# Prof. Muki Shpigel – Curriculum Vitae

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## Education

* **B.Sc. in Biology** – Tel Aviv University (1972–1974)
* **M.Sc. in Marine Biology** – Tel Aviv University (1974–1978, with honors). Thesis: “The spatial heterogeneity in branching corals and fish species diversity” (Advisor: Prof. Yossi Loya).
* **Ph.D. in Marine Biology** – Tel Aviv University (1978–1985). Thesis: “Aspects of the biology and ecology of the Red Sea groupers *Cephalopholis* (Serranidae, Teleostei)” (Advisor: Prof. Lev Fishelson).
* **Postdoctoral Research** – Virginia Institute of Marine Science (VIMS), College of William & Mary, USA (1989–1990). Research focus: bivalve bioenergetics.

## Positions Held and Academic Status

* **2018–Present:** Senior Research Scientist, Morris Kahn Marine Research Station, University of Haifa.
* **2017–2018:** Visiting Scientist, Interuniversity Institute for Marine Sciences (IUI), Eilat, Israel.
* **2010–Present:** Adjunct Professor, Ben-Gurion University of the Negev.
* **1985–2017:** Senior Research Scientist, Israel Oceanographic & Limnological Research – National Center for Mariculture (Grade A+).
* **1998–1999:** Sabbatical Fellow, NOAA Milford Laboratory (Connecticut, USA).

## Employment History

* **1985–2017:** Head of Department, Integrated Multi-Trophic Aquaculture (IMTA) Systems, National Center for Mariculture.
* **1982–1985:** Research Assistant, Dept. of Zoology, Tel Aviv University (for Prof. Lev Fishelson and Prof. Yossi Loya).
* **1982–1985:** Chief Scientist, environmental impact surveys for the Municipality of Herzliya, Israel.
* **1984–1985:** Chief Scientist, preliminary marine impact survey for the Municipality of Haifa, Israel.
* **1985:** Lead Scientist, aquaculture–recreation impact survey for a private company in Nigeria.
* **1975–1982:** Director, Field Study Center in Na’ama (Sinai) – Society for the Protection of Nature in Israel. Responsible for nature conservation in the Gulf of Eilat and head of the Center’s educational program.
* **1973–1974:** Assistant Curator, Zoological Museum, Tel Aviv University.

## Professional Activities

**Professional and Academic Administrative Roles:**

* 2017 – Member of the grants evaluation committee, Ministry of Science.
* 2012–2017 – Expert Panel member, European Commission (EU).
* 2015 – Member of the grants evaluation committee, Ministry of Agriculture.
* 2015 – Member of the grants evaluation committee for ERA-Net COFASP (French National Research Agency).
* 1999–2009 – Member of the Honors and Awards Committee, World Aquaculture Society.
* 2006 – Session organizer (Polyculture Session) for World Aquaculture Conference, Florence, Italy.
* 2005 – Committee member, EFARO (European Fisheries & Aquaculture Research Organization) on the future of aquaculture in Europe.
* 2003 – Steering committee member, Sea Urchin International Conference, Chile.
* 2002 – Session organizer, World Aquaculture Society Conference, Beijing, China.
* 2001 – Organizer and moderator of Polyculture Session, World Aquaculture Society Conference, Orlando, USA.
* 1985–1988 – Advisor to the Ministry of the Environment (Israel) on coral reef protection (impact of marinas, sedimentation, sewage).
* 1985–2000 – Advisor to the Israel Nature Reserves Authority on coral reef protection (impacts of divers, underwater vessels, and fish farming).
* 1993–1999 – Member of the Directorate, Israeli Diving Federation; initiated a grant program for M.Sc. student research on the marine environment.
* 1993–1998 – Advisor to the Israel Union for Environmental Defense on marine nature protection issues.
* 1998 – Invited consultant to Fremantle University of TAFE (Western Australia) to establish an experimental IMTA system.
* 1998 – Invited consultant to Big Island Abalone Farm (Kailua-Kona, Hawaii) to establish an abalone–seaweed integrated system.
* 1992–2000 – Board Member, Israeli Underwater Federation (22,000 members); Head of Environmental Protection Committee.
* 1998 – Organizer of the Integrated Systems session for World Aquaculture Society Conference (Sydney, 1999).
* 1993–1995 – Steering committee member for development of a mariculture curriculum at “Mevuot Yam” Maritime & Mariculture College (Michmoret, Israel).
* 1992 – Organizer of a national Sea Protection symposium (with Tel Aviv University’s Institute for Nature Conservation and the Israeli Underwater Federation), Tel Aviv University (September 23, 1992).
* 1976–1982 – Chief Scientist for marine and terrestrial surveys in the Sinai Peninsula (Society for the Protection of Nature in Israel).

**Editorial Board Memberships:**

* Associate Editor, *Journal of the World Aquaculture Society* (1999–2016).
* Associate Editor, *Journal of Applied Aquaculture* (2007–2014).
* Associate Editor, *Aquatic Biosystems* (2012–2014).
* Editorial Board Member, *Yam* (diving magazine) (1988–1995); Editor of a special issue on marine conservation (1994).

**Reviewer for Scientific Journals:**
*Aquaculture; Aquacultural Engineering; Aquaculture International; Aquaculture Research; Bamidgeh (Isr. Journal of Aquaculture); Journal of Experimental Marine Biology and Ecology; Journal of Shellfish Research; Marine Biology; Marine Ecology; Environmental Technology; Journal of Applied Phycology.*

**Reviewer of Research Grant Proposals:**
*German–Israeli Foundation (GIF); Inter-University Ecology Fund (Israel); Binational Agricultural R&D Fund (BARD); Israel Science Foundation (ISF); U.S. Department of Commerce SBIR program; Israel Academy of Sciences and Humanities; National Research Foundation (South Africa); Ministry of Agriculture (Israel); European Commission Expert Panel (2011–2015).*

**Professional Society Memberships:**

* World Aquaculture Society (Member since 1987).
* European Aquaculture Society (Member since 1990).
* National Shellfisheries Association (USA) – Member 1987–2016.
* Israel Society of Aquaculture – Member 2004–2014.
* Israel Society of Zoology – Member 1985–1995.

## Educational Activities

**Courses Taught – National:**

* 2024–Present – Lecturer, University of Haifa (School of Marine Sciences): *Introduction to Mariculture*.
* 2017–Present – Lecturer, Maritime College of Mikhmoret: *Introduction to Mariculture*.
* 2009–2017 – Lecturer, Ben-Gurion University of the Negev: *Fish Biology, Ecology and Biotechnology*.
* 1995–2013 – Coordinator & Lecturer, Hebrew University of Jerusalem (Faculty of Agriculture): *Introduction to Mariculture* (lectures on *Molluscs in Mariculture*; *Marine Polyculture and Integrated Systems*).
* 2000–2003 – Guest Lecturer, Heinz Steinitz Marine Biology Institute (Eilat): course on *Ecology of the Gulf of Eilat* (lectures on *Effects of Mariculture on the Gulf*; *Predator–Prey Interactions and Sex Reversal on Coral Reefs*; *Environmentally Friendly Aquaculture*).
* 1998–2000 – Lecturer, Maritime College of Mikhmoret: courses on *Fish Behavior* and *Introduction to Mariculture*.
* 1994–2000 – Coordinator & Lecturer, Technion – Israel Institute of Technology: *Introduction to Mariculture* (lectures on *Bivalves as Biofilters*; *Marine Polyculture*).
* 1986–1993 – Lecturer, Hebrew University of Jerusalem (Faculty of Agriculture): *Bivalve Culture and Reproduction* (as part of *Introduction to Mariculture* course).
* 1982–1985 – Teaching Assistant, Tel Aviv University (Dept. of Zoology): courses in *Invertebrate Zoology*, *Marine Ecology*, and *Life in the Intertidal Zone*.

**Courses Taught – International:**

* 2025 – Visiting Professor, University of Cagliari (Sardinia, Italy): Coordinator, *Introduction to Mariculture* course.
* 2013 – Visiting Professor, University of Cagliari (Sardinia, Italy): Coordinator, *Introduction to Mariculture* course.
* 2005 – Lecturer, China–Israel Workshop on Aquaculture (Qingdao, China).
* 2005–2011 – Lecturer, International Post-Graduate Course on Aquaculture (organized by Hebrew University of Jerusalem).
* 2003 – Invited Lecturer, CIHEAM Advanced Seminar on Mollusk Production in Mediterranean Countries (Zaragoza, Spain).
* 2002/2004 – Invited Lecturer, CIHEAM Training Course on Recirculating Systems for Fish Culture (Sète, France).
* 2000 – Invited Lecturer, Advanced Training Course on Sea Urchin Aquaculture & Integrated Systems (International Marine Center, Sardinia, Italy).
* 1988–1990 – Guest Lecturer, University of Maryland (USA): *Space Partitioning and Symbiosis in Coral Reef Fish* (in course “Life in the Ocean”, Prof. Eugenie Clark).

**Supervision of Graduate Students:**

* **1988–1990 – Miron Sarid** (M.Sc., Hebrew University of Jerusalem). *Thesis:* "The influence of water temperature, algae concentration, and water flow on the rates of *Crassostrea gigas*" (co-supervised with Prof. Balfour Heffer).
* **1991–1992 – Micha Vaisbaum** (B.Sc. final project, Technion – Israel Institute of Technology). *Project:* "Grading machine for edible oysters" (co-supervised with Prof. Eitan Kimmel).
* **1992–1994 – Alon Ben-Gal** (M.Sc., Hebrew University of Jerusalem). *Thesis:* "Bioaccumulation of halogenated phenols from chlorinated seawater in bivalve mollusks" (co-supervised with Prof. Hillel Shuval).
* **1993–1994 – Dana Zelding** (Practical Engineering final project, Braude College). *Project:* "Using edible oysters and clams as a biofilter for fishpond effluents."
* **1993–1994 – Gal Hauzer** (Practical Engineering final project, Braude College). *Project:* "Bioenergetics of the European abalone (*Haliotis tuberculata*)."
* **1993–1994 – Shaul Golomb** (Engineering final project, Technion). *Project:* "Commercial methods for collecting burrowing clams from sediment" (co-supervised with Prof. Eitan Kimmel).
* **1998 – 2003 Nurit Gordon** (M.Sc., Hebrew University of Jerusalem). *Thesis:* "Nutritional requirements of metamorphosed abalone (*Haliotis discus hannai*)" (co-supervised with Dr. Shmuel Harpaz and Dr. Amir Neori).
* **2001–2002 – Andreas Schuenhoff** (M.Sc., University of Las Palmas, Spain). *Thesis:* "Performance of a semi-commercial integrated system for the culture of fish and seaweed."
* **2003–2006 – Eran Hadas** (Ph.D., Tel Aviv University). *Thesis:* "Energy budget of the demosponge *Negombata magnifica*" (co-supervised with Dr. Micha Ilan; graduated with honors).
* **2004–2007 – Hagar Katz** (M.Sc., Hebrew University of Jerusalem). *Thesis:* "Nitrogen budget in a fish–bivalve–seaweed integrated system" (co-supervised with Prof. Jaap van Rijn).
* **2010–2014 – Hanit Ben-Ari** (Ph.D., Ben-Gurion University of the Negev). *Thesis:* "Controlling gametogenesis of the purple sea urchin (*Paracentrotus lividus*)" (co-supervised with Dr. Hanna Rosenfeld; graduated with honors).
* **2010–2014 – Tomer Ben-Ari** (M.Sc., Ben-Gurion University of the Negev). *Thesis:* "Nutrient and energy budget in a multi-trophic integrated mariculture system" (graduated with honors).
* **2011–2015 – Erez Yeruham** (M.Sc., Tel Aviv University). *Thesis:* "Ecology of the sea urchin *Paracentrotus lividus* on the Eastern Mediterranean coast" (co-supervised with Prof. Avigdor Abelson).
* **2016–2017 – Dr. Suzanne Buxbaum** (Post-Doctoral Fellow, University of Haifa).
* **2016–2018 – Matan Yona** (M.Sc., Hebrew University of Jerusalem). *Thesis:* "Biomineralization processes in sea urchins using fluorescent dyes and confocal microscopy" (co-supervised with Prof. Jonathan Erez).
* **2019–2022 – Itay Kalski** (M.Sc., University of Haifa). Research project at Morris Kahn Marine Research Station (co-supervised with Prof. Tali Mass).
* **2024–Present – Hadar Sunis** (M.Sc. candidate, University of Haifa).
* **2025–Present – Uri Tessel** (M.Sc. candidate, University of Haifa).
* **2025–Present – Doru Hashiloni** (PhD. candidate, University of Haifa).

## Scientific Publications

**(a) Authored Books:**

* Shpigel, M. (1994). *Red Sea Fish*. Society for the Protection of Nature in Israel, 183 pp. (Translated into 5 languages).

**(b) Book Chapters:**

* Shpigel, M. (1983). The Serranidae. In *Encyclopedia of Plant and Animal Life in Israel*, Vol. 1 (Society for the Protection of Nature & Ministry of Defense Publ.), pp. 165–167. (In Hebrew)
* Lawrence, J.M.; McBride, S.C.; Plank, L.R.; Shpigel, M. (2003). Ammonia tolerance of sea urchins *Lytechinus variegatus*, *Arbacia punctulata*, *Strongylocentrotus franciscanus*, and *Paracentrotus lividus*. In *Echinoderm Research 2001* (Féral & David, Eds.), pp. 233–236. Swets & Zeitlinger, Lisse.
* Shpigel, M. (2005). The use of bivalves as biofilters and valuable products in land-based aquaculture systems – a review. In *The Comparative Roles of Suspension-Feeders in Ecosystems* (R. Dame & S. Olenin, Eds.), Kluwer Academic, Dordrecht.
* Neori, A.; Shpigel, M. (2006). Algae: Key for sustainable mariculture. In *Seaweed Resources of the World* (A.T. Critchley, M. Ohno, D.B. Largo, Eds.), ETI Bioinformatics, Univ. of Amsterdam (book + DVD).
* Neori, A.; Shpigel, M. (2006). An integrated system for farming fish, seaweed and abalone (invited contribution). In *CAB International Aquaculture Compendium* (online). Wallingford, UK.
* Shpigel, M.; Neori, A. (2007). Evaluation of macroalgae, microalgae, and bivalves as biofilters in sustainable land-based mariculture systems. In *Ecological and Genetic Implications of Aquaculture Activities* (T.M. Bert, Ed.), Kluwer, Dordrecht.
* Shpigel, M. (2009). Coral nutrition. In *Working with Aquarium Corals* (R. Leewis, T. Wijgerde, M. Laterveer, & R. Osing, Eds.), European Association of Zoos and Aquaria.
* Shpigel, M. (2013). Mariculture systems, integrated land-based. In *Sustainable Food Production* (W. Goddek et al., Eds.), Springer, New York, pp. 111–120.
* Shpigel, M. (2015). Land-based Integrated Multi-Trophic Mariculture System. In *Encyclopedia of Sustainability Science and Technology*, Springer, New York.
* Shpigel, M. (2013). Environmentally friendly mariculture. In *Glory of the Sea: Stability and Change in the Aquatic Systems of Israel* (N. Stambler, T. Lotan, I. Berman-Frank, Eds.), Israel Association of Aquatic Sciences, 457 pp. (In Hebrew).
* Neori, A.; Shpigel, M.; Guttman, L.; Israel, A. (submitted). The development of Integrated Multi-Trophic Aquaculture (IMTA) in Israel. In *Greening the Blue Revolution: The Turquoise Revolution of IMTA* (T. Chopin et al., Eds.), Springer (in press).

**(c) Refereed Articles in Scientific Journals:**

1. Shpigel, M. (1982). Niche overlap among two species of coral-dwelling fishes of the genus *Dascyllus* (Pomacentridae). *Environmental Biology of Fishes* 7(1): 65–68.
2. Shpigel, M.; Fishelson, L. (1983). Ecology and sociobiology of coexistence in two species of *Dascyllus* (Pomacentridae, Teleostei). *Bulletin of the Israeli Oceanographic & Fisheries Institute* 9: 207–224.
3. Diamant, A.; Shpigel, M. (1985). Interspecific associations of groupers (Serranidae, Teleostei) with octopus and moray eels in the Northern Red Sea. *Environmental Biology of Fishes* 13: 153–159.
4. Shpigel, M.; Fishelson, L. (1986). Behavior and physiology of two species of *Dascyllus* (Pomacentridae, Teleostei). *Environmental Biology of Fishes* 17: 253–261.
5. Shpigel, M.; Coon, S.L.; Kluytmans, J.H. (1989). Growth and survival of cultchless spat of *Ostrea edulis* L. produced using epinephrine and shell chips. *Journal of Shellfish Research* 8(2): 355–357.
6. Shpigel, M. (1989). Gametogenesis of the European flat oyster (*Ostrea edulis*) and Pacific oyster (*Crassostrea gigas*) in warm water in Israel. *Aquaculture* 80(3–4): 343–349.
7. Shpigel, M.; Fishelson, L. (1989). Food habits and feeding behavior of Red Sea groupers (*Cephalopholis* spp.). *Environmental Biology of Fishes* 24: 67–73.
8. Shpigel, M.; Fishelson, L. (1989). Habitat partitioning between species of *Cephalopholis* across the fringing reef of the Gulf of Aqaba (Red Sea). *Marine Ecology Progress Series* 58(1–2): 17–22.
9. Shpigel, M.; Fridman, R. (1990). Propagation of the Manila clam *Tapes semidecussatus* in the effluent of fish aquaculture ponds in Eilat, Israel. *Aquaculture* 90(2): 113–122.
10. Gordin, H.; Krom, M.; Neori, A.; Popper, D.; Porter, C.; Shpigel, M. (1990). Intensive integrated seawater fish ponds: fish growth and water quality. In: *Research in Modern Aquaculture* (H. Rosenthal & S. Sarig, Eds.), Special Publication No. 11, pp. 45–64.
11. Shpigel, M.; Fishelson, L. (1991). Territoriality and associated behavior in three species of *Cephalopholis* (Serranidae) in the Gulf of Aqaba, Red Sea. *Journal of Fish Biology* 38(6): 887–896.
12. Shpigel, M.; Fishelson, L. (1991). Experimental removal of piscivorous groupers (*Cephalopholis* spp.) from coral habitats in the Gulf of Aqaba. *Environmental Biology of Fishes* 31(2): 131–138.
13. Shpigel, M.; Blaylock, R.A. (1991). The Pacific oyster (*Crassostrea gigas*) as a biological filter for marine fishpond effluents. *Aquaculture* 92(2–3): 187–197.
14. Sami, S.; Shpigel, M.; Faisal, M. (1991). Comparison of host defense mechanisms in diploid vs. triploid oysters (*Crassostrea gigas*): effect of thermal stress on hemocyte surface ConA-binding. *Zeitschrift für Angewandte Zoologie* 78(1): 69–78.
15. Shpigel, M.; Barber, B.J.; Mann, R. (1992). Effects of elevated temperature on growth, gametogenesis, physiology, and biochemical composition in diploid and triploid Pacific oysters (*Crassostrea gigas* Thunberg). *Journal of Experimental Marine Biology and Ecology* 161(1): 15–25.
16. Shpigel, M.; Lee, J.; Soohoo, B.; Fridman, R.; Gordin, H. (1993). Use of effluent water from fish ponds as a food source for the Pacific oyster (*Crassostrea gigas*). *Aquaculture Research* 24(4): 529–543.
17. Shpigel, M.; Neori, A.; Popper, D.M.; Gordin, H. (1993). A proposed model for an “environmentally clean” land-based culture of fish, bivalves and seaweeds. *Aquaculture* 117: 115–128.
18. Allen, S.K.; Shpigel, M.; Utting, S.; Spencer, B. (1994). Incidental production of tetraploid Manila clams *Tapes philippinarum*. *Aquaculture* 128(1–2): 13–19.
19. Shpigel, M.; Spencer, B. (1996). Performance of diploid and triploid Manila clams (*Tapes philippinarum*) at various tidal exposures in the UK and in fishpond effluent in Eilat, Israel. *Aquaculture* 141(3–4): 159–171.
20. Shpigel, M.; Neori, A. (1996). Integrated culture of seaweed, abalone, fish, and clams in modular intensive land-based systems: I. Proportions, yields, and projected revenues. *Aquacultural Engineering* 15(5): 313–326.
21. Shpigel, M.; Marshall, A.; Lupatsch, I.; Mercer, J.P.; Neori, A. (1996). Acclimation and propagation of the abalone *Haliotis tuberculata* in a land-based culture system in Israel. *Journal of the World Aquaculture Society* 27(4): 435–442.
22. Shpigel, M.; Neori, A.; Marshall, A. (1996). Suitability of several abalone species for land‑based culture with pond-grown seaweed in Israel. *Israeli Journal of Aquaculture – Bamidgeh* 48(4): 192–200.
23. Shpigel, M.; Gasith, A.; Kimmel, E. (1997). A biomechanical filter for treating fishpond effluents. *Aquaculture* 152(1–4): 103–117.
24. Neori, A.; Ragg, N.L.C.; Shpigel, M. (1998). Integrated culture of seaweed, abalone, fish, and clams in intensive land-based systems: II. Performance and nitrogen partitioning in an abalone–seaweed system (*Haliotis tuberculata* with *Ulva lactuca* and *Gracilaria conferta*). *Aquacultural Engineering* 17(4): 215–239.
25. Shpigel, M.; Ragg, N.C.; Lupatsch, I.; Neori, A. (1999). Protein content determines the nutritional value of the seaweed *Ulva lactuca* for the abalone *Haliotis tuberculata* and *Haliotis discus hannai*. *Journal of Shellfish Research* 18(1): 227–233.
26. Neori, A.; Shpigel, M. (1999). Using algae to treat effluents and feed invertebrates in sustainable integrated mariculture. *World Aquaculture* 30(2): 46–51.
27. Neori, A.; Shpigel, M.; Ben-Ezra, D. (2000). Integrated culture of seaweed, abalone, fish, and clams in modular intensive land‑based systems: III. Fish, seaweed and abalone. *Aquaculture* 186(3–4): 279–291.
28. McBride, S.C.; Rotem, E.; Ben-Ezra, D.; Shpigel, M. (2001). Seasonal energetics of *Haliotis fulgens* and *Haliotis tuberculata*. *Journal of Shellfish Research* 20(2): 659–665.
29. Boarder, S.J.; Shpigel, M. (2001). Comparative performance of juvenile *Haliotis roei* fed enriched *Ulva rigida* vs. various artificial diets. *Journal of Shellfish Research* 20(2): 653–659.
30. Shpigel, M.; Neori, A.; Zmora, O. (2002). Sustainable land-based mariculture in arid environments. In *Sea Urchin Aquaculture* (workshop proceedings, Torregrande, Italy), pp. 139–144.
31. Lee, J.J.; Shpigel, M.; Freeman, S.; McLeod, S.; Bowen, S.; Pearson, M.; Szostek, S. (2003). Physiological ecology and possible control of a toxic benthic dinoflagellate (*Amphidinium* sp.) in a mariculture pond. *Aquaculture* 217: 351–371.
32. Schuenhoff, A.; Shpigel, M.; Lupatsch, I.; Ashkenazi, A.; Msuya, F.E.; Neori, A. (2003). A semi-commercial, recirculating integrated system for culture of fish and seaweed. *Aquaculture* 221(1–4): 167–181.
33. Neori, A.; Msuya, F.E.; Shauli, L.; Schuenhoff, A.; Lupatsch, I.; Shpigel, M. (2003). A novel three-stage *Ulva lactuca* biofilter design for integrated mariculture: fast ammonia uptake and high protein yield. *Journal of Applied Phycology* 15: 543–553.
34. Lee, J.; Shpigel, M.; Olea, R.; Pochon, X.; Cevasco, M.; Pawlowski, J. (2004). *Amphidinium eilatiensis* sp. nov.: a toxic benthic dinoflagellate from a mariculture sedimentation pond in Eilat, Israel. *Journal of Eukaryotic Microbiology* 50(6): 439–448.
35. Neori, A.; Chopin, T.; Troell, M.; Buschmann, A.H.; Kraemer, G.P.; Halling, C.; Shpigel, M.; Yarish, C. (2004). Integrated aquaculture: rationale, evolution and state of the art, emphasizing seaweed biofiltration. *Aquaculture* 231: 361–391.
36. Shpigel, M.; McBride, S.C.; Marciano, S.; Lupatsch, I. (2004). Effect of photoperiod and temperature on reproduction of the European sea urchin (*Paracentrotus lividus*). *Aquaculture* 232: 343–355.
37. Gordon, N.; Shpigel, M.; Harpaz, S.; Lee, J.J.; Neori, A. (2004). Settlement of abalone (*Haliotis discus hannai*) larvae on culture layers of different diatoms. *Journal of Shellfish Research* 23(2): 561–568.
38. Lee, J.; Rodriguez, D.; Zmora, O.; Neori, A.; Symons, A.; Shpigel, M. (2004). Transition from earthen sedimentation ponds to PVC-lined ponds in integrated mariculture systems: considerations and solutions. *Journal of Applied Phycology* 16: 341–353.
39. Hadas, E.; Shpigel, M.; Ilan, M. (2005). Sea ranching of the marine sponge *Negombata magnifica* (Demospongiae, Latrunculiidae) as a first step for latrunculin-B production. *Aquaculture* 244: 159–169.
40. Shpigel, M.; McBride, S.C.; Marciano, S.; Ron, S.; Ben-Amotz, A. (2005). Improving gonad color and somatic index in the European sea urchin (*Paracentrotus lividus*). *Aquaculture* 245: 101–109.
41. Schlosser, S.; Lupatsch, I.; Lawrence, J.M.; Lawrence, A.L.; Shpigel, M. (2005). Protein and energy digestibility and gonad development in the European sea urchin (*Paracentrotus lividus*) fed algal vs. prepared diets. *Aquaculture Research* 36(10): 972–982.
42. Hadas, E.; Marie, D.; Shpigel, M.; Ilan, M. (2006). Virus predation by sponges is a new pathway in coral reef nutrient flow. *Limnology & Oceanography* 51(3): 1548–1550.
43. Gordon, N.; Neori, A.; Harpaz, S.; Lee, J.J.; Shpigel, M. (2006). Effect of diatom diets on growth and survival of abalone (*Haliotis discus hannai*) postlarvae. *Aquaculture* 252: 225–233.
44. Zmora, O.; Shpigel, M. (2006). Intensive mass production of *Artemia* in a recirculated system. *Aquaculture* 255: 488–494.
45. Shpigel, M.; Schlosser, S.; Ben-Amotz, A.; Lawrence, A.L.; Lawrence, J.M. (2006). Effect of dietary carotenoids on the gut and gonad of the sea urchin *Paracentrotus lividus*. *Aquaculture* 261: 1269–1280.
46. Hadas, E.; Shpigel, M.; Ilan, M. (2008). Oxygen consumption by a coral reef sponge. *Journal of Experimental Biology* 211: 2185–2190.
47. Stuart, B.; Shpigel, M. (2009). Evaluating the economic potential of horizontally integrated land-based marine aquaculture. *Aquaculture* 294: 43–51.
48. Hadas, E.; Shpigel, M.; Ilan, M. (2009). Particulate organic matter as food for corals? *Journal of Experimental Biology* 212(22): 3643–3650.
49. Wegi, W.A.; Shpigel, M.; Sagi, M. (2010). Molybdenum application and its effects on molybdenum-enzymes (NR and XDH) in seawater-irrigated *Salicornia*. *Scientia Horticulturae* 126: 395–401.
50. Ventura, Y.; Wegi, W.; Myrzabayeva, M.; Alikulov, Z.; Shpigel, M.; Samocha, T.; Sagi, M. (2011). Effect of seawater concentration on productivity and nutritional value of annual *Salicornia* and perennial *Sarcocornia* halophytes. *Scientia Horticulturae* 128: 189–196.
51. Bergman, O.; Haber, M.; Mayzel, B.; Anderson, M.A.; Shpigel, M.; Hill, R.; Ilan, M. (2011). Mariculture of *Diacarnus* sponges and the bacterial community of wild vs. maricultured sponges and their larvae. *Marine Biotechnology* 13(6): 1169–1182.
52. Ventura, Y.; Wegi, W.; Shpigel, M.; Samocha, T.M.; Klim, B.; Cohen, S.; Santos, R.; Sagi, M. (2011). Effects of day length on flowering and yield of *Salicornia* and *Sarcocornia* species. *Scientia Horticulturae* 130: 510–516.
53. Bergman, O.; Mayzel, B.; Anderson, M.A.; Shpigel, M.; Hill, R.; Ilan, M. (2011). Marine cultivation of demo-sponges for bioactive compounds: case studies. *Marine Drugs* 9(11): 2201–2219.
54. Osinga, R.; Schutter, M.; Wijgerde, T.; Rinkevich, B.; Shafir, S.; Shpigel, M.; … Laterveer, M. (2012). The CORALZOO project: a synopsis of four years of public aquarium science. *Journal of the Marine Biological Association of the UK* 92(4): 753–768.
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2. Shpigel, M. (1999). Evaluation of the possibilities of setting up a commercial integrated system of fish–abalone–seaweed in WA. Report to the South Metropolitan College of TAFE (Western Australia).
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5. Shpigel, M.; Place, A. (2001). Development of sodium alginate encapsulation of diatom concentrates as a nutrient delivery system to enhance growth and survival of post-larval abalone (*Haliotis* spp.). BARD Project No. IS-3115-99.
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13. Shpigel, M. (2007). Sea urchin production in integrated systems – nutrition and roe enhancement. (Project report)
14. Ilan, M.; Shpigel, M.; Hill, R.T. (2008). Novel marine natural products from sponges and microorganisms. Final Report, BARD Project IS-3115-99.
15. Shpigel, M. (2009). Improving in-situ and ex-situ mass culturing methodologies of exotic marine invertebrates for the ornamental trade and public aquaria (CORALZOO – EU Project). Final Report.
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17. Shpigel, M. (2011). Enrichment of aquaculture systems by introduction of commercially underdeveloped marine species from different trophic levels (ENRICH – EU Project). Final Report.
18. Shpigel, M. (2011). Integration of gilthead seabream (*Sparus aurata*) culture with shellfish and seaweeds in an IMTA system to increase profitability and reduce environmental impact (MERC-USAID project; PI: H. Abdel Rahman). Final Report to U.S. AID.
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20. Shpigel, M. (2013). Integration of the IMS project with all-female mullet production for enhanced roe (Batarekh/Karasumi). Final Report to MERC-USAID.
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**(g) Scientific & Technical Reports (till 2006):**

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* Shpigel, M. (2000). 1. Integrated systems (abalone, fish, seaweed); 2. Sea urchins – effect of various feeds on gonad growth and color. Steering Committee Report, Nov. 2000, Ministry of National Infrastructures.
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* Boarder, S.J.; Shpigel, M. (2002). Comparative performance of juvenile *Haliotis roei* fed an artificial diet. Report provided to Adam & Amos Abalone Foods.
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* Kissil, G.Wm.; Lupatsch, I.; Shpigel, M. (2003). Evaluation of lycopene accumulation from Lycofiber feed in the green tiger prawn (*Penaeus semisulcatus*) and gilthead seabream (*Sparus aurata*). Report to LycoRed Ltd.
* Shpigel, M. (2003). 1. Rearing of shrimp in semi-recirculated systems; 2. Protocol development for shrimp larval rearing; 3. Protocol for post-larval rearing; 4. Oxygen consumption and ammonia excretion in sea urchins; 5. Effect of stocking density on post-larval growth. Steering Committee Report, Nov. 2003, Ministry of National Infrastructures.
* Shpigel, M. (2004). 1. Environmentally friendly system based on constructed wetlands for effluent treatment; 2. Optimization of sea urchin growth, gonad quality, and diet; 3. Innovative methods for culturing the red sponge *Negombata magnifica* at sea; 4. Scientific support for commercial entities. Steering Committee Report, Nov. 2004, Ministry of National Infrastructures.
* Shpigel, M. (2005). 1. Integrated systems (GENESIS project); 2. Incorporating sea urchins into the integrated system (SPIINES); 3. Sea ranching of marine sponges (BARD); 4. Studying nutritional requirements of stony corals (CoralZoo). Steering Committee Report, Nov. 2005, Ministry of National Infrastructures.
* Shpigel, M. (2006). 1. Incorporating sea urchins into the integrated system (SPIINES); 2. Studying nutritional requirements of stony corals (CoralZoo); 3. Sea sponge mariculture for natural products (BARD). Steering Committee Report, Nov. 2006, Ministry of National Infrastructures.

## Research Grants

### International Competitive Grants:

* **1985–1988** – United States–Israel Binational Agricultural Research & Development Fund (BARD): “Oyster production in the outflow of saltwater fish ponds” (Co-Investigator 1985; Principal Investigator 1986–1988). Total budget $150,000 (researcher’s share $75,000).
* **1994–1997** – European Community (INTAB Project): Developed a polyculture technology for seaweed and macro-algivores on fishpond effluents. Principal Investigator. Total budget $450,000 (researcher’s share $113,800).
* **1996** – European Community: Developed eco-friendly technologies for recycling fish-cage nutrients (phyco-depuration & secondary crop production). Co-Investigator. Grant €45,000 (researcher’s share €10,000).
* **1998–2000** – EU & Israel Ministry of Science: Pilot IMTA system for polyculture of fish, seaweed and herbivores on fishpond effluents. Principal Investigator. Total budget €1,710,000 (researcher’s share €171,000).
* **1999–2001** – Texas–Israel Exchange (TIE) Program: Pilot production of edible sea urchin (*Paracentrotus lividus*) in land-based facilities – effects of photoperiod, temperature and diet on gonad production. Principal Investigator. Budget $100,000 (researcher’s share $49,550).
* **2000–2001** – BARD: Development of sodium alginate encapsulation of diatom concentrates to enhance growth and survival of post-larval abalone. Principal Investigator. Budget $100,000 (researcher’s share $50,000).
* **2001–2003** – Texas–Israel Exchange Program: Eco-friendly land-based integrated system for production of shrimp, fish and seaweed. Principal Investigator. Budget $108,000 (researcher’s share $54,000).
* **2001–2004** – European Community (GENESIS Project): Polyculture of fish, bivalves and seaweed for effluent bio-remediation and high-value crops (abalone & sea urchin). Project Coordinator. Total budget €2,500,000 (researcher’s share €230,000).
* **2004–2007** – European Community (SPIINES Project): Integrating sea urchins into IMTA systems (nutrition and roe enhancement). Principal Investigator. Total budget €806,213 (researcher’s share €147,554).
* **2004–2007** – BARD: Novel marine natural products from sponges and associated microorganisms. Co-Investigator. Total budget $288,000 (researcher’s share $75,000).
* **2005–2009** – European Community (CORALZOO Project): Improving in-situ and ex-situ culturing of exotic marine invertebrates for the aquarium trade. Principal Investigator. Total budget €2,610,000 (researcher’s share €255,000).
* **2006–2009** – European Community (ENVIROPHYTE Project): Improving the cost-effectiveness of land-based aquaculture via constructed wetland biofilters (*Salicornia* as a by-product). Project Coordinator. Total budget €1,644,550 (researcher’s share €226,000).
* **2007–2010** – MERC–USAID: Polyculture of gilthead seabream (*Sparus aurata*) with shellfish and seaweeds to increase profit and reduce environmental impact. Principal Investigator. Budget $496,100 (researcher’s share $243,650).
* **2008–2011** – EU (ENRICH Project): Enrichment of aquaculture systems by introducing underdeveloped species from different trophic levels. Principal Investigator. Total budget €1,108,000 (researcher’s share €117,300).
* **2008–2011** – BARD (Texas): Cultivation of the halophyte *Salicornia* in constructed wetlands for shrimp effluent treatment and biodiesel production. Principal Investigator. Budget $360,000 (researcher’s share $90,000).
* **2010–2013** – MERC–USAID: Integrating the IMS project with development of all-female mullet populations for enhanced roe production (Batarekh/Karasumi). Principal Investigator. Budget $496,100 (researcher’s share $122,650).
* **2013–2016** – EU (RESURCH Project): Improving profitability and environmental sustainability of sea urchin farming. Principal Investigator. Budget €1,108,900 (researcher’s share €88,000).
* **2017–2020** – EU COST Action “Oceans Past Platform” – travel grant (participant).
* **2017–2020** – BARD: Plant-based biofilters for sustainable mariculture systems. Co-Investigator. Budget $360,000.
* **2020–2024** – Israel Ministry of Science: Exploring perennial *Sarcocornia* as a biofilter for mariculture effluents and as a source of food/biochemicals. Budget ₪389,000.
* **2021–2025** – EU COST Action CA201106 (“Ulva – Tomorrow’s Wheat of the Sea”): A model for innovative mariculture (Project Coordinator). Budget €660,000.
* **2023–2026** – EU Horizon Europe (NOVAFOODIES Project): Innovative functional food production from sustainable marine/freshwater raw materials. Principal Investigator. Budget €315,000.

### National Competitive Grants:

* **1994–1998** – MAGNETON (with SeaOr Marine Ltd.): Developing a commercial abalone culture system in Israel. Principal Investigator. Funded by Ministry of Industry & Commerce ($300,000) and SeaOr Marine Ltd. ($150,000).
* **1997–1998** – MAGNETON (Ministry of Industry & Commerce): Algal cultivation and product development (PI: Dr. M. Friedlander). Co-Investigator. Budget $200,000 (researcher’s share $12,000).
* **2000–2003** – Israel Ministry of Agriculture: Domestication of the purple sea urchin (*Paracentrotus lividus*) in land-based facilities – growth rates, survival, product quality. Principal Investigator. Budget $155,000.
* **2001–2003** – MAGNETON (Ministry of Industry & Commerce): Developing a sustainable land-based culture system for shrimps (*Penaeus semisulcatus*). Principal Investigator. Budget $350,000 (researcher’s share $90,000).
* **2013–2016** – IOLR (Israel) – Use of *Salicornia* and *Sarcocornia* in constructed wetland biofilters for intensive fish farm effluents, producing a high-value crop. Principal Investigator. Budget $59,000 (researcher’s share $40,000).
* **2019–2023** – Israel Ministry of Agriculture: Reproduction and farming of the Mediterranean murex snail (*Hexaplex trunculus*) for production of natural blue dye (*Tekhelet*). Budget ₪890,000.
* **2024–2028** – VATAT (Israel Council for Higher Education): Establishing a research network for next-generation land-based aquaculture. Budget $6,255,000 (researcher’s share $300,000).

### Other Research Grants:

* **1981–1982** – Council for Development of the Sinai Peninsula: Study of the ecology and biology of Red Sea groupers (*Cephalopholis* spp.). Principal Investigator. $15,000.
* **1991–1992** – Negev & Arava R&D (Jewish Agency): Using bivalves as biofilters in fishpond effluents. Principal Investigator. $25,000.
* **1992–1993** – Negev & Arava R&D: Developing biomechanical filters for fishpond effluents. Principal Investigator. $30,000.
* **1994–1995** – Negev & Arava R&D: Pilot-scale fish–bivalve–seaweed IMTA system (PIs: H. Gordin & N. Mozes). Co-Investigator. $120,000.
* **1995–1996** – NOAA (USA) – Joint project with Prof. R. Mann (VIMS) & Dr. R. Kilada (Egypt): Field survey of *Tridacna* giant clams in the Gulf of Aqaba. Principal Investigator. $22,000 (researcher’s share $8,000).
* **1996–1997** – Irish Department of Agriculture: International collaboration program on echinoculture techniques. €2,000 grant.
* **2001** – LycoRed Ltd.: Evaluation of dietary lycopene (Lycofiber) in shrimp and fish. Principal Investigator. $12,000 (researcher’s share $16,000).
* **2008–2009** – Friends of IOLR (North America): Utilizing fish pond effluent water to culture stony corals. Principal Investigator. $18,000.

## Lectures and Presentations

**Invited Plenary & Keynote Lectures:**

* **1999** – Keynote speaker, Aquaculture America ’99 (Tampa, FL, USA) – presented on sustainable mariculture in Israel.
* **1999** – Keynote speaker, World Aquaculture ’99 (Sydney, Australia) – presented on sustainable integrated mariculture.
* **2001** – Keynote speaker, World Aquaculture ’01 (Orlando, FL, USA).
* **2002** – Keynote speaker, World Aquaculture ’02 (Beijing, China) – *“Integrated Mariculture Systems: An Overview”*.
* **2003** – Keynote speaker, International Organic Aquaculture Workshop (Minneapolis, MN, USA).
* **2003** – Keynote speaker, “Putting the Green Back into the Blue” Marine Aquaculture Conference (Brisbane, Australia).
* **2003** – Keynote speaker, NATO Advanced Research Workshop on Suspension Feeders (Nida, Lithuania) – use of bivalves as biofilters.
* **2009** – Keynote speaker, European Aquaculture Society Conference (Trondheim, Norway) – *“Multi-Trophic Systems: Benefits and Constraints”*.
* **2012** – Keynote speaker, EU–Mediterranean Conference on Research and Innovation (Barcelona, Spain) – *“Ecosystem-based Approaches for Aquaculture”*.
* **2013** – Keynote speaker, Third Marine Eco-Civilization Forum (Wenzhou, China) – *“Future-Oriented Mariculture”*.
* **2013** – Keynote speaker, Asian Pacific Aquaculture Conference (Hanoi, Vietnam) – presented on integrated multi-trophic aquaculture.
* **2014** – Keynote speaker & Session Chair, 24th PACON Marine Science Conference (Xi’an, China).
* **2015** – Keynote speaker, 107th National Shellfisheries Association Meeting (Monterey, CA, USA) – *“IMTA: Benefits and Constraints”*.
* **2017** – Keynote speaker, International Seaweed Symposium (Wando, South Korea) – IMTA session.
* **2017** – Keynote speaker, International IMTA Symposium (Busan, South Korea).
* **2018** – Keynote speaker, “Rendez-Vous de Concarneau” Marine Biotechnology Conference (Concarneau, France).
* **2020** – Session Chair & Speaker, 3rd India International Seaweed Expo & Summit (virtual).
* **2023** – Keynote speaker, Nordic Seaweed Conference (Grenaa, Denmark).

**Invited Session Chair & Speaker Roles:**

* **1997** – Session Chair & Speaker, 3rd International Abalone Symposium (Monterey, CA, USA).
* **2000** – Session Chair & Speaker, World Aquaculture Society Special Session (Nice, France) – presented on biofilters in mariculture systems.
* **2000** – Session Chair & Speaker, 4th International Abalone Symposium (Cape Town, South Africa).
* **2003** – Session Chair & Speaker, International Fisheries & Aquaculture Conference (Puerto Varas, Chile) – *“Domestication of the European Sea Urchin in Israel”*.
* **2006** – Session Chair & Speaker, Sea Urchin Aquaculture session, National Shellfisheries Association Conference (Monterey, CA, USA).
* **2006** – Session Organizer & Chair, World Aquaculture Conference (Florence, Italy).
* **2006** – Session Chair & Speaker, 12th International Echinoderm Conference (Durham, NH, USA).
* **2006** – Session Chair, 10th Annual Dan Popper Aquaculture Symposium (Eilat, Israel).
* **2007** – Session Chair & Speaker, 8th International Marine Biotechnology Conference (Eilat, Israel).
* **2008** – Session Chair & Moderator, World Aquaculture Society Meeting (Busan, South Korea).

**Other Invited Lectures:**

* **1990** – Invited speaker, 10th Annual Shellfish Biology Seminar (Milford, CT, USA) – *“The integrated aquaculture system in Israel.”*
* **1997** – Invited speaker, 4th International Marine Biotechnology Conference (Sorrento, Italy) – *“Integrated system in Israel.”*
* **1998** – Invited speaker, Sea Grant Marine Aquaculture Conference (Stamford, CT, USA) – *“Sustainable mariculture systems.”*
* **2012** – Invited speaker, Conference on Marine Environment & Aquaculture (Wenzhou, China) – *“IMTA systems: costs and benefits.”*

**Invited Presentations at International Workshops:**

* **1993** – Speaker, EC Workshop on Fish Farm Effluents (Hamburg, Germany) – use of Pacific oyster (*Crassostrea gigas*) as a biofilter in fish ponds.
* **1994** – Speaker, Second Japan–Israel Symposium on Aquaculture (Kagoshima, Japan) – culturing abalone (*Haliotis tuberculata*) to convert seaweed biofilter biomass into high-value crop.
* **1996** – Speaker, International Collaboration Workshop (Galway, Ireland) – role of diet supplements and grow-out techniques in developing Irish echiniculture.
* **2003** – Keynote speaker, NATO Advanced Research Workshop on Suspension Feeders (Nida, Lithuania).
* **2005** – Speaker, EFARO (European Fisheries & Aquaculture Org.) Workshop (Brussels, Belgium) – “State of the art and future developments of integrated systems.”
* **2005** – Speaker, Fisheries Science Workshop (Qingdao, China).
* **2010** – Speaker, International Sea Urchin Aquaculture & Restoration Conference (Palermo, Italy).
* **2011** – Speaker, International Workshop on Edible Sea Urchin Management (Palermo, Italy).
* **2012** – Speaker, Euro-Mediterranean Conference on Research & Innovation (Barcelona, Spain).
* **2016** – Keynote speaker & Chair, APEC Training Workshop on Coastal Eco-Aquaculture (Xiamen, China).

**Conference Presentations (Contributed Oral/Poster by M. Shpigel):**

1. Shpigel, M. (1980). The relationship between the spatial structure of branched corals and the species diversity of fishes. Zoological Society of Israel, Tel Aviv University (*Israel Journal of Zoology* 29: 205).
2. Shpigel, M. (1985). The ecology and biology of the Red Sea groupers. Biennial Scientific Meeting, Interuniversity Institute, Eilat, Israel (abstract p. 18).
3. Shpigel, M. (1988). Gametogenesis and reproduction of *Crassostrea gigas* and *Ostrea edulis* in a warm-water system in Eilat, Israel. Meeting of the Israel Aquaculture Society, Haifa, Israel.
4. Shpigel, M. (1988). Mortality and diseases of *Crassostrea gigas* and *Ostrea edulis* in a warm-water system in Eilat, Israel. International Fish Health Conference, Vancouver, Canada.
5. Shpigel, M.; Lee, J.J.; Soohoo, B. (1989). Fish–oyster polyculture in warm-water marine ponds. *Journal of Shellfish Research* 8(2): 481 (abstract).
6. Shpigel, M.; Fridman, R. (1990). Bivalve culture in warm-water marine ponds in Eilat. 10th Annual Shellfish Biology Seminar (Milford, CT, Feb 1990), abstract p. 15.
7. Shpigel, M.; Lee, J.J.; Soohoo, B. (1990). Fish–oyster mariculture in Eilat, Israel. 82nd Annual Meeting, National Shellfisheries Association (Williamsburg, VA, Apr 1990), abstract p. 481.
8. Shpigel, M.; Fishelson, L. (1991). Results of removal of piscivorous groupers (*Cephalopholis* spp.) from coral habitat. 27th Annual Meeting of the Zoological Society of Israel (Jerusalem) (*Isr. J. Zool.* 37(3): 163).
9. Shpigel, M.; Barber, B.J.; Mann, R. (1991). The effect of temperature on growth, physiology and gametogenesis in diploid and triploid Pacific oyster *Crassostrea gigas*. European Aquaculture Society Meeting (Dublin, June 1991) – abstract in *EAS Special Publication* No. 14: 294 (poster).
10. Shpigel, M.; Neori, A.; Gordin, H. (1991). Oyster and clam production in the outflow of marine fish ponds in Israel. European Aquaculture Society Meeting (Dublin, June 1991) – abstract in *EAS Special Publication* No. 14: 295.
11. Shpigel, M.; Neori, A.; Popper, D.M.; Gordin, H. (1992). A proposed model for “clean” land-based polyculture of fish, bivalves and seaweeds. US–Israel Workshop on Mariculture & Environment (Eilat, June 1992), pp. 43–55.
12. Shpigel, M.; Neori, A.; Popper, D.M.; Gordin, H. (1992). A land-based polyculture of fish, bivalves and seaweeds. World Aquaculture Society Meeting (Orlando, FL, May 1992).
13. Shpigel, M.; Neori, A.; Popper, D.M.; Gordin, H. (1992). A proposed model for “clean” land-based polyculture of fish, bivalves and seaweeds. Japanese–Israeli Symposium on Aquaculture (Haifa/Eilat, Nov 1992) – abstract in *Bamidgeh* 44(4): 147.
14. Shpigel, M.; Neori, A.; Ben-Ezra, D.; Gordin, H. (1993). Polyculture for bio-purification of fish farm effluents. World Aquaculture Society Meeting (Torremolinos, Spain, May 1993), abstract p. 467.
15. Shpigel, M.; Neori, A. (1994). Culturing abalone (*Haliotis tuberculata*) to convert seaweed from mariculture effluents into high-value crop. Second Japanese–Israeli Symposium on Aquaculture (Kagoshima, Japan, Nov 1994).
16. Shpigel, M.; Neori, A. (1994). *Haliotis tuberculata* – an herbivore for aquaculture biofilters. 25th Annual Meeting of the Society for Ecology & Environmental Quality Sciences (Tel Aviv, 1994), abstract p. 106.
17. Shpigel, M.; Neori, A. (1995). The effect of temperature on growth, physiology and gametogenesis in diploid and triploid Pacific oyster *Crassostrea gigas*. World Aquaculture ’95 (San Diego, CA, Feb 1995), abstract p. 444.
18. Shpigel, M.; Fishelson, L. (1996). The impact of “super-gun” fishing on piscivorous groupers (*Cephalopholis* spp.) on Red Sea coral reefs. Gulf of Aqaba Ecosystem & Peace Conference III (Eilat, Jan 1996), abstract p. 89.
19. Shpigel, M.; Neori, A.; Ben-Ezra, D. (1997). Performance of an eco-friendly polyculture system of fish, abalone and seaweed. World Aquaculture ’97 (Seattle, WA, Feb 1997), abstract p. 328.
20. Shpigel, M. (1997). Integrated system in Israel. 4th International Marine Biotechnology Conference (Sorrento, Italy, Sep 1997), abstract p. 45.
21. Shpigel, M.; Neori, A.; Mercer, J.; Ben-Ezra, D.; Fridman, R. (1997). Sustainable abalone culture in an “environmentally clean” integrated system. 3rd International Abalone Symposium (Monterey, CA, Oct 1997), abstract p. 64.
22. Shpigel, M.; Neori, A.; Ben-Ezra, D. (1997). Sustainable integrated culture of seabream, seaweed and abalone in Israel – from laboratory to pilot. 3rd International Abalone Symposium (Monterey, CA, Oct 1997), abstract p. 63.
23. Shpigel, M. (1998). *Ulva lactuca* as a food source for abalone in a land-based integrated system. *Journal of Shellfish Research* 17(1): 362–363 (abstract).
24. Shpigel, M. (1998). *Ulva lactuca* as a food source for abalone in a land-based integrated system. 18th Milford Aquaculture Seminar (Milford, CT, Feb 1998), abstract p. 42.
25. Shpigel, M.; Neori, A.; Popper, D.; Mozes, N.; Zmora, O.; Gordin, H. (1998). Environmentally clean integrated mariculture in Israel. World Aquaculture ’98 (Las Vegas, NV, Feb 1998), abstract p. 490.
26. Shpigel, M.; Neori, A.; Popper, D.; Mozes, N.; Gordin, H. (1999). Sustainable integrated mariculture. World Aquaculture ’99 (Sydney, Australia, Apr 1999), abstract p. 698.
27. Shpigel, M.; Lupatsch, I.; Neori, A.; Ragg, N.L.C. (2000). Protein content significantly influences the nutritional value of *Ulva lactuca* for abalone (*Haliotis tuberculata*, *H. discus hannai*, *H. fulgens*). *Journal of Shellfish Research* 19(1): 534 (abstract).
28. Shpigel, M.; Neori, A. (2000). Evaluation of macroalgae, microalgae, and bivalves as biofilters in sustainable land-based mariculture systems. Aquaculture Europe 2000 (Nice, France, May 2000), abstract.
29. Shpigel, M.; Neori, A.; Zmora, O. (2001). Sustainable land-based mariculture systems: a generic concept. World Aquaculture ’01 (Orlando, FL, Jan 2001), abstract p. 589.
30. Shpigel, M.; McBride, S.; Marciano, S.; Lupatsch, I. (2001). Domestication of the European sea urchin (*Paracentrotus lividus*) in Israel. International Conference on Fisheries & Aquaculture (Puerto Varas, Chile, 2003), abstract.
31. Shpigel, M.; Lupatsch, I. (2006). Introduction of the European sea urchin (*P. lividus*) in a land-based integrated system in Israel. 98th Annual Meeting, National Shellfisheries Association (Monterey, CA, Mar 2006), abstract p. 84.
32. Shpigel, M. (2006). Constructed wetlands with *Salicornia* as an eco-friendly biofilter and valuable by-product. World Aquaculture 2006 (Florence, Italy, May 2006), abstract (CD-ROM).
33. Shpigel, M.; Marciano, S.; Golombek, E.; Ben-Ezra, D.; Ben-Amotz, A.; Lupatsch, I.; Kelly, M. (2006). Introducing the European sea urchin (*P. lividus*) in a land-based integrated system. 12th International Echinoderm Conference (Durham, NH, Aug 2006), abstract p. 57.
34. Shpigel, M.; Sagi, M. (2007). Constructed wetlands with *Salicornia* as an eco-friendly biofilter and valuable by-product. 8th International Marine Biotechnology Conference (Eilat, Israel, Mar 2007), abstract p. 164.
35. Shpigel, M. (2008). World Aquaculture Society Meeting (Busan, South Korea, May 2008) – presented results on IMTA systems (abstract).
36. Shpigel, M. (2009). European Aquaculture Society Meeting (Trondheim, Norway, Aug 2009) – presented results on IMTA vs. RAS systems (abstract).
37. Shpigel, M. (2010). 8th International Conference on Recirculating Aquaculture (Roanoke, VA, Aug 2010) – *“Land-based multi-trophic vs. RAS systems: benefits and constraints.”*
38. Shpigel, M. (2010). World Aquaculture 2010 (San Diego, CA, May 2010) – *“Culture of the sea urchin* P. lividus *in a multi-trophic integrated system.”*
39. Shpigel, M. (2011). International Conference on Marine Resources (Bremen, Germany, Sep 2011) – *“Land-based multi-trophic systems: benefits and constraints.”*
40. Shpigel, M. (2012). 14th International Echinoderm Conference (Brussels, Belgium, Aug 2012) – presented findings on sea urchin aquaculture (abstract).
41. Shpigel, M. (2012). World Aquaculture 2012 (Prague, Czech Republic, Sep 2012) – *“Cost and benefit of IMTA systems: an ecological approach.”*
42. Shpigel, M. (2013). World Aquaculture 2013 (Nashville, TN, Feb 2013) – *“Integrated Multi-Trophic Mariculture Systems: An Ecological Approach for Sustainable Aquaculture.”*
43. Shpigel, M. (2016). World Aquaculture 2016 (Las Vegas, NV, Feb 2016) – *“Culture of* P. lividus *in a multi-trophic integrated system.”*
44. Shpigel, M. (2017). Aquaponics and Integrated Systems – Research and Application (Midreshet Ben Gurion, Israel, Apr 2017) – *“Land-based multi-trophic systems: benefits and constraints.”*

**Co-authored Conference Presentations:**

1. Fishelson, L.; Shpigel, M. (1989). Compound territories and associated behavior of three *Cephalopholis* species sympatric on Red Sea coral reefs. 21st International Ethological Conference (Utrecht, Netherlands), abstract p. 17.
2. Porter, C.B.; Krost, P.; Shpigel, M.; Gordin, H. (1993). Grey mullet (*Mugil cephalus*) as a forager of organically enriched sediments beneath marine fish cages (poster). World Aquaculture ’93 (Torremolinos, Spain), abstract p. 562.
3. Neori, A.; Ragg, N.; Shpigel, M. (1997). Increased protein content in *Ulva lactuca* significantly improves its nutritional value to abalone (*Haliotis discus hannai*, *H. tuberculata*). World Aquaculture ’97 (Seattle, WA), abstract p. 336.
4. Neori, A.; Ragg, N.; Lupatsch, I.; Shpigel, M. (1997). *Ulva lactuca* as a food source for juvenile abalone. 4th International Marine Biotechnology Conference (Sorrento, Italy), abstract p. 202.
5. Neori, A.; Shpigel, M. (1998). Macroalgae treat effluents and feed invertebrates in sustainable, integrated mariculture. World Aquaculture ’98 (Las Vegas, NV), abstract p. 385.
6. Goldberg, R.; Clark, P.; Wikfors, G.H.; Shpigel, M. (1988). Performance of *Ulva rigida* as a biofilter in a flow-through mariculture system. 18th Milford Aquaculture Seminar (Milford, CT, Feb 1988), abstract p. 55 (*J. Shellfish Res.* 17(1): 354–355).
7. McBride, S.C.; Rotem, E.; Ben-Ezra, D.; Shpigel, M. (2000). Evaluation of seasonal bioenergetics of *Haliotis fulgens* and *Haliotis tuberculata*. *J. Shellfish Res.* 19(1): 525 (abstract).
8. Mozes, N.; Blancheton, J.P.; Sadek, S.; Gordin, H.; Shpigel, M. (2000). Overview of land-based mariculture in the Mediterranean with emphasis on sustainable intensive systems. Aquaculture Europe 2000 (Nice, France), Special Publication No. 28: 491.
9. Boarder, S.J.; Shpigel, M. (2000). Comparative growth performance of juvenile *Haliotis roei* fed enriched *Ulva rigida* vs. artificial diets. *J. Shellfish Res.* 19(1): 502 (abstract).
10. Neori, A.; Shpigel, M. (2001). Sustainable land-based mariculture: evaluating algae and bivalves as biofilters in intensive fish culture. 17th International Seaweed Symposium (Cape Town, South Africa).
11. Neori, A.; Shpigel, M.; Sharfstein, B. (2001). Land-based low-pollution IMTA: principles of design, operation and economics. Aquaculture Europe 2001 (Trondheim, Norway), abstract p. 256.
12. McBride, S.; Shpigel, M.; Lupatsch, I.; Lawrence, J.M.; Lawrence, A.L. (2001). The effect of energy and protein supply on gonad development of European sea urchins (*P. lividus*) fed algal vs. prepared diets. World Aquaculture ’01 (Orlando, FL), abstract p. 418.
13. Zmora, O.; Shpigel, M. (2001). Filter feeders as biofilters in marine land-based systems. World Aquaculture ’01 (Orlando, FL), abstract p. 716.
14. Neori, A.; Shpigel, M.; Odintsov, V.; Krom, M.D. (2002). Integrated and zero-effluent mariculture technologies: the future is here. Aquaculture Europe 2002 (Trieste, Italy), abstract p. 372.
15. Schuenhoff, A.; Shpigel, M.; Lupatsch, I.; Neori, A. (2002). A semi-recirculating integrated system for culture of fish and seaweed. World Aquaculture ’02 (Beijing, China), abstract p. 685.
16. Gordon, N.; Neori, A.; Harpaz, S.; Shpigel, M. (2002). Nutritional requirements of postlarval Japanese abalone (*Haliotis discus hannai*). *Isr. J. Aquac. – Bamidgeh* 54(2): 59.
17. Neori, A.; Shpigel, M. (2003). Mariculture sustainability by integration of algae/algivores into fish/shrimp ponds – a working technology. 1st Congress of the International Society for Applied Phycology (Almeria, Spain, 2003).
18. Neori, A.; Chopin, T.; Troell, M.; Buschmann, A.H.; Kraemer, G.P.; Halling, C.; Shpigel, M.; Yarish, C. (2004). Seaweed biofilters in modern integrated intensive mariculture – rationale, evolution and state of the art. World Aquaculture ’04 (Honolulu, HI), abstract p. 992.
19. Neori, A.; Shpigel, M. (2004). Algae: a key for sustainable integrated mariculture – expanding mariculture without pollution. World Aquaculture ’04 (Honolulu, HI), abstract p. 836.
20. Hussenot, J.; Blachier, P.; Bunting, S.; MacDougall, K.; Husson, B.; Rigby, M.; Sharfstein, B.; Shpigel, M. (2004). Biological results and environmental evaluation of marine land-based IMTA prototypes (Genesis project). World Aquaculture ’04 (Honolulu, HI), abstract p. 227.
21. Neori, A.; Shpigel, M. (2004). The ultimate food frontier: algal culture is key to sustainable use of the sea. Australasian Aquaculture 2004 (Sydney, Australia), abstract p. 76.
22. Volkis, B.; Marciano, S.; Ben-Amotz, A.; Shpigel, M. (2005). Determination of carotenoids in gonads of sea urchins (*P. lividus*) fed artificial vs. natural diets. Israel Society for Marine Sciences Symposium (Eilat, 2005), abstract p. 16.
23. Lupatsch, I.; Golombek, E.; Shpigel, M. (2006). Energy and protein requirements for maintenance and growth in the sea urchin (*P. lividus*). 98th Annual Meeting, National Shellfisheries Association (Monterey, CA, 2006).
24. Anderson, M.A.; Ilan, M.; Shpigel, M.; Hill, R.T. (2007). Microbial communities of three Red Sea sponges in an open-water aquaculture system. 8th International Marine Biotechnology Conference (Eilat, 2007), abstract p. 157.
25. Ben-Ari, H.; Shpigel, M.; Rosenfeld, H. (2010). 11th Dan Popper Symposium (Eilat, Israel, Feb 2010) – presented research on controlling sea urchin reproduction (conference proceedings).
26. Ben-Ari, H.; Shpigel, M.; Rosenfeld, H. (2010). Israel Association for Aquatic Sciences Conference (Eilat, 2010) – presented findings on sea urchin aquaculture.
27. Ben-Ari, H.; Shpigel, M.; Rosenfeld, H. (2011). Aquaculture Europe 2011 (Rhodes, Greece) – presented research on sea urchin gonad enhancement (conference abstract).
28. Shpigel, M. (2011). Dual Taiwan–Israel Research Symposium (Haifa, Israel, Dec 2011) – *“Sustainable Multi-Trophic Mariculture Systems in the Red Sea: Back to the Future.”*
29. Ben-Ari, H.; Shpigel, M.; Rosenfeld, H. (2012). 14th International Echinoderm Conference (Brussels, Belgium, Aug 2012).
30. Ben-Ari, H.; Shpigel, M.; Rosenfeld, H. (2012). Aquaculture Europe 2012 (Prague, Czech Republic, Sep 2012).