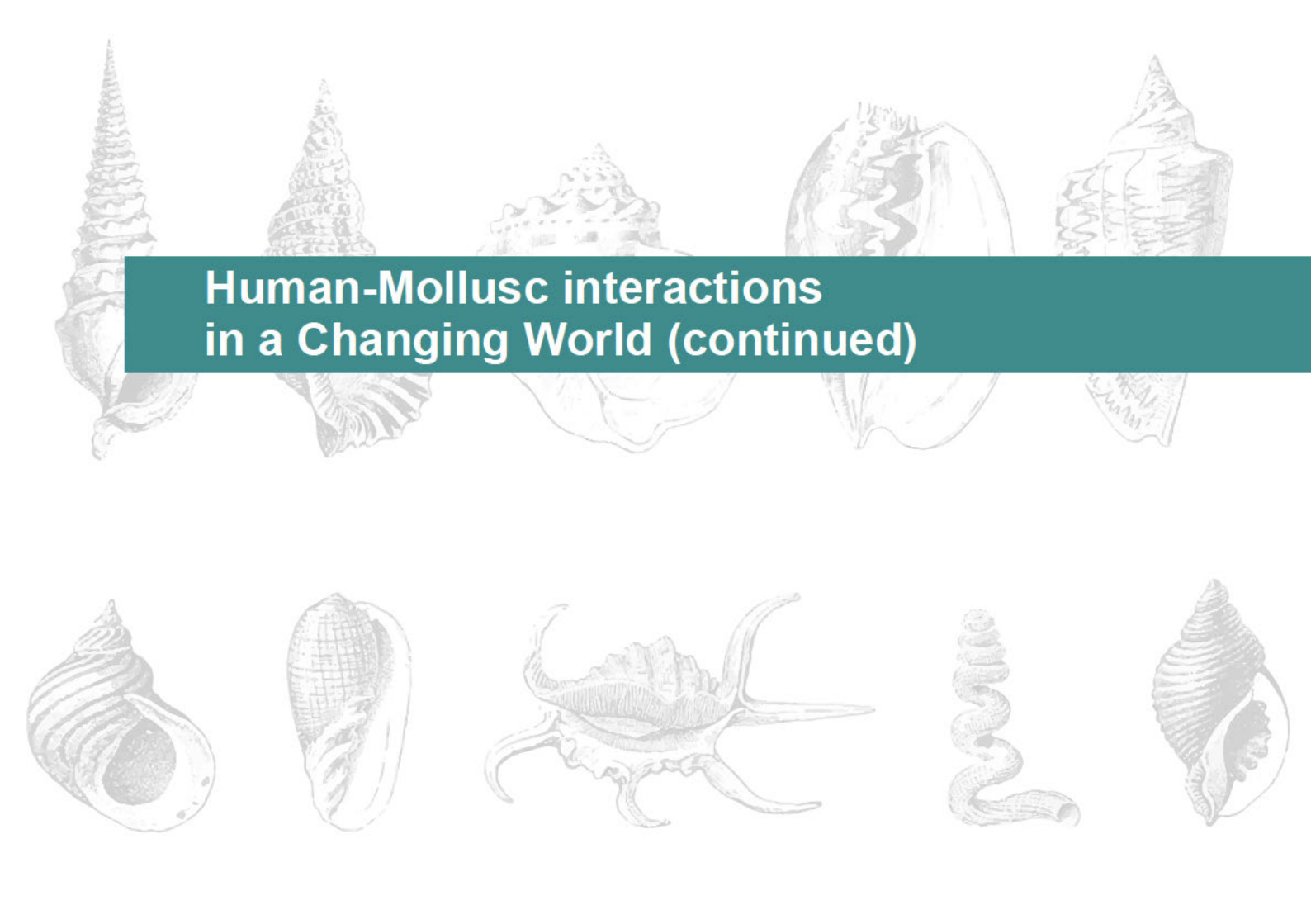
Unité Santé, Génétique et Microbiologie des Mollusques, Ifremer, France

Sylvie.Lapegue@ifremer.fr

During the last century, shellfish farming in France has been based on three species. During the last 15 years, the number of episodes of mortality on different wild and cultivated shellfish species has increased, although the reasons behind these episodes of mortality are not yet well understood. The Pacific oyster (*Crassostrea gigas*), is considered an invasive species in France, and was introduced about 50 years ago in two bays and is now reproducing along the French coasts. At present, it is difficult to disentangle the increase in sea temperature and the invasive capacities of this species in their range expansion. To address this, a qualitative and quantitative study of phytoplanktonic distribution, which oysters feed on, was undertaken. Changes in the microbial community were observed to coincide with episodes of mortality. Other parameters such as salinity or acidity are also thought to be associated with higher mortality and subsequently, the impact of ocean acidification also needs to be considered. Socio-economic impacts of invasive species and shellfish mortality on French shellfisheries raises a number of questions and challenges that need to be more deeply addressed through an interdisciplinary approach.

Keywords:

oysters, production, diseases, recruitment, adaptation, invasion

The background of the slide features a collection of detailed, grayscale illustrations of various mollusk shells. These include several tall, conical nautilus-like shells in the top row, a variety of bivalve shells in the middle row, and a mix of gastropod shells, including a large chambered nautilus, a small scallop with prominent siphons, and a small, tightly coiled shell, in the bottom row. The shells are arranged in a way that they appear to be floating or scattered across the slide.

Human-Mollusc interactions in a Changing World (continued)



Pangandaran, along the south coast of Java, Indonesia,
where they offer large protected shells (in this case chambered *Nautilus*) openly for sale.
© Vincent Nijman

Monitoring trade in large marine shells in and from Indonesia

Vincent Nijman

Department of Social Sciences, Oxford Brookes University, England

vnijman@brookes.ac.uk

Indonesia has a comprehensive system in place to protect large marine molluscs such as *Nautilus*, horned helmet, false trumpet, and giant clams. These species are protected and cannot be traded, or, in the case of giant clams, only second-generation maricultured individuals can be sold internationally. Other species, such as the false trumpet, are not protected but their trade is regulated through a quota system, and with current quotas set at zero, no commercial trade in them is allowed. In practice, however, all these species are traded in large quantities, seemingly with impunity. Since 2012, we initiated a monitoring program in Java and Bali where we (1) record and quantify trade in the open wildlife markets; (2) keep track of the online wholesale trade in large marine shells; (3) locate seizure data and subsequent prosecutions and (4) liaise with stakeholders within and outside Indonesia to improve trade regulations and increase protection of large marine molluscs in Indonesian waters. Thus far we have recorded the trade in thousands of shells in the markets, 10,000s shells offered by wholesalers, and over 100,000 confiscated shells in over 20 separate seizures. Partially as a result of our efforts, proposals were prepared to include nautilus species on Appendix II of CITES to regulate international trade. We hope that this will lower the illegal exports of nautilus out of Indonesia, and that the international focus on nautilus can lead to better regulated trade in other species as well.

Keywords:

Cassis, CITES, *Nautilus*, Southeast Asia, illegal wildlife trade



A house in southwestern Madagascar rendered with sokay (a lime render made from sea shells).
© Ivan Scales

Molluscs in a Globalising world: experiences from the mangrove forests of southwestern Madagascar

Ivan Scales

Department of Geography, University of Cambridge, England

irs28@cam.ac.uk

Molluscs play an important role in the livelihoods of many coastal communities in the tropics. They provide a wide range of natural resources, from food to building materials. In this paper I explore how emerging markets, commodity chains, and resource uses are creating new opportunities but also placing novel stresses on species and ecosystems. I explore how livelihoods in a remote area of southwest Madagascar are being transformed by new global commodity chains in marine products, including molluscs such as octopus, thereby placing increased pressure on mangrove ecosystems. I focus on the production of 'sokay', a seashell based lime render produced in mangrove wood kilns and used to improve the durability of houses. Drawing on concepts from political ecology I argue that resource management policies must pay closer attention to the multi-scalar socio-ecological links between ecosystems, species, and people.

Keywords:

Madagascar, seashells, livelihoods, mangroves, globalisation



Shellfish are consumed throughout the Pacific like in Kiribati where they are gleaned at low tide. The farming of shellfish for food remains, however, a foreign concept in the region despite the urgent need to improve the productivity of coastal fisheries.
© Frank Magron

The opportunities and challenges for a transition from the gleaning to the farming of shellfish in the Pacific region

Michel Bermudes

Coastal Fisheries Programme, Pacific Community, New Caledonia

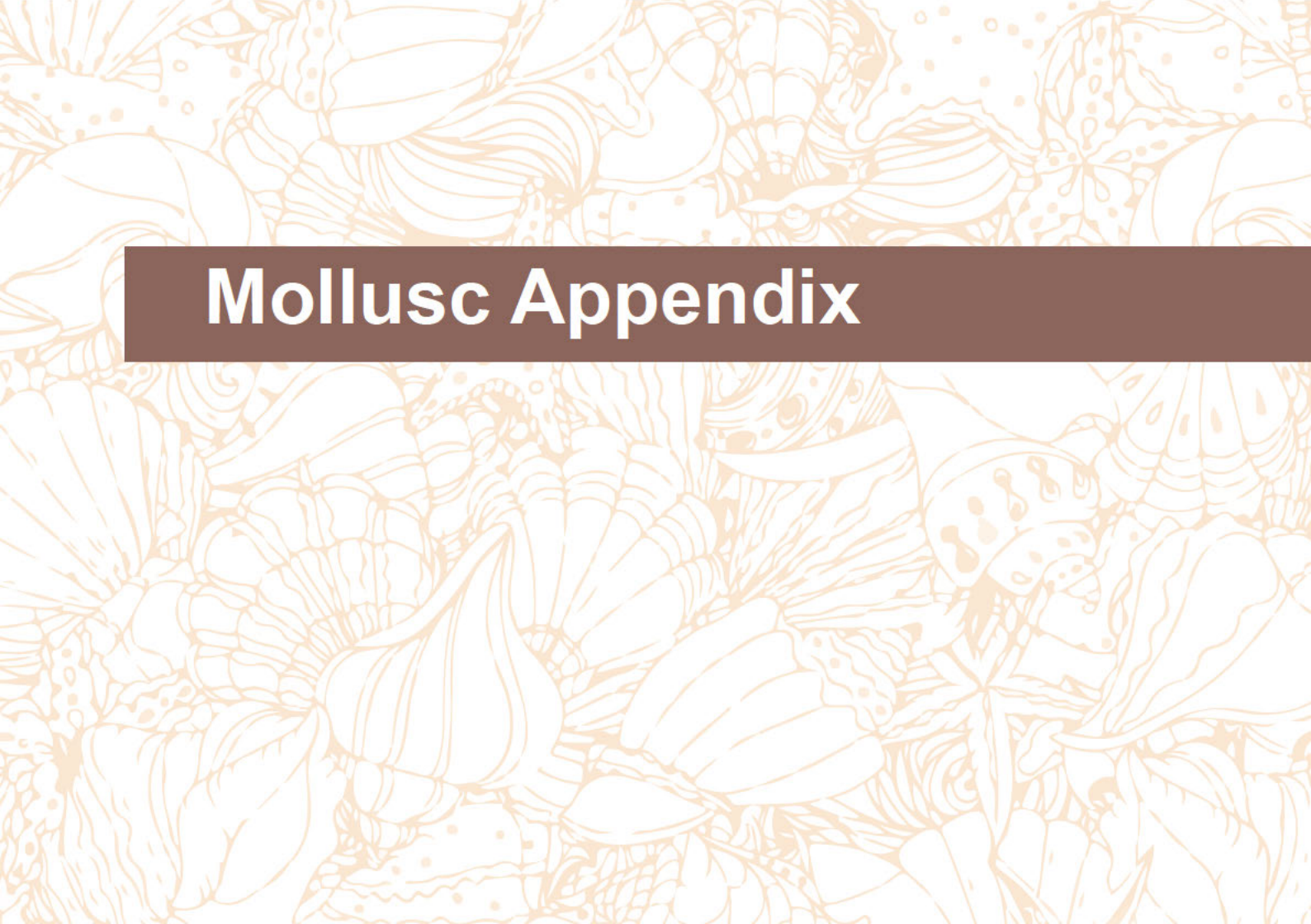
michelbe@spc.int

Shellfish hold a critical and a special place for coastal and island communities in the Pacific Islands Region. They are a ubiquitous and incredibly versatile resource in the way they can be used for food, the manufacture of tools, handicrafts and curios, and culturally when used as traditional money. Beyond their material and food value, shellfish play a pervasive socio-economic role as they are collected by both men and women regardless of their social standing and for either professional or subsistence reasons. Under the continued and increasing pressure of population growth, and while not well documented, there is anecdotal evidence that suggests localised depletion (e.g., *Spondylus* sp. used for shell money, *Anadara* sp. used for food and barter). Despite the increased frequency of localised depletions, the farming of shellfish for food has not been systematically approached in the Pacific Islands Region despite many attempts over the past 50 years. This paper will review the current status of shellfish farming in the Pacific Islands Region and previous attempts at framing shellfish for food to better understand the challenges that exist in having coastal and island communities transition from the gleaning to the framing of shellfish in the Pacific Islands region.

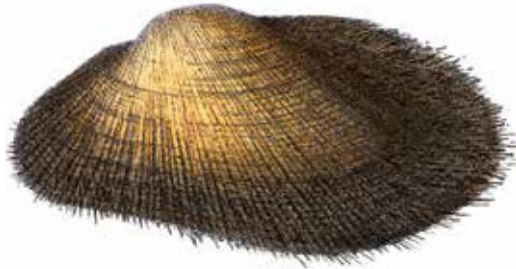
Keywords:

shellfish, farming, aquaculture, Pacific, island, food security





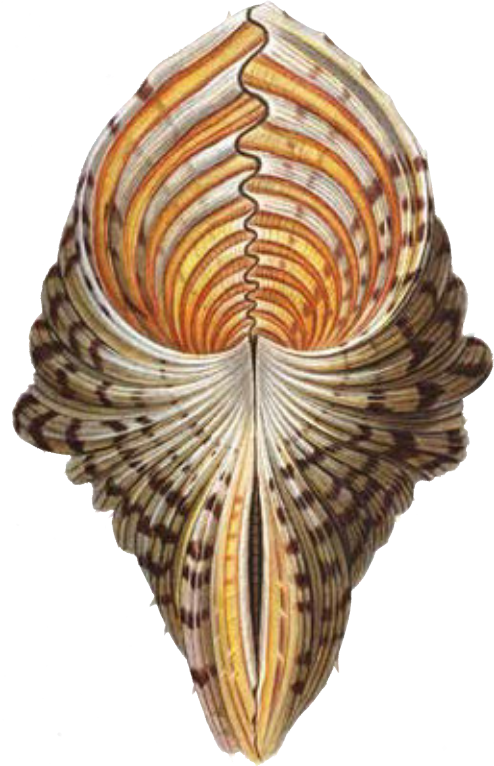
Mollusc Appendix



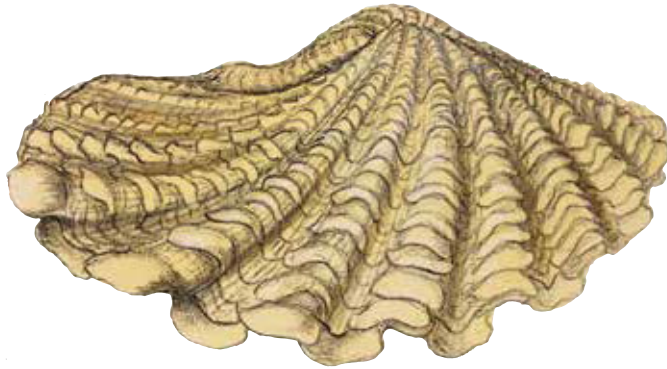
Arcidae : *Barbatia* sp.



Arcidae : *Senilia* sp.



Cardiidae : *Hippopus* sp.



Cardiidae : *Tridacna* sp.



Hiatellidae : *Panopea* sp.



Lucinidae : *Fimbria* sp.

Bivalves

Bivalves



Malleidae : *Mallens* sp.



Pectinidae : *Chlamys* sp.



Pinnidae : *Pinna* sp.



Pteriidae : *Isognomon* sp.



Solenidae : *Solen* sp.

Bivalves



Spondylidae : *Spondylus* sp.



Spondylidae : *Spondylus* sp.



Unionidae : *Anodonta* sp.



Unionidae : *Physunio* sp.



Veneridae : *Venus* sp.

Bivalves

Gastropods



Campanilidae : *Campanile* sp.



Cassidae : *Cassis* sp.



Conidae : *Conus* sp.



Cypraeidae : *Cypraea* sp.



Gastropods

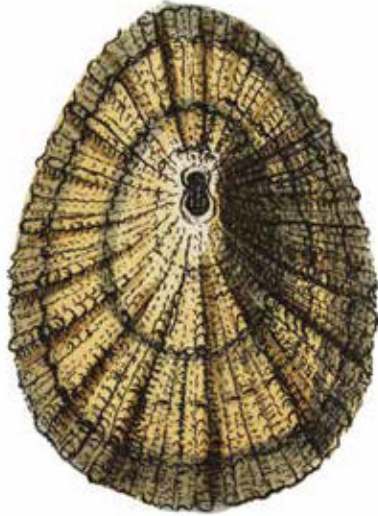
Gastropods



Cypraeidae : *Cypraea* sp.



Fascioliariidae : *Fusus* sp.

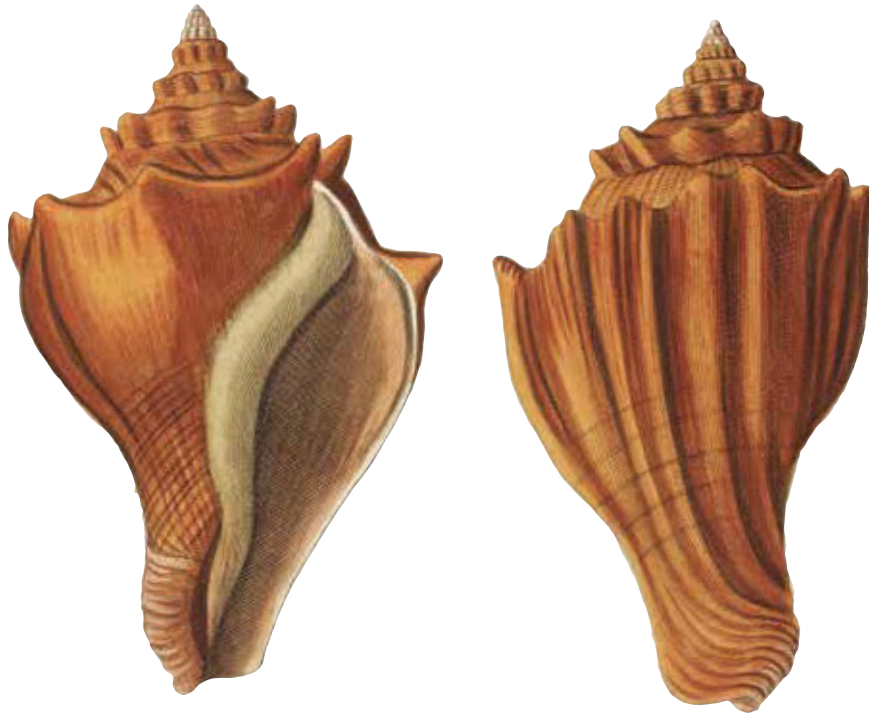


Fissurellidae : *Fissurella* sp.

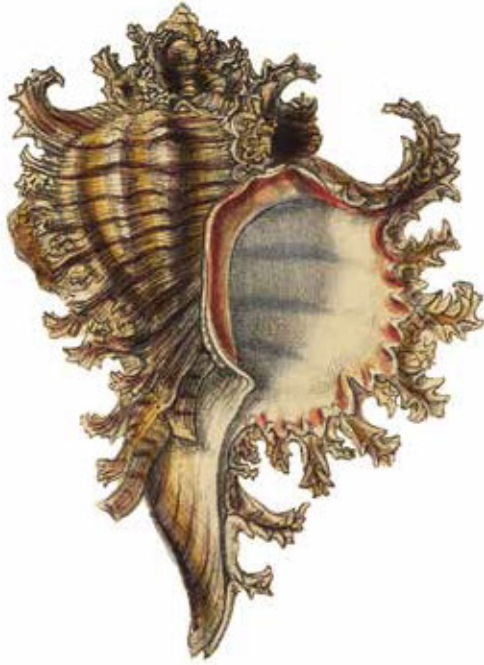


Haliotidae : *Haliotis* sp.

Gastropods



Melongenidae : *Volema* sp.



Muricidae : *Murex* sp.



Neritidae : *Nerita* sp.

Gastropods

Gastropods



Olividae : *Oliva* sp.



Strombidae : *Strombus* sp.



Strombidae : *Lambis* sp.



Turbinidae : *Turbo* sp.

Gastropods



Vermetidae : *Vermetus* sp.

Acknowledgements

This workshop was supported by a grant from the Agence Nationale de la Recherche under LabEx ANR-10-LABX-0003-BCDiv, in the program “Investissements d’avenir” ANR-11-IDEX-0004-02 and was part of a research project on “Local knowledge, shell fisheries dynamics and socio-ecological change in coastal ecosystems of the Tigak Group of Islands (New Ireland, Papua New Guinea)”. Thanks are extended to the Papua New Guinean National Fisheries College and the Nago Island Mariculture Research Facility for hosting the field part of the project and contributing to the organization of the workshop.

Financial support was provided through grants from the French National Museum of Natural History, «Sorbonne Universités» and the “Société des Amis du Muséum National d’Histoire Naturelle et du Jardin des Plantes”.

The workshop organizers would like to thank the following colleagues and support staff who kindly provided assistance in the workshop preparation and logistical arrangements: Serge Bahuchet, Bruno Alacoque, Hélène Arthaud, Philippe Béarez, Jean-Maurice Poutiers, Marie-Christine Cormier-Salem, Alain Epelboin, Sylvie Ofranc, Florence Loiseau, Taoues Lahrem, Pauline Rameau, Philippe Maestrati, Virginie Heros and Claudia Ratti.

Special thanks go to Jean-Denis Vigne, Frédérique Chlous, André Delpuech, Anthony Herrel, Laure Emperaire, Dominique Guillaud, Samuel Pavard, Denis Couvet, Denis Duclos, Lea Brunelle, Myriam Meziou, Anne-Cécile Haussonne and Theo Gund.

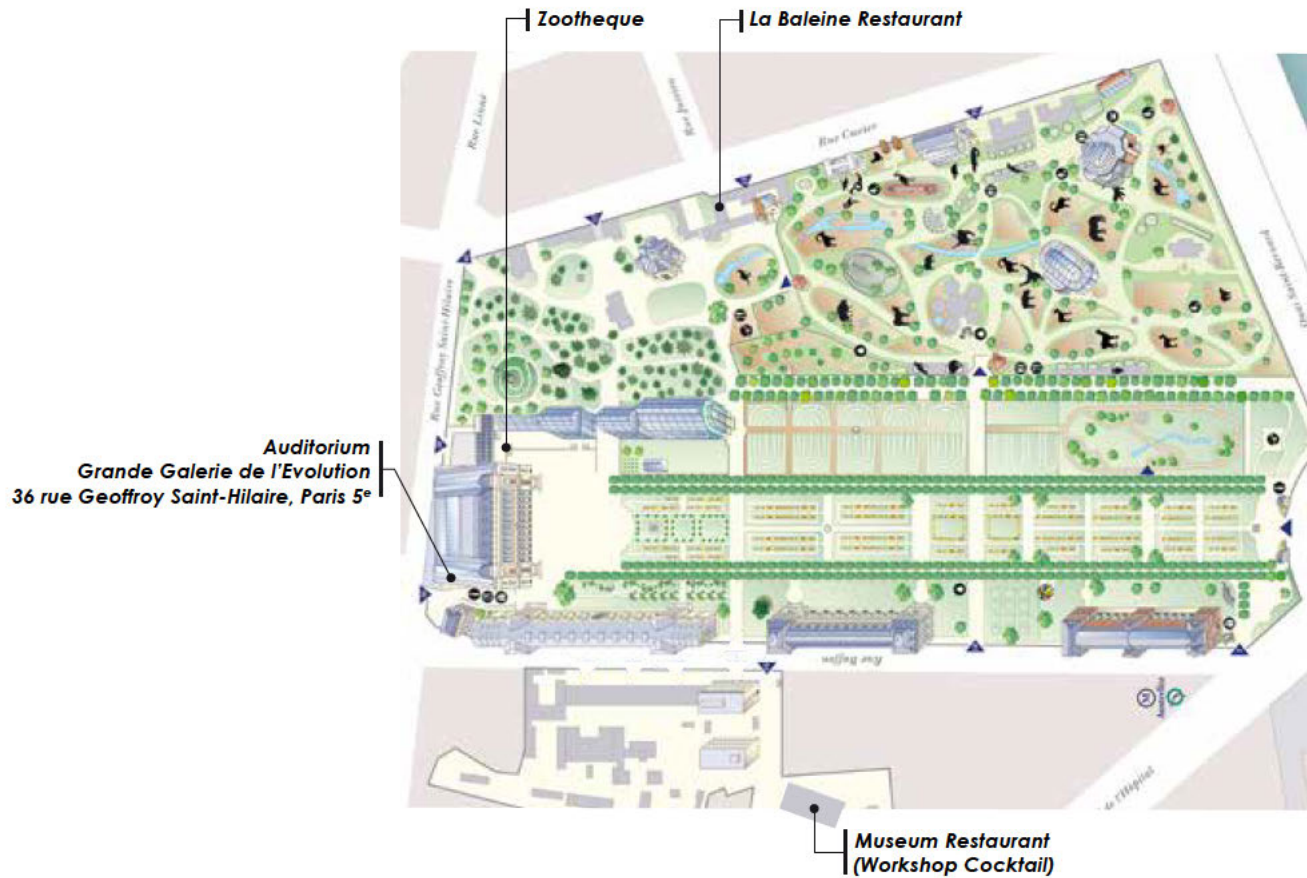
We would like to thank the Recolnat project (ANR-11-INBS-0004) and Pierre Lozouet for their assistance at different levels of the project and workshop organization.

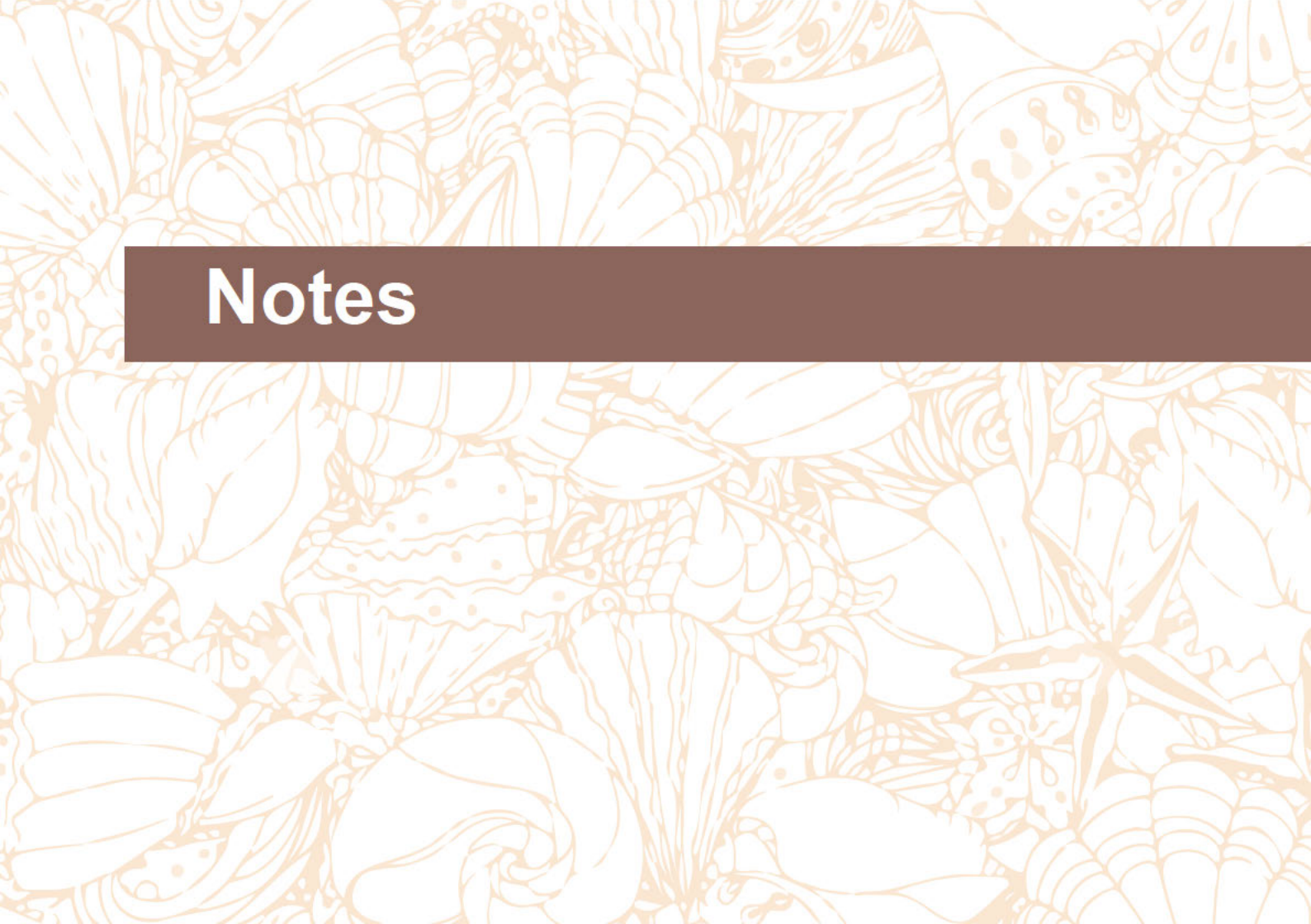
The front cover drawing was provided by Peyo Dillais. Photographs on page 12 and 76 are Copyright of Thierry Magniez/PNI/MNHN/Our Planet Reviewed. Drawings for the mollusc appendix were selected from antique books and photographs were produced by Marie Henion.

Thanks are expressed to Laurence Billault for formatting and final presentation of the workshop abstract book.

The workshop organizers would like to warmly thank each of the individual contributors who made the effort to participate and/or to provide case studies that stimulated the dynamics and outcome of the workshop.

Maps





Notes

