

Contents

| | |
|--|-----------|
| <i>List of Contributors</i> | xiv |
| <i>Series Foreword</i> | xix |
| <i>Acknowledgements</i> | xxii |
| Part I Social-Ecological Systems in Fisheries | 1 |
| 1 Introduction | 3 |
| <i>Rosemary E. Ommer and R. Ian Perry</i> | |
| Reference | 8 |
| 2 Restoring Unity: The Concept of Marine Social-Ecological Systems | 9 |
| <i>Fikret Berkes</i> | |
| Introduction | 10 |
| Social-ecological systems concept and background | 11 |
| Complexity, globalization, and social-ecological systems | 14 |
| Participatory management and governance | 19 |
| Conclusions | 22 |
| Acknowledgements | 24 |
| References | 24 |
| Part II Modeling | 29 |
| 3 Predicting the Impacts and Socio-Economic Consequences of Climate Change on Global Marine Ecosystems and Fisheries: The QUEST_Fish Framework | 31 |
| <i>Manuel Barange, Icarus Allen, Eddie Allison, Marie-Caroline Badjeck, Julia Blanchard, Benjamin Drakeford, Nicholas K. Dulvy, James Harle, Robert Holmes, Jason Holt, Simon Jennings, Jason Lowe, Gorka Merino, Christian Mullon, Graham Pilling, Lynda Rodwell, Emma Tompkins, and Francisco Werner</i> | |
| Introduction | 32 |
| Framing the problem | 35 |
| Geographical and temporal framework | 35 |
| The role of GCMs and RCMs | 36 |
| Developing physical-biological models for the shelf seas | 37 |

| | |
|--|-----------|
| Estimating potential fish production | 40 |
| Estimating socio-economic consequences | 44 |
| Methodology for national vulnerability assessment | 44 |
| Methodology for global assessment of a marine-based commodity: fishmeal | 48 |
| Opportunities and boundaries of the QUEST_Fish approach | 52 |
| Endnotes | 54 |
| References | 54 |
| | |
| 4 | |
| Fleets, Sites, and Conservation Goals: Game Theoretic Insights on Management Options for Multinational Tuna Fisheries | 60 |
| <i>Kathleen Miller, Peter Golubtsov, and Robert McKelvey</i> | |
| | |
| Introduction | 61 |
| Background – Tuna exploitation and management in the Western and Central Pacific | 62 |
| The model | 66 |
| The single-season subgame: The split-stream extensive model | 68 |
| The two-fleet interior game | 68 |
| The RFMO-guided seasonal game between distant-water fleets and coastal countries | 70 |
| Simulations and implications | 72 |
| Game structure of RFMO–sites–fleets interaction | 72 |
| Policy choices for sustaining stocks | 73 |
| Effects of coalition-formation | 80 |
| Climate-related shifts in distribution of stocks | 84 |
| Summary, policy implications and future directions | 86 |
| Acknowledgement | 87 |
| Endnotes | 87 |
| References | 88 |
| | |
| 5 | |
| Fishing the Food Web: Integrated Analysis of Changes and Drivers of Change in Fisheries of the Bay of Biscay | 90 |
| <i>Olivier Thébaud and Fabian Blanchard</i> | |
| | |
| Introduction | 91 |
| Patterns of change in fisheries landings by French fleets | 92 |
| Drivers of change | 93 |
| Institutional context: a case of “regulated open access” | 94 |
| Increased competition in markets for fish | 95 |
| Effects of sea warming on the fish community structure | 97 |
| Perspectives | 101 |
| Acknowledgements | 102 |
| Endnotes | 102 |
| References | 103 |

| | | |
|----------|---|------------|
| 6 | Interdisciplinary Modeling for an Ecosystem Approach to Management in Marine Social-Ecological Systems | 105 |
| | <i>Anthony M. Starfield and Astrid Jarre</i> | |
| | Introduction | 105 |
| | Focusing attention and setting objectives | 106 |
| | A model of a model | 108 |
| | Rapid prototyping | 109 |
| | The question of balance | 111 |
| | Frame-based modeling | 112 |
| | People and resources | 115 |
| | Concluding remarks | 117 |
| | Acknowledgements | 118 |
| | References | 118 |
| 7 | People's Seas: "Ethno-oceanography" as an Interdisciplinary Means to Approach Marine Ecosystem Change | 120 |
| | <i>Maria A. Gasalla and Antonio C. S. Diegues</i> | |
| | Introduction | 120 |
| | Defining "ethno-oceanography" | 122 |
| | Ethnoecology approach | 122 |
| | The significance of key communication: Ethno-oceanography and changes in marine social-ecological systems of Brazil | 124 |
| | "Ethno-oceanography" as a framework to approach climate and marine ecosystem change | 128 |
| | Looking beyond uncertainty: Implications of climate change to fisheries | 129 |
| | Redefining the reach of ethno-oceanography: a conceptual approach | 130 |
| | Concluding remarks | 132 |
| | Acknowledgements | 132 |
| | Endnotes | 133 |
| | References | 133 |
| | Part III Knowledge | 137 |
| 8 | The Utility of Economic Indicators to Promote Policy-Relevant Science for Climate Change Decisions | 139 |
| | <i>Judith Kildow</i> | |
| | Introduction | 139 |
| | Indicators | 141 |
| | Economic indicators: a framework | 143 |
| | Economic indicators function in multiple ways | 143 |
| | The evidence from society | 146 |
| | Conclusion | 148 |
| | Endnotes | 149 |
| | References | 149 |

| | | |
|-----------|---|------------|
| 9 | Scientific Advice for Fisheries Management in West Africa in the Context of Global Change | 151 |
| | <i>Bora Masumbuko, Moctar Bâ, P. Morand, P. Chavance, and Pierre Failler</i> | |
| | Introduction | 151 |
| | West African context | 152 |
| | Method | 155 |
| | ECOST/ISTAM survey results | 156 |
| | Scientific advice: content and processes | 156 |
| | Use and non-use of scientific advice and its implications | 157 |
| | Improvement of the quality of scientific advice and its use in the decision process | 160 |
| | Discussion | 161 |
| | Conclusion | 164 |
| | Acknowledgements | 165 |
| | Endnotes | 165 |
| | References | 166 |
| 10 | Knowledge and Research on Chilean Fisheries Resources: Diagnosis and Recommendations for Sustainable Development | 168 |
| | <i>Eleuterio Yáñez, Exequiel González, Luis Cubillos, Samuel Hormazábal, Héctor Trujillo, Lorena Álvarez, Alejandra Órdenes, Milton Pedraza, and Gustavo Aedo</i> | |
| | Introduction | 169 |
| | Framework | 169 |
| | System structure, elements, interactions, and knowledge to be considered | 174 |
| | Current status of knowledge | 176 |
| | Governance of the fisheries system (a system of problems) | 179 |
| | Discussion | 179 |
| | Future research path for fisheries management | 179 |
| | Endnotes | 181 |
| | References | 181 |
| 11 | Moving Forward: Social-Ecological Interactivity, Global Marine Change and Knowledge for the Future | 182 |
| | <i>Barbara Neis</i> | |
| | Introduction | 182 |
| | Social-ecological knowledge | 183 |
| | Knowing where we want to go and finding our way there | 190 |
| | Conclusion | 195 |
| | Endnote | 197 |
| | References | 197 |

| | |
|---|------------|
| Part IV Values | 201 |
| 12 Unaccounted Values: Under-reporting Sardine Catches as a Strategy Against Poverty in the Bali Strait, Indonesia | 203 |
| <i>Eny Anggraini Buchary, Tony J. Pitcher, and Ussif Rashid Sumaila</i> | |
| Introduction | 203 |
| Area description | 204 |
| The Lemuru fishery | 205 |
| Materials and methods | 206 |
| Data collection | 206 |
| Analytical methods | 207 |
| Results and discussion | 211 |
| Fate of landed lemuru and distribution of reported catch | 211 |
| Estimated true catch | 214 |
| Financial insecurity: lending schemes and debt-to-assets ratio | 215 |
| Measuring relative poverty in fisheries | 217 |
| Conclusions | 218 |
| Acknowledgements | 219 |
| Endnotes | 220 |
| References | 221 |
| 13 “You Don’t Know What You’ve Got ‘Til It’s Gone”: The Case for Spiritual Values in Marine Ecosystem Management | 224 |
| <i>Nigel Haggan</i> | |
| Introduction | 224 |
| Golden Rule #1: Love your neighbor as yourself | 226 |
| Golden Rule #2: The one with the gold makes the rules | 227 |
| Golden Rule #3: The gold goes where the gold grows | 227 |
| Concepts of value | 228 |
| The roots of whole ecosystem evaluation | 229 |
| Formal frameworks, 1987–1991 | 230 |
| Measuring ecosystem value | 231 |
| A bridge between intrinsic and instrumental value | 234 |
| Conclusion | 236 |
| Acknowledgements | 237 |
| Appendix 1: Catagories used in total economic value and ecosystem services frameworks | 237 |
| References | 239 |
| 14 Social-Ecological Restructuring and Implications for Social Values | 247 |
| <i>Grant Murray</i> | |
| Introduction | 248 |
| Approach and methods | 249 |

| | |
|--|------------|
| Social-ecological restructuring: Putting climate change in context | 249 |
| Changes in social structures and processes | 251 |
| Size and connection with fishing industry | 251 |
| Age structure | 252 |
| Internal stratification | 253 |
| Fishing as a way of life: Now and in the future | 258 |
| Discussion | 259 |
| Conclusion | 261 |
| Endnotes | 262 |
| References | 262 |
| | |
| 15 Economic Valuation of Mangroves in the Niger Delta: An Interdisciplinary Approach | 265 |
| <i>Godstime K. James, Jimmy O. Adegoke, Ekechukwu Saba, Peter Nwilo, Joseph Akinyede, and Sylvester Osagie</i> | |
| Introduction | 265 |
| Study area | 266 |
| Integration of remote sensing and socio-economic data | 267 |
| Economic valuation of mangrove resources | 268 |
| Methodology | 269 |
| Remote sensing analysis | 269 |
| Focus group analysis | 270 |
| Household survey | 271 |
| Empirical data processing | 271 |
| Estimation of net income from the sale of mangrove resources | 271 |
| Estimation of the mangrove area that supported mangrove income (A_k) | 272 |
| Annual household net income at the community level | 273 |
| Results and analysis | 274 |
| Socio-economic characteristics of household survey respondents | 274 |
| Area of mangrove that support income stream (A_k) | 274 |
| Results from the economic valuation | 274 |
| Conclusions | 277 |
| References | 278 |
| | |
| 16 US Marine Ecosystem Habitat Values | 281 |
| <i>Ussif Rashid Sumaila, Jackie Alder, G. Ishimura, William. W. L. Cheung, L. Dropkin, S. Hopkins, S. Sullivan, and A. Kitchingman</i> | |
| Introduction | 281 |
| Geographical scope of study | 282 |
| Assigning use and non-use values to habitat types | 283 |
| Direct use: Habitat associated commercial values | 283 |

| | |
|--|------------|
| Direct use: Habitat associated recreational values | 284 |
| Non-use and indirect value: Habitat values based on iconic species | 285 |
| The results | 285 |
| Direct use: Habitat associated commercial values | 286 |
| Direct use: Habitat associated recreational values | 286 |
| Non-use and indirect value: Habitat values based on iconic species | 286 |
| Concluding remarks | 287 |
| Acknowledgements | 288 |
| Endnotes | 288 |
| References | 288 |
| Part V Governance | 291 |
| 17 Historical Transitions in Access to and Management of Alaska's Commercial Fisheries, 1880–1980 | 293 |
| <i>Emilie Springer</i> | |
| Introduction | 293 |
| Early days: Gold and salmon; 1867–1919 | 294 |
| 1899 Report by Jefferson Moser, United States Navy Commander of the steam ship <i>Albatross</i> | 294 |
| 1920–1939: The records of Hubbell and Waller | 296 |
| The mid-century era of fisheries: 1940–1969 | 299 |
| 1954–1970 Total Catch Statistics | 300 |
| Species shift, changing technology, improved access, and awareness of off-shore waters: 1970s–1980s | 301 |
| Three Alaskan competitors: Japan, Russia/Soviet Union, and Korea | 302 |
| Organization of the North Pacific Fishery Management Council (NPFMC) | 304 |
| Discussion and conclusions | 305 |
| Endnotes | 307 |
| References | 307 |
| 18 Can Fishers' Virtuous Behavior Improve Large Marine Ecosystem Health? | 310 |
| <i>Valentina Giannini</i> | |
| Introduction | 310 |
| Guatemala: A case study | 314 |
| Vicious chains: Exploitation and degradation | 314 |
| Virtuous chains and the Red: A partial solution to conflict and overfishing | 316 |
| Discussion | 317 |
| Conclusions | 318 |
| Acknowledgements | 319 |
| References | 319 |
| Useful websites | 321 |

| | | |
|-----------|---|------------|
| 19 | Ecosystem-based Management in the Asia-Pacific Region | 322 |
| | <i>Mitsutaku Makino and Hiroyuki Matsuda</i> | |
| | Introduction | 322 |
| | Global comparison of fisheries sectors | 323 |
| | Ecosystem-based management at the Shiretoko World Natural Heritage, Japan | 329 |
| | Discussion | 331 |
| | Conclusion | 332 |
| | Acknowledgement | 332 |
| | Endnotes | 332 |
| | References | 333 |
| 20 | A Network Approach to Understanding Coastal Management and Governance of Small-scale Fisheries in the Eastern Caribbean | 334 |
| | <i>Kemraj Parsram and Patrick McConney</i> | |
| | Introduction | 334 |
| | Coastal and fisheries resources | 335 |
| | Governance issues | 337 |
| | Network governance thinking | 340 |
| | Tuna fishery management | 341 |
| | Fisheries science networks | 343 |
| | Regional fisher folk organization | 346 |
| | Conclusion | 347 |
| | References | 348 |
| 21 | Uncertainty Demands an Adaptive Management Approach to the Use of Marine Protected Areas as Management Tools | 351 |
| | <i>Michel J. Kaiser</i> | |
| | Introduction | 351 |
| | Quantifying the performance of MPAs | 352 |
| | The “plaice-box” as a case study | 353 |
| | Climate effects on MPA performance metrics | 355 |
| | Dealing with future uncertainty | 356 |
| | References | 357 |
| 22 | Building Resilience to Climatic and Global Change in High-Latitude Fishing Communities: Three Case Studies from Iceland and Alaska | 359 |
| | <i>James R. McGoodwin</i> | |
| | Introduction | 360 |
| | Impacts that are forecast for marine ecosystems and the world’s coastal fishing communities | 361 |
| | Case studies from three high-latitude fishing communities | 364 |

| | |
|---|------------|
| Case Study 1: Heimaey, Iceland | 365 |
| Case Study 2: Dillingham, Southwest Alaska | 367 |
| Case Study 3: The Yup'ik community, Southwest Alaska | 369 |
| Conclusion: recommendations for increasing the resilience of the three high-latitude coastal fishing communities | 372 |
| Recommendations for Heimaey, Iceland | 372 |
| Recommendations for Dillingham, Southwest Alaska | 373 |
| Recommendations for the Yup'ik community, Southwest Alaska | 373 |
| General recommendations | 373 |
| Regarding ordinary climatic variability | 373 |
| Regarding severe coastal storms and extreme weather events, sea-level rise, and saltwater intrusion | 374 |
| Regarding changes in marine ecosystem compositions | 374 |
| Regarding building the capacity of fisheries-management systems to more effectively deal with global warming and change | 375 |
| Regarding future fisheries research | 375 |
| Regarding regional fisheries management organizations | 376 |
| Acknowledgements | 377 |
| Endnotes | 377 |
| References | 378 |
| | |
| 23 Coping with Environmental Change: Systemic Responses and the Roles of Property and Community in Three Fisheries | 381 |
| <i>Bonnie J. McCay, Wendy Weisman, and Carolyn Creed</i> | |
| Introduction | 381 |
| Case Study 1: Fogo Island, Newfoundland, Canada | 383 |
| Case Study 2: Pacifico Norte, Baja California Sur, Mexico | 386 |
| Case Study 3: US Surfclam Fishery | 391 |
| Conclusion: Enclosures, feedback, and the future | 394 |
| Acknowledgements | 396 |
| References | 397 |
| | |
| Part VI Conclusions | 401 |
| 24 Conclusion: Hierarchy, Power, and Potential Regime Shifts in Marine Social-Ecological Systems | 403 |
| <i>Rosemary E. Ommer and R. Ian Perry</i> | |
| References | 406 |
| | |
| <i>Index</i> | 407 |

A color plate section falls between pages 208 and 209