**APPENDIX\_Global spreading of jellyfish hazards mirrors the pace of human imprint change in the marine environment**

**Lee et al 2022**

Appendix A. Socio-economic jellyfish hazards in LMEs

Appendix B. Records of human fatal events

Appendix C. Records of sting envenomation

Appendix D. Records of impairing industrial fisheries

Appendix E. Records of powerplant operation damage

Appendix F. The summary of jellyfish hazards from 1884 - 2019

Appendix G. The pace of jellyfish hazards changes in Anthropocene

Data collected from varied sources, including review articles and specialized textbooks. In the present study, an important amount of data was gathered from Yasuda, 2003, Purcell et al. 2007, Gershwin, 2013, and Graham et al. 2014. Records used were kept as in the original sources. Citations of personal communication were also referred as in the original documents.

**Appendix A. Summary of socio-economic jellyfish hazards in LMEs**

Figure A.1 (a) Search formula used in this study, (b) schematic flow of dataset of jellyfish hazards dataset PRISMA applied in this study.

|  |  |
| --- | --- |
|  |  |

Table A.1 Summary of human fatal events in LMEs from 1960s to 2010s.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Fatal cases in LMEs** | **1960** | **1970** | **1980** | **1990** | **2000** | **2010** |
| 5. Gulf of Mexico |  |  |  | 1 |  |  |
| 6. Southeast US Continental Shelf | 1 |  | 2 |  |  |  |
| 13. Humboldt Current |  |  |  |  |  | 1 |
| 26. Mediterranean Sea |  |  |  |  |  | 1 |
| 34. Bay of Bengal |  |  |  |  |  | 1 |
| 35. Gulf of Thailand |  |  | 1 | 4 | 5 | 2 |
| 36. South China Sea |  |  | 1 | 1 |  | 1 |
| 37. Sulu-Celebes Sea |  |  | 2 |  |  |  |
| 38. Indonesian Sea |  |  |  |  | 3 |  |
| 39. North Australian Shelf | 3 | 7 | 7 |  | 2 |  |
| 40. Northeast Australian Shelf | 9 | 2 | 3 | 1 | 5 | 1 |
| 45. Northwest Australian Shelf |  |  |  |  |  | 1 |
| 47. East China Sea | 1 | 1 | 2 |  |  |  |
| 48. Yellow Sea |  |  | 1 | 1 | 2 | 3 |
| 50. East Sea (Sea of Japan) |  | 1 |  |  |  |  |

Table A.2 Summary of sting envenomation events in LMEs from 1960s to 2010s.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sting envenomation in LMEs** | **1960** | **1970** | **1980** | **1990** | **2000** | **2010** |
| 3. California Current |  |  |  |  | 1 |  |
| 5. Gulf of Mexico |  |  |  |  | 2 | 1 |
| 6. Southeast US Continental Shelf |  |  | 2 |  | 1 | 12 |
| 11. Pacific Central American Coastal |  |  |  | 1 |  |  |
| 12. Caribbean Sea |  |  |  |  | 4 | 1 |
| 13. Humboldt Current |  |  |  |  |  | 1 |
| 15. South Brazil Shelf |  |  |  | 3 | 2 |  |
| 24. Celtic-Biscay Shelf |  |  |  |  | 1 | 2 |
| 26. Mediterranean Sea |  | 2 | 5 | 1 | 7 | 1 |
| 30. Agulhas Current |  |  | 3 | 2 |  |  |
| 32. Arabian Sea |  |  |  |  | 2 | 1 |
| 33. Red Sea |  |  |  |  | 1 |  |
| 35. Gulf of Thailand |  |  |  | 5 | 8 | 8 |
| 36. South China Sea |  |  |  |  |  | 10 |
| 38. Indonesian Sea |  |  |  |  | 12 | 9 |
| 39. North Australian Shelf |  |  |  | 4 |  |  |
| 40. Northeast Australian Shelf |  |  | 2 | 1 | 2 | 4 |
| 45. Northwest Australian Shelf |  |  |  |  | 1 |  |
| 46. New Zealand Shelf |  |  |  |  | 1 |  |
| 47. East China Sea |  | 2 | 7 | 2 | 8 | 15 |
| 48. Yellow Sea |  |  | 2 | 1 | 7 | 3 |
| 49. Kuroshio Current | 1 | 1 |  | 1 | 1 |  |
| 50. East Sea (Sea of Japan) | 2 | 3 | 2 | 3 | 5 | 2 |
| 47+48+50: Korean Peninsula |  |  |  |  |  | 5 |
| 47+49+50: Japan coast |  |  |  |  | 1 |  |
| N.A.: region does not correspond LMEs |  |  |  | 1 |  |  |
| N.A.: Australia region |  |  |  |  | 4 |  |

TableA.3 Summary of industrial fisheries damage in LMEs from 1960s to 2010s.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Industrial fisheries damage in LMEs** | **1960** | **1970** | **1980** | **1990** | **2000** | **2010** |
| 1. East Bering Sea |  |  |  | 1 | 1 |  |
| 5. Gulf of Mexico |  |  |  | 1 | 2 |  |
| 6. Southeast US Continental Shelf |  | 1 |  |  |  |  |
| 13. Humboldt Current |  |  |  |  | 5 | 1 |
| 15. South Brazil Shelf |  |  |  |  | 1 |  |
| 21. Norwegian Sea |  |  | 1 | 6 | 2 | 4 |
| 29. Benguela current |  |  | 1 | 1 | 1 |  |
| 24. Celtic-Biscay Shelf |  |  | 1 | 4 | 11 | 7 |
| 26. Mediterranean Sea |  | 3 | 7 | 3 | 7 | 5 |
| 32. Arabian Sea |  |  |  |  | 2 |  |
| 40. Northeast Australian Shelf |  |  |  | 2 |  |  |
| 42. Southeast Australian Shelf |  |  |  |  |  | 1 |
| 46. New Zealand Shelf |  |  |  | 1 |  | 1 |
| 47. East China Sea |  |  | 4 | 1 | 2 |  |
| 48. Yellow Sea |  |  |  |  | 2 |  |
| 49. Kuroshio Current |  |  | 2 | 1 | 3 |  |
| 50. East Sea (Sea of Japan) | 1 | 4 | 2 | 3 | 4 |  |
| 62. Black Sea |  | 1 | 1 | 1 | 1 |  |
| 47+48+50: Korean Peninsula |  |  |  |  |  | 3 |
| 47+49+50: Japan coast |  |  |  | 2 | 2 |  |
| 49+50: Japan western coast |  |  |  |  | 1 |  |

These data do not represent the magnitude of fishery damage but indicating the number of report by LME.

Table A.4 Summary of powerplant operation damage in LMEs from 1960s to 2010s.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Powerplant operation damage in LMEs** | **1960** | **1970** | **1980** | **1990** | **2000** | **2010** |
| 3. California Current |  |  |  |  | 1 | 1 |
| 6. Southeast US Continental Shelf |  |  | 4 | 1 |  | 2 |
| 7. Northeast US Continental Shelf | 1 |  |  |  | 2 |  |
| 14. Patagonian Shelf |  |  |  |  | 1 |  |
| 23. Baltic Sea |  | 5 |  |  | 2 | 1 |
| 24. Celtic-Biscay Shelf |  |  |  | 2 |  | 1 |
| 26. Mediterranean Sea |  |  |  |  | 1 | 2 |
| 32. Arabian Sea |  |  | 2 |  | 2 |  |
| 36. South China Sea |  |  |  | 1 | 1 |  |
| 41. East-Central Australian Shelf | 1 |  |  |  |  |  |
| 42. Southeast Australian Shelf |  |  |  |  | 1 |  |
| 45. Northwest Australian Shelf |  | 1 |  |  |  |  |
| 48. Yellow Sea |  |  |  |  | 1 |  |
| 49. Kuroshio Current | 14 | 8 | 1 | 2 | 1 | 1 |
| 50. East Sea (Sea of Japan) | 2 | 4 |  | 6 | 12 | 1 |

Table A.5 Classification Ocean regions and LMEs used in this study.

|  |  |
| --- | --- |
| **Marine region** | **LMEs** |
| Northeast Pacific Ocean | 1. East Bering Sea |
| Northeast Pacific Ocean | 3. California Current |
| Northeast Pacific Ocean | 11. Pacific Central-American Coastal |
| Northwest Pacific Ocean | 36. South China Sea |
| Northwest Pacific Ocean | 47. East China Sea |
| Northwest Pacific Ocean | 48. Yellow Sea |
| Northwest Pacific Ocean | 49. Kuroshio Current |
| Northwest Pacific Ocean | 50. East Sea / Sea of Japan |
| North Pacific Ocean | 10. Insular Pacific-Hawaiian |
| Indo-Pacific Ocean | 32. Arabian Sea |
| Indo-Pacific Ocean | 33. Red Sea |
| Indo-Pacific Ocean | 34. Bay of Bengal |
| Indo-Pacific Ocean | 35. Gulf of Thailand |
| Indo-Pacific Ocean | 37. Sulu-Celebes Sea |
| Indo-Pacific Ocean | 38. Indonesian Sea |
| Indo-Pacific Ocean | 39. North Australian Shelf |
| Indo-Pacific Ocean | 41. East-Central Australian Shelf |
| Indo-Pacific Ocean | 45. Northwest Australian Shelf |
| Indo-Pacific Ocean | 30. Agulhas Current |
| Southeast Pacific Ocean | 13. Humboldt Current |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf |
| Southwest Pacific Ocean | 42. Southeast Australian Shelf |
| Southwest Pacific Ocean | 46. New Zealand Shelf |
| Northeast Atlantic Ocean | 21. Norwegian Sea |
| Northeast Atlantic Ocean | 22. North Sea |
| Northeast Atlantic Ocean | 23. Baltic Sea |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf |
| Northwest Atlantic Ocean | 5. Gulf of Mexico |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf |
| Northwest Atlantic Ocean | 7. Northeast US continental Shelf |
| Northwest Atlantic Ocean | 12. Caribbean Sea |
| North Atlantic | 26. Mediterranean Sea\* |
| North Atlantic | 62. Black Sea\* |
| Southeast Atlantic Ocean | 29. Benguela Current |
| Southwest Atlantic Ocean | 14. Patagonian Shelf |
| Southwest Atlantic Ocean | 15. South Brazil Shelf |

\* Two LMEs are enclosed but as a part of the Atlantic Ocean, here we grouped North Atlantic.

Table A.6 List of identified jellyfish species causing socio-economical hazards.

|  |  |  |
| --- | --- | --- |
| **Jellyfish hazards** | **Identified species** | **Database** |
| Fatal event | *Chirodropids* sp.*, Chironex fleckeri, Chiropsalmus* sp.*, Chiropsoides* sp.*, Chrysaora melanaster, Chrysaora quinquecirrha, Irukandji* sp.*, Nemopilema nomurai, Olindias formosa, Physalia physalis, Physalia utriculus* | Appendix B |
| Sting envenomation | *Agalma okenii, Aurelia aurita, Carukia barnesi, Carybdea alata, Carybdea marsupialis, Carybdea rastoni, Chirodropid, Chironex fleckeri, Chiropsalmus quadrigatus, Chrysaora melanaster, Chrysaora quinquecirrha, Chrysaora* sp.*, Cyanea capillata, Euphysora bigelowi\*, Gonionemus oshoro, Gonionemus vertens, Hydromedusae, Linuche* sp.*, Nemopilema nomurai, Olindias formosa, Olindias sambaquiensis, Pelagia noctiluca, Physalia physalis, Physalis utriculus, Porpita porpita, Stomolophus nomurai, Tamoya ohboya* | Appendix C |
| Industrial fisheries impact | *Aequorea coerulescens, Aequorea forskalea, Agalma okenii, Apolemia uvaria, Aurelia aurita, Bolinopsis infundibulum\*\*, Bolinopsis mikado\*\*, Catostylus mosaicus, Chiropsalmus quadrigatus, Chrysaora hysoscella, Chrysaora melanaster, Crambionella orsini, Cyanea capillata, Dipleurosoma typicum, Lychnorhiza lucerna, Mnemiopsis leidyi\*\*, Moerisia lyonsi, Muggiaea atlantica, Nemopilema nomurai, Olindias sambaquiensis, Pelagia noctiluca, Periphylla periphylla, Phialella quadrata, Phyllorhiza punctata, Porpita pacifica, Rhizostoma pulmo, Rhopilema nomadica, Solmaris corona, Stomolophus meleagris, Velella velella* | Appendix D |
| Powerplant operation damage | *Aurelia aurita, Aurelia labiate, Catostylus mosaicus, Chrysaora melanaster, Crambionella orsini, Cyanea nozakii, Nemopilema nomurai, Rhizostoma* sp.*, Rhopilema esculenta* | Appendix E |

\* Accepted name, *Corymorpha bigelowi* (Maas, 1905)

\*\* Phylum Ctenophora

**Appendix B. Records of human fatal events**

Table B.1 Human fatal events from 1884 to 2016.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Marine regions** | **LME** | **Country** | **Location** | **Lat(N)** | **Long(E)** | **Year(s)** | **Identified species** | **No. victim (s)** | **Reference** |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Ross Island, Townsville | -19.16 | 146.19 | 1884 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011)\* |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Townsville | -19.15 | 146.49 | 1884 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Strand, Townsville | -19.14 | 146.48 | 1885 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Port Darwin, Sea baths | -12.28 | 130.50 | 1892 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Darwin baths | -12.17 | 130.56 | 1894 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 37. Sulu-Celebes Sea | Philippines | - | 13.00 | 122.00 | 1907 |  | 1 | Old HH., 1908 (in Fenner et al., 2010) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Cannonvale, Proserpine | -20.17 | 148.40 | 1910 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Cannonvale, Proserpine | -20.17 | 148.40 | 1910 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Pioneer Bay | -20.44 | 148.42 | 1911 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Kissing Pt, Townsville | -19.14 | 146.80 | 1916 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Mars Beach, Cannonvale | -20.16 | 148.41 | 1923 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Picnic Bay, Magnetic Island | -19.80 | 146.50 | 1930 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Googarra Beach, Tully Heads | -18.00 | 146.30 | 1934 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Bramston Beach | -17.21 | 146.10 | 1937 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Darwin baths (near) | -12.17 | 130.56 | 1938 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Googarra Beach, Tully Heads | -18.00 | 146.30 | 1939 | *Physalia* *physalis* | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Horseshoe Bay, Cannonvale | -19.70 | 146.50 | 1939 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Aurukun | -13.21 | 141.43 | 1940's | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Aurukun | -13.21 | 141.43 | 1940's | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Darwin | -12.17 | 130.56 | 1941 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Townsville | -19.15 | 146.49 | 1941 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Townsville | -19.15 | 146.49 | 1941 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, South Mission Beach, Tully | -17.57 | 146.30 | 1943 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory | -20.00 | 134.00 | 1944 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Darwin | -12.17 | 130.56 | 1944 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 36. South China Sea | Malaysia | Borneo | 5.17 | 115.14 | 1945 | Chirodropids various | 1 | Fenner and University of London, 1997 |
| Indo-Pacific region | 36. South China Sea | Malaysia | Borneo | 5.00 | 115.17 | 1945 | Chirodropids various | 1 | Fenner and University of London, 1997 |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Appel Channel, Mornington Island | -16.31 | 139.24 | 1947 | Box jellyfish | 1 | Cl & S (Kinsey88) (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, North Mission Beach, Tully | -17.52 | 146.60 | 1949 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Mindil Beach, Darwin | -12.26 | 130.49 | 1950 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Darwin | -12.17 | 130.56 | 1951 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Kissing Pt, Townsville | -19.14 | 146.80 | 1951 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Saltwater Creek, N of Townsville | -19.40 | 146.28 | 1953 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Larrakeyah Beach, Darwin | -12.27 | 130.49 | 1954 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, the Gulf at Rose N.A.B. Station | -20.00 | 134.00 | 1954 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Snake Bay, Melville Island | -11.25 | 130.39 | 1954 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Myilly Pt, Bathurst Island | -11.44 | 130.25 | 1955 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Rose R., Arnhemland | -12.50 | 132.53 | 1955 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Cardwell | -18.15 | 146.10 | 1955 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Pearce Creek, Ross River, Tville | -19.24 | 146.44 | 1956 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 36. South China Sea | Malaysia | Borneo | 6.53 | 116.50 | 1956 | Chirodropids various | 1 | Fenner and University of London, 1997 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Bluff Beach, Yeppoon | -23.70 | 150.44 | 1957 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, North Mission Beach, Tully | -17.52 | 146.60 | 1957 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Maningrida, Liverpool R. | -12.30 | 134.13 | 1959 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Maningrida, Liverpool R. | -12.30 | 134.13 | 1961 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Shirahama, Okinawa Island | 26.22 | 127.66 | 1961 | Chirodropids | 1 | Fenner and Williamson, 1996; Drs. Araki, pers. comm. (in Fenner, 1997) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Bamaga, Cape York | -10.89 | 142.38 | 1962 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Thursday Island | -10.34 | 142.13 | 1962 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Yorkeys Knob, Trinity Bay | -16.50 | 145.34 | 1962 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, South Mission Beach, Tully | -17.57 | 146.30 | 1962 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Bucasia Beach, Mackay | -21.03 | 149.16 | 1963 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Mica Beach, Darwin | -12.28 | 130.46 | 1964 | Box jellyfish | 1 | Cleland, J. B., Southcott, R. V., 1965; Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Palm Cove. Cairns | -16.44 | 145.40 | 1964 | Box jellyfish | 1 | Cleland, J. B., Southcott, R. V., 1965; Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida | 25.48 | -80.08 | 1964 | *Physalia physalis* | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Mornington Island | -16.31 | 139.24 | 1965 | Box jellyfish | 1 | Kinsey, B. E., 1986\* (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Half Moon Bay (Yorkey’s) | -16.48 | 145.42 | 1966 | Box jellyfish | 1 | Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Milingimbi, Arnhem Land | -12.50 | 134.53 | 1967 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Aurukun | -13.21 | 141.43 | 1967 | Box jellyfish | 1 | Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Shoal Bay, Darwin | -12.17 | 130.56 | 1970 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Forrest Beach, Ingham | -18.42 | 146.17 | 1970 | Box jellyfish | 1 | Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Seaforth Beach, N of Mackay | -21.80 | 149.10 | 1971 | Box jellyfish | 1 | TROVE (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, North Mission Beach, Tully | -17.52 | 146.60 | 1971 | Box jellyfish | 1 | Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Melville Island | -11.31 | 131.09 | 1974 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Bathurst Island | -11.44 | 130.25 | 1975 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Yirrkala, Arnhem Land | -12.15 | 136.53 | 1975 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Snake Bay, Melville Island | -11.25 | 130.39 | 1977 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Maningrida, Liverpool R. | -12.30 | 134.13 | 1978 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Maningrida, Liverpool R. | -12.30 | 134.13 | 1979 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Nagasaki Pref. | 26.22 | 127.66 | 1979 | *Olindias formosa* | 1 | Yasuda, 1988 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.14 | 136.08 | 1979 | *Chrysaora melanaster* | 1 | Yasuda, 1988 |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Snake Bay, Melville Island | -11.25 | 130.39 | 1980 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Wongaling Beach, Tully | -17.53 | 146.50 | 1980 | Box jellyfish | 1 | Kinsey, B. E., 1986 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 47. East China Sea | Japan |  | 32.72 | 129.85 | 1980 | *Olindias formosa* | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.22 | 127.66 | 1981 | Chirodropids | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 37. Sulu-Celebes Sea | Philippines | Bolineo habor | 13.00 | 122.00 | 1982 |  | 1 | Fenner and Williamson, 1996; Anonymous, pers. comm. (in Fenner, 1997) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Goulburn Island | -11.36 | 133.23 | 1983 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Milingimbi, Arnhem Land | -12.50 | 134.53 | 1983 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996. (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Qinhuangdao, Hebei Province | 36.06 | 120.38 | 1983-1987; 1995 -2000 | *Nemopilema nomurai* | 2 | Li, 1988; Wang, 2002; Xu et al., 2007 (Dong et al., 2010) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Elcho Island | -11.58 | 135.41 | 1984 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Milingimbi, Arnhem Land | -12.50 | 134.53 | 1985 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 37. Sulu-Celebes Sea | Philippines | Bolineo | 13.00 | 122.00 | 1985 |  | 1 | Fenner and Williamson, 1996; Anonymous, pers. comm. (in Fenner, 1997) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Barney Point Beach, Gladstone | -23.50 | 151.16 | 1987 | Box jellyfish | 1 | Lumley et al., 1988 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida | 26.43 | -80.25 | 1987 | *Physalia physalis* | 1 | Stein et al., 1989 |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Garden Point, Melville Island | -11.24 | 130.25 | 1988 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Snake Bay, Melville Island | -11.25 | 130.39 | 1988 | Box jellyfish | 1 | Williamson, J. A., Fenner, P. J., Burnett, J. W., Rifkin, J., 1996 (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida | 30.35 | -81.60 | 1988 | *Physalia physalis* | 1 | Burnett and Gable, 1989 |
| Indo-Pacific region | 36. South China Sea | Brunei | Penanjong beach | 4.5 | 114.4 | 1989 | *Chirodropid* sp. | 1 | Nor Azila, pers. comm. (in Fenner, 1997) |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Penanjong beach | 4.51 | 114.41 | 1989 | Chirodropids | 1 | Fenner and Williamson, 1996; Fenner and University of London, 1997 |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | US | Galveston Island, the Gult of Mexico | 29.23 | -94.89 | 1990 | *Chiropsalmus quadrumanus* | 1 | Bengston et al., 1991 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | North Labuan Island | 5.19 | 115.12 | 1992 | Chirodropids | 1 | Fenner and Williamson, 1996; Fenner and University of London, 1997 |
| Indo-Pacific region | 36. South China Sea | Malaysia | Labuan Island, Tanjung kubong | 5.22 | 115.14 | 1992 | *Chirodropid* sp. | 1 | Fenner and University of London, 1997 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Weihai, Shandong province | 37.55 | 122.13 | 1994-2000; 2007 | *Nemopilema nomurai* | 10 | Cao and Shao, 2001; Liu et al., 2002; Wang and Wang, 2002; Jiang et al., 2008b; Zhang and Yang, 2008 (in Dong et al., 2010) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Langkawi Island, border with Malaysia | 6.21 | 99.48 | 1995 | *Chiropsoides buitendijki* or *Chiropsalmus quadrigatus* | 2 | Fenner and University of London, 1997 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Northern Territory, Aboriginal Island | -11.99 | 134.81 | 1996 | *Chironex fleckeri* | 1 | Currie and Jacups, 2005 (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Pantain cenang, Pulau langkawi | 6.29 | 99.73 | 1996 | *Chiropsoides buitendijki* | 2 | Fenner et al., 2010 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Chawang beach, Samui Island, Surat Tahni Province | 9.53 | 100.06 | 1999 | *Chironex fleckeri* | 1 | Suntrarchun et al., 2001 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Northern Queensland | -16.54 | 145.52 | 2000 | *Chironex fleckeri* | 1 | Currie and Jacups, 2005; Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Palau Pangkor | 4.13 | 100.33 | 2000 | Box jellyfish | 1 | Lippmann et al., 2011 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Dalian, Liaoning Province | 38.50 | 121.40 | 2001-2004; 2007 | *Nemopilema nomurai* | 1 | Li and Sun, 2003; Zhang et al., 2005; Chen et al., 2006; Wang et al., 2008; Wang, 2009 (in Dong et al., 2010) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Hamilton Island, Whitsundays | -20.21 | 148.57 | 2002 | Irukandji | 1 | Fenner and Hadok, 2002 (in Australian Marine Stinger Advisory Services, 2011); Gershwin, L-A. 2012 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Opal Reef, Port Douglas | -16.29 | 145.27 | 2002 | Irukandji | 1 | Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | East rin beach, Pha-ngan Island, Surat thani Province | 9.70 | 100.00 | 2002 | Box jellyfish | 2 | Sonthichai et al., 2010 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Wongaling Beach, Queensland | -17.91 | 146.09 | 2003 | Box jellyfish | 1 | Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Northern Queensland | -16.55 | 145.46 | 2003 | *Chironex fleckeri* | 1 | Currie and Jacups, 2005 |
| Indo-Pacific region | 39. North Australian Shelf | Australia | North Queensland, Bamaga Umagico | -10.89 | 142.35 | 2006 | Box jellyfish | 1 | Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Shenyang, golden sand beach | 40.60 | 122.14 | 2006 | Unknown | 2 | Anonymous, 2006 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Palau Sapi, near Kota Kinabalu | 5.91 | 117.41 | 2006 | Chirodropids | 1 | Lippmann et al., 2011 |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory, Aboriginal community | -11.25 | 130.40 | 2007 | Box jellyfish | 1 | Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Banyuputih, Situbondo | -7.46 | 114.15 | 2008 | *Physalia utriculus* | 1 | Radar Banyouwangi, 2008 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Bembang beach, Jebus | -1.57 | 104.18 | 2008 | *Chrysaora quinquecirrha* | 1 | Bangka Post, 2008 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Mlandingan, Situbondo | -7.78 | 113.79 | 2008 | *Physalia utriculus* | 1 | Radar Banyouwangi, 2008 (in Mujiono, 2010) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Koh Chang, Trat province | 12.60 | 102.21 | 2008 | Box jellyfish | 1 | Sonthichai et al., 2010 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Lanta Island, Krabi Province | 7.35 | 99.03 | 2008 | Box jellyfish | 1 | Sonthichai et al., 2010 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Italy | Porto Tramatzu, Sardinia | 40.17 | 8.39 | 2010 | *Physalia physalis* | 1 | Nick, P., 2010 |
| Indo-Pacific region | 34. Bay of Bengal | Malaysia | Pantain cenang, Pulau langkawi | 6.28 | 99.73 | 2010 | Box jellyfish | 1 | Simpson, P. V., 2010 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Beidaihe, Qinhuangdao, Hebei province | 39.50 | 119.29 | 2012 | *Physalia physalis* | 1 | Da, W., 2012 |
| Southeast Pacific Ocean | 13. Humboldt Current | South Africa | Cape town | -33.55 | 18.25 | 2012 | *Physalia physalis* | 1 | Stewart, M., 2012 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Incheon | 37.44 | 126.37 | 2012 | *Nemopilema nomurai* | 1 | Kim et al., 2018 |
| Indo-Pacific region | 45. Northwest Australian Shelf | Australia | Western Australia, Elle’s Beach, S of Coral Bay | -23.26 | 113.46 | 2013 | Irukandji | 2 | Gershwin, L-A. (in Australian Marine Stinger Advisory Services, 2011) |
| Indo-Pacific region | 36. South China Sea | Malaysia | Borneo | 6.21 | 116.26 | 2013 | Box jellyfish | 1 | Chock, S. Y., 2013 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Khuat beach, Pha-ngan Island | 9.45 | 101.01 | 2014 | Box jellyfish | 1 | Taikruea and Siriariyaporn, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Dalian, Liaoning Province | 37.04 | 120.23 | 2015 | *Physalia physalis* | 2 | Lee, G., 2015 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Southern Island of Koh Samui | 9.32 | 99.56 | 2015 | Box jellyfish | 2 | Taikruea and Siriariyaporn, 2016 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Great Barrier reef | -18.17 | 147.42 | 2016 | Irukandji | 3 | Sam, R., 2016 |

\* Record of fatal events in Australia from 1885 to 2013 are directly referred from Australian Marine Stinger Advisory Services. Online available at http://www.stingeradvisor.com/boxydeaths.htm (last accessed 23 September 2019).

Note: Few records possess an unspecified locality or cover a large area, i.e., Japan coasts, near Red Sea. In those cases, the adjacent country or sea region (e.g., Japan, Red Sea) were reported.

Table B.2 Record of human fatal events from 1884 to 2016. Reports are uncertain or incomplete.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marine region** | **Location** | **Year** | **Identified Sp.** | **No. victim (s)** | **Reference** |
| Indo-Pacific region | Australia, Victoria, near Perth | 1980s | Irukandji | ? | Gershwin et al., 2010 |
| Indo-Pacific region | Maldives, Myanmar, Southern India | Unknown |  | ? | Fenner et al., 2010 |
| Northwest Pacific Ocean | Philippines | - | Chirodropids various | 20-50 deaths yr-1 | Fenner, 1998 |
| Northwest Pacific Ocean | Philippines | Unknown |  | 1 | Anonymous, P.J. Fenner pers. comm. (in Fenner 2007, p.61) |
| Northwest Pacific Ocean | Indonesia, Balikpapan | Unknown |  | 1 | R Grenfell, 1998, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.119) |
| Northwest Pacific Ocean | Northwest Borneo, Brunei, Tutong beach | 1983 |  | 1 | Nor Azila, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.115) |
| Northwest Pacific Ocean | Malaysia, Labuan Island, Tutong beach | 1989 |  | 1 | Nor Azila, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.115) |
| Northwest Pacific Ocean | Miri (Sarawak) | 1990 |  | 1 | Nor Azila, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.115) |
| Northwest Pacific Ocean | Malaysia, Labuan Island | 1991 |  | 1 | Nor Azila, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.115) |
| Northwest Pacific Ocean | Malaysia, Labuan Island | - |  | 2-3 deaths yr-1 | Nor Azila, P.J. Fenner pers. comm. (in Fenner M.D thesis, P.115) |
| Northwest Pacific Ocean | Japan, Okinawa | Unknown | *Chiropsalmus quadrigatus* | 1 | Y Araki, 1995, pers. comm. (in Fenner M.D thesis, P114) |
| Northwest Pacific Ocean | China\* | Unknown | *Nemopilema nomurai* | 8 | Mingliang 1988b, 1992; Mingliang and Qin Shede 1990, 1991 (in Fenner and William, 1996) |
| Southwest Pacific Ocean | Solomon (Bougainville Island), Papua New Guinea | 1932-1933 | probably a box jellyfish | 1 | Fenner and Williamson, 1996; Fenner and University of London, 1997 |
| Southwest Pacific Ocean | Australia, near Rottnest Island off Perth | 2003 | Irukandji | ? | Gershwin et al., 2010 |

\*China fatal event (8 victims) is presumed to overlap with fatal events at Qinghuangdao (1983-1987; 1995-2000, 2 victims in Table B.1). However, the accurated time of fatal accidents is unconfirmed. "Mingliang 1988b, 1992 and Mingliang & Qin Shede 1990, 1991 in Fenner MD thesis, p. 111" records are given as in the original format.

? denotes uncomplete reports.

Table B.3 List of reference of human fatal events caused by jellyfish from 1884 to 2016.

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**Appendix C. Records of critical sting envenomation by jellyfish**

Table C.1 Record of sting envenomation by jellyfish from 1961 to 2019.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Marine region** | ***LME*** | **country** | ***Location*** | ***Lat. (°N)*** | ***Long. (°E)*** | ***Year(s)*** | **Identified Sp.** | | **No. affected person** | **Reference** |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Japan, Kanagawa Pref | 35.26 | 139.38 | 1961 | *Physalia physalis* | | 15000 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Japan, Hokkaido (Saroam lake), Aomori Pref. (Tsugaru) | 43.13 | 142.51 | 1961-1963 | *Gonionemus oshoro, Chrysaora melanaster* | | 175 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 1967 | *Chrysaora melanaster* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Niigata Pref. | 37.37 | 138.52 | 1970 | *Cyanea capillata* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref. | 35.58 | 135.67 | 1976 | *Chrysaora melanaster* | | 300 | Yasuda, 2003 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Italy | Adriatic Sea, Italian coast | 43.69 | 7.27 | 1976 - 1986 | *Pelagia noctiluca* | | several | Rottini Sandrini and Stravisi, 1981; Piccinetti Manfrin and Piccinetti, 1983; 1983-84; Rottini Sandrini et al., 1984; Piccinetti et al., 1991 (in Mariottini et al., 2008) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Northern Adriatic Sea, Yugoslavian coasts \* | 44.52 | 13.51 | 1977, 1978, 1979 | *Pelagia noctiluca* | | 250000 (only 1978) | Maretić et al., 1980 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Japan, Hyogo Pref | 34.65 | 135.18 | 1978 | *Carybdea rastoni, Gonionemus vertens* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Nagasaki Pref. | 32.44 | 128.52 | 1979 | *Olindias formosa* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 1979 | *Chrysaora melanaster* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 1979 | *Chrysaora melanaster* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 1981 | *Chiropsalmus quadrigatus* | | >3 | Yamaguchi, 1982 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Monaco, France | Ligurian Sea from Cannes to Monaco | 43.15 | 6.38 | 1981-1985, 1994-1996, 1998-2000, 2003-2008 | *Pelagia noctiluca* | | 1000 per summer season (July to August) | Bernard et al., 2011 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Greece | - | 39 | 22 | 1982 | *Pelagia noctiluca* | | 1500 | Axiak et al., 1991 (in Canepa et al., 2014) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Nagasaki Pref. | 32.44 | 128.52 | 1982 | *Physalia physalis* | | 40 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 1982 | *Physalia physalis* | | 400 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Niigata Pref. | 37.37 | 138.52 | 1983 | *Carybdea rastoni, Gonionemus vertens* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref. | 35.58 | 135.67 | 1983 | *Chrysaora melanaster* | | 200 | Yasuda, 2003 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Adriatic Sea, Croatia coast | 44.52 | 13.51 | 1983 | *Pelagia noctiluca* | | several | Benovic, 1984 (in Mariottini et al., 2008) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Qinhuangdao, Hebei province | 39.56 | 119.36 | 1983-1987: 1995-2000 | - | | 583 | Li, 1988; Wang, 2002; Xu et al., 2007 (in Dong et al., 2010) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 1984 | *Chrysaora melanaster, Gonionemus vertens* | | >10 | Yasuda, 2003 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Coast of Bohai, Beidaihe beach | 39.5 | 119.29 | 1984, 1986, 1987, 1988 | *Nemopilema nomurai* | | 3000 | Fenner, 1997 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Adriatic Sea, Croatia coast | 44.52 | 13.51 | 1985 | *Pelagia noctiluca* | | several | Zavodnik, 1991 (in Mariottini et al., 2008) |
| Northwest Pacific Ocean | 47. East China Sea | China | Sanya, Hainan Island | 18.15 | 109.3 | 1985-1993: 2001-2005 | - | | 133 | Li and Chen, 1994; Cui and Xu, 2008 (in Dong et al., 2010) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 1986 | Irukandji | | 65 | Gershwin, 2013 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 1986-1999 | Irukandji and *Chironex fleckeri* | | 50-200 yr-1 | Fenner and Harrison, 2000 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Israel | - | 31 | 35 | 1987 | *-* | | 30 | Galil et al, 2008 |
| Indo-Pacific region | 30. Agulhas Current | South Africa | Eastern Cape, main beach areas of the City of East London | -32.59 | 27.52 | 1987 | *Physalia* spp. | | 202 | Fenner, 1997 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Miami | 26.76 | -80.19 | 1987 | *Physalia physalis* | | 1 | Burnett et al., 1996 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Massachusetts, Cape cod | 41.65 | -70.18 | 1987 | - | | dozens | Hanafin T., 1987 (in Graham et al., 2014) |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1987/1988 | | 2273 | | Surf life saving queensland (in Fenner and William, 1996) |
| Indo-Pacific region | 30. Agulhas Current | South Africa | Eastern Cape, main beach areas of the City of East London | -32.59 | 27.52 | 1988 | *Physalia* spp. | | 371 | Fenner, 1997 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 1988 | *Chiropsalmus quadrigatus* | | 1 | Burnett et al., 1996; Fenner, 1997 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1988/1989 | | 1328 | | Surf life saving queensland (in Fenner and William, 1996) |
| Indo-Pacific region | 30. Agulhas Current | South Africa | Eastern Cape, main beach areas of the City of East London | -32.59 | 27.52 | 1989 | *Physalia* spp. | | 456 | Fenner, 1997 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 1989 | *Chiropsalmus quadrigatus* | | 1 | Burnett et al., 1996; Fenner, 1997 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1989/1990 | | 1611 | | Surf life saving queensland (in Fenner and William, 1996) |
| Indo-Pacific region | 30. Agulhas Current | South Africa | Eastern Cape, main beach areas of the City of East London | -32.59 | 27.52 | 1990 | *Physalia* spp. | | 170 | Fenner, 1997 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1990/1991 | | 1648 | | Surf life saving queensland (in Fenner and William, 1996) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory | -12.2 | 132.24 | 1990-2007 | Irukandji | | 87 | Nickson et al., 2009 (in Graham et al., 2014) |
| Indo-Pacific region | - | Britain | Diego Garcia, Chagos Archipelago | -7.18 | 72.24 | 1991 | *Chiropsalmus quadrigatus* | | 1 | Fenner, 1997 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Yugoslavia\* | 44.49 | 20.27 | 1991 | *Pelagia noctiluca* | | 110 | Axiak et al., 1991 (in Canepa et al., 2014) |
| Indo-Pacific region | 30. Agulhas Current | South Africa | Eastern Cape, main beach areas of the City of East London | -32.59 | 27.52 | 1991 | *Physalia* spp. | | 91 | Fenner, 1997 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Labuan Island | 5.22 | 115.14 | 1991 | *Chirodropid* sp. | | 1 | Fenner, 1997 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Northern Labuan | 5.22 | 115.14 | 1991 | *Chirodropid* sp. | | 2 | Fenner, 1997 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1991/1992 | | 1637 | | Surf life saving queensland (in Fenner and William, 1996) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory | -12.2 | 132.24 | 1991-2002 | - | | 311 | Currie et al., 2005 (in Graham et al., 2014) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory | -12.2 | 132.24 | 1991-2003 | Irukandji | | 70 | Currie et al., 2005 (in Graham et al., 2014) |
| Indo-Pacific region | 39. North Australian Shelf | Australia | Northern Territory | -12.2 | 132.24 | 1991-2004 | *Chironex fleckeri* | | 225 | Currie et al., 2005 (in Graham et al., 2014) |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Brunei | 4.5 | 114.4 | 1992 | *Chirodropid* sp. | | 1 | Fenner, 1997 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Labuan Island | 5.22 | 115.14 | 1992 | *Chirodropid* sp. | | 1 | Dr. J Hooper, 1992. pers. comm. (in Fenner, 1997) |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Pulau sapi | 5.91 | 117.41 | 1992 | *Chirodropid* sp. | | 1 | Fenner, 1997 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1992/1993 | | 576 | | Surf life saving queensland (in Fenner and William, 1996) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 1993 | - | | 500 | Burnett et al., 1996 |
| Southwest Pacific Ocean | - | Australia | Australian beaches | -19.44 | 147.49 | 1993/1994 | | 2418 | | Surf life saving queensland (in Fenner and William, 1996) |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Sâo Paulo | 23.33 | 46.38 | 1994 | *Physalia physalis* | | 295 | Fenner, 1997 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Weihai, Shandong province | 37.3 | 122.12 | 1994 | - | | 1274 | Cao and Shao, 2001; Liu et al., 2002; Wang and Wang, 2002; Jiang et al., 2008b; Zhang and Yang, 2008 (in Dong et al., 2010) |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Sâo Paulo, Cabelo Gordo de Dentro beach | 23.33 | 46.38 | 1995 | *Tamoya haplonema* | | 1 | Morandini, A C and Marques, A C, 1997, unpublished record (in Fenner, 1997) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 1995 | *Agalma okeni* | | >10 | Yasuda, 2003 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Cairns beach | -16.9 | 144.77 | 1996 | *Chironex fleckeri* | | 62 | Little M. and Mulcahy RF, 1998 (in Graham et al., 2014) |
| Southeast Pacific Ocean | 11. Pacific Central American Coastal | Costa Rica | Quepos, Manuel Antonio beach | 9.43 | 84.16 | 1997 | possibly *Chirodropid* sp. | | 1 | Fenner, 1997 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Shimane to Yamagata Pref. | 35.46 | 133.05 | 1997 | *Chrysaora melanaster, Gonionemus vertens* | | >100 | Yasuda, 2003 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Japan, Hyogo Pref | 34.65 | 135.18 | 1998 | *Aurelia aurita, Agalma okeni, Gonionemus vertens* | | 50 | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | China | Zhejiang province | 29.8 | 119.47 | 1998-2004 | - | | 32 | Xu, 2005 (in Dong et al., 2010) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukuoka to Yamagata Pref. | 33.35 | 130.24 | 1999 | *Chrysaora melanaster* | | >100 | Yasuda, 2003 |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Santa Catarina coast | -27.9 | -48.34 | 1999/2000 | *Olindias sambaquiensis* and other species | | 13 | Resgalla Jr. et al., 2005 |
| North Pacific Ocean | 10. Insular Pacific-Hawaiian | US | Hawaii | 21.29 | -157.85 | 2000 | *Carybdea alata (Alatina moseri)* | | 62 | Thomas et al., 2001 (in Cegolon et al., 2013) |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | Mexico | Mexico, Puerto Morales beach | 20.51 | -86.52 | 2000 | possibly C*arybdeid* or *Linuche* sp. | | 1 | Fenner, 1997 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 2000 | *Agalma okeni* | | 3 | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref. | 36.3 | 136.13 | 2000 | *Euphysora bigelowi* | | >10 | Yasuda, 2003 |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Santa Catarina coast | -27.9 | -48.34 | 2000/2001 | *Olindias sambaquiensis* and other species | | 72 | Resgalla Jr. et al., 2005 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2001 | Irukandji | | 44 | Sando et al., 2010 (Lucas et al., 2014) |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Santa Catarina coast | -27.9 | -48.34 | 2001/2002 | *Olindias sambaquiensis* and other species | | 20 | Resgalla Jr. et al., 2005 |
| Northwest Pacific Ocean | 47. East China Sea | China | Fujian province | 26.29 | 117.55 | 2001: 2006 | - | | 106 | Chen et al., 2003; Wu et al., 2007 (in Dong et al., 2010) |
| Indo-Pacific region | 45. Northwest Australian Shelf | Australia | Broome beach | -17.95 | 122.24 | 2001-2003 | Irukandji | | 88 | Macrokanis et al., 2004 (in Graham et al., 2014) |
| Southwest Pacific Ocean | ? | Australia | - | -19.44 | 147.49 | 2001-2003 | *Carukia barnesi* and other sp., Irukandji Syndrome | | 88 | Bailey et al., 2003; Macrokanis et al., 2004 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Quingdao, Shandong province | 36.4 | 120.22 | 2001-2003: 2005-2006 | - | | 93 | Yang and Qian, 2003; Chou and Bian, 2005; Li, 2007 (in Dong et al., 2010) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Dalian, Liaoning province | 38.54 | 121.36 | 2001-2004: 2007 | - | | 241 | Li and Sun, 2003, Zhang et al., 2005; Chen et al., 2006; Wang et al., 2008, and Wang, 2009 (in Dong et al., 2010) |
| Northwest Atlantic Ocean | 12. Caribbean Sea | Dominican Republic | Punta Cana | 18.32 | -6.22 | 2002 | possibly *Carybdeid* sp. or *Chirodropid* spp. | | 1 | Fenner, 1997 |
| Indo-Pacific region | 32. Arabian Sea | Oman | - | 21 | 57 | 2002 | possibly *Carybdea alata* with Irukandji-like syndrome | | 1 | Fenner, 1997 |
| Indo-Pacific region | 33. Red Sea | Egypt | Red Sea | 22 | 38 | 2002 | possibly *Carybdeid* sp. | | 1 | Fenner, 1997 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2002 | *Carukia barnesi* and other sp., Irukandji Syndrome | | 74 and 113 by seasons | Gershwin, 2013 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2002 | Irukandji | | 50 | Sando et al., 2010 (Lucas et al., 2014) |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Yantai, Shandong province | 37.27 | 121.26 | 2002 | - | | 1 | Zhang et al., 2002 (in Dong et al., 2010) |
| Northwest Pacific Ocean | 47+49+50 | Japan | Japan | 35 | 149 | 2002 (and after) | *Nemopilema nomurai* | | >100 | Kawahara et al., 2007, S. Uye per.obs. (in Purcell et al. 2007) |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Chiba Pref. | 35.36 | 140.07 | 2002 (and after) | *Porpita porpita* | | >1 | Oiso et al., 2005 (in Purcell et al., 2007) |
| Southwest Pacific Ocean | ? | Australia | - | -19.44 | 147.49 | 2002-2007 | *Physalia physalis* | | frequent | Purcell et al., 2007 (in Graham et al., 2014) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2003 | Irukandji | | 18 | Sando et al., 2010 (Lucas et al., 2014) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Bali | -8.2 | 115.05 | 2003 | possibly *Physalia physalis* | | 1 | Fenner, 1997 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Southern province (Surat Thani, Krabi, Phuket, and Satun) | 9.8 | 99.19 | 2003-2009 | *-* | | 381 | Thaikruea and Siriariyaporn, 2016 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2004 | Irukandji | | 16 | Sando et al., 2010 (Lucas et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Monaco | Monaco, French riviera | 43.15 | 6.38 | 2004 | *Pelagia noctiluca* | | 45000 | Purcell et al., 2007 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Depok beach | -8 | 110.17 | 2004 | *Physalia utriculus* | | 50 | Werdiono, 2007 (in Mujiono, 2010) |
| Northwest Pacific Ocean | 47. East China Sea | China | Guangdong province | 23.22 | 113.45 | 2004 | - | | 35 | Lin et al., 2005 (in Dong et al., 2010) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Pattaya beach | 12.93 | 100.87 | 2004 | Chirodropid | | 1 | Fenner et al., 2010 (in Graham et al., 2014) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2005 | Irukandji | | 19 | Sando et al., 2010 (Lucas et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | Mediterranean | 39.68 | 0.2 | 2005 | - | | 15000 | Nash E., 2005 (in Graham et al., 2014) |
| Southwest Pacific Ocean | ? | Australia | - | -19.44 | 147.49 | 2005-2007 | *Physalia* spp. | | 1200 | Fenner and Williamson, 1996; de Pastino, 2007 (in Purcell et al. 2007) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2006 | Irukandji | | 106 | Gershwin, 2013 |
| Southwest Pacific Ocean | ? | Australia | - | -19.44 | 147.49 | 2006 | *Physalia* spp. | | 30000 | Fenner and Williamson, 1996; de Pastino, 2007 (in Purcell et al. 2007) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | East and south coasts of Spain | 37.5 | -1.44 | 2006 | *Pelagia noctiluca* | | 14000 | Pingree and Abend, 2006 (in Purcell et al., 2007) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2006 | Irukandji | | 106 | Gershwin, 2013 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Jeju Island | 33.29 | 126.29 | 2006 |  | | 62 | Jejunews, 2010 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Huludao, Liaoning province | 40.42 | 120.5 | 2006 | - | | 2 | Yu et al., 2007 (in Dong et al., 2010) |
| Northwest Atlantic Ocean | 12. Caribbean Sea | Britain | British Virgin Islands, Norman Island | 18.19 | -64.37 | 2006 | Cubozoan | | 1 | Anonymous, 2006 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Malta | - | 35.95 | 14.41 | 2006 | - | | 1000 | Anonymous, 2006 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Rhode Island | 41.32 | -71.8 | 2006 | *Physalia physalis* | | multiple | Lord P., 2006 (in Graham et al., 2014) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2007 | Irukandji | | 24 | Sando et al., 2010 (Lucas et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | - | 39.68 | 0.2 | 2007 | *Pelagia noctiluca* | | more than 14000 | Pingree and Abend, 2006 (in Percell et al., 2007) |
| Northeast Pacific Ocean | 3. California Current | US | San Diego | 32.42 | 117.09 | 2007 | - | | 200 per day | LaFee S., 2007 (in Ward et al., 2012) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Depok beach | -8 | 110.17 | 2007 | *Physalia utriculus* | | 10 | Health Insurance Review and Assessment service Korea, 2016 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Parangtritis beach | -8.1 | 110.19 | 2007 | *Physalia utriculus* | | >10 | Utantoro, 2007 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Teleng Ria beach | -8.13 | 111.4 | 2007 | *-* | | >10 | Adi, 2007 (in Mujiono, 2010) |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Namhae, southern Sea of Korea | 34.83 | 127.89 | 2007 | - | | 203 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2007 | - | | 40 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | East Sea | 38.84 | 135 | 2007 | - | | 52 | Health Insurance Review and Assessment service Korea, 2016 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Koh Mak island | 11.81 | 102.47 | 2007 | Cubozoan | | 1 | Jones A., 2008 (in Graham et al., 2014) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Koh Mak island | 11.81 | 102.47 | 2007 | *Chirodropid* sp. | | 6 | Fenner et al., 2010 (in Graham et al., 2014) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Ko Tao | 10.1 | 99.83 | 2007 | Irukandji | | 1 | Fenner et al., 2010 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 24 Celtic-Biscay Shelf | France | Southern French Atlantic coast. | 44.35 | 0 | 2008 | *Physalia physalis* | | 40 | Labadie et al., 2012 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Italy | between Nice and Cannes | 43.69 | 7.27 | 2008 | *Pelagia noctiluca* | | 500 | Le Masurier J., 2008 (in Graham et al., 2014) |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan\*\* | 35.1 | 129.4 | 2008 | - | | 123 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Namhae, southern Sea of Korea | 34.83 | 127.89 | 2008 | - | | 145 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2008 | - | | 26 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | East Sea | 38.84 | 135 | 2008 | - | | 62 | Health Insurance Review and Assessment service Korea, 2016 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Hau hin | 12.54 | 99.97 | 2008 | *Chirodropid* sp. | | 1 | Fenner et al., 2010 (in Graham et al., 2014) |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Bungalow Bay, Phuket | 7.86 | 98.4 | 2008 | *Chirodropid* sp. | | 1 | Fenner et al., 2010 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | US | Florida, Pensacola beach | 30.33 | -87.15 | 2008 | - | | multiple | Lucio D., 2008 (in Graham et al., 2014) |
| Indo-Pacific region | 32. Arabian Sea | India | Juhu beach | 19.09 | 72.83 | 2008 | *-* | | 50 | Anonymous, 2008 (in Graham et al., 2014) |
| North Pacific Ocean | 10. Insular Pacific-Hawaiian | US | Hawaii | 21.29 | -157.85 | 2008 | Cubozoan | | 82 | Star-Bulletin Staff, 2008 (in Graham et al., 2014) |
| Southwest Pacific Ocean | 46. New Zealand Shelf | New Zealand | New Zealand, Takapuna beach | -36.79 | 174.78 | 2008 | Hydromedusae | | 26 | Koing E., 2008 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | Denia | 38.85 | 0.1 | 2008 | *Carybdea marsupialis* | | 3330 | Bordehore et al., 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 12. Caribbean Sea | Bermuda | Elbow beach | 32.28 | -64.77 | 2009 | *Physalia physalis* | | 50 | Jardine H., 2009 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 12. Caribbean Sea | Costa Rica | - | 10.19 | -83.22 | 2009 | - | | 1 | Anonymous, 2009 (in Graham et al., 2014) |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | - | 2.3 | 112.3 | 2009 | *Chirodropid* sp. | | 1 | Lippmann et al., 2011 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Depok beach | -8 | 110.17 | 2009 | *Physalia utriculus* | | 2 | Werdiono, 2007 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Glagah indah and Trisik beach | -7.58 | 110.1 | 2009 | *Chrysaora quinquecirrha* | | >10 | Kuntadi, 2009 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Kukup beach | -8.8 | 110.33 | 2009 | *-* | | 64 | Wulan, 2009 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Pangandaran beach | -8.8 | 110.33 | 2009 | *-* | | 1 | Pikiran, R., 2009 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Parangtritis beach | -8.1 | 110.19 | 2009 | *Physalia utriculus* | | >100 | Heru, 2009 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Samas beach | -7.41 | 108.38 | 2009 | *Physalia utriculus* | | >10 | Waskita, 2009 (in Mujiono, 2010) |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Indonesian, Widrapayung beach | -7.41 | 109.15 | 2009 | *Physalia utriculus* | | >100 | Republika, 2009 (in Mujiono, 2010) |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan | 35.1 | 129.4 | 2009 | - | | 643 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Namhae, southern Sea of Korea | 34.83 | 127.89 | 2009 | - | | 228 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2009 | - | | 175 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | East Sea | 38.84 | 135 | 2009 | - | | 38 | Health Insurance Review and Assessment service Korea, 2016 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Gold coast | -28.05 | 153.45 | 2010 | *Physalia physalis* | | 700 | AAP, 2010 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | Denia, Coasta Blanca | 38.85 | 0.1 | 2010 | *Pelagia noctiluca* | | 50 | Govan F., 2010 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | France | Aquitaine coast | 44.35 | 0 | 2010 | *Physalia physalis* | | 154 | Labadie et al., 2012 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | - | 2.3 | 112.3 | 2010 | *Chirodropid* sp. and Irukandji | | 7 | Lippmann et al., 2011 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Pha-gnan Island, Surat Thani Province | -23.33 | 46.38 | 2010 | *Chirodropid* sp. | | 1 | Thaikruea et al., 2017 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Trad Province, Mak Island | -23.33 | 46.38 | 2010 | *Chirodropid* sp. | | 1 | Thaikruea et al., 2017 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2010 | *-* | | 101 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Carolina | 32.65 | -79.94 | 2010 | - | | 100 | Smith G., 2010 (in Graham et al., 2014) |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan | 35.1 | 129.4 | 2010 | - | | 479 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Namhae, southern Sea of Korea | 34.83 | 127.89 | 2010 | - | | 161 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2010 | - | | 31 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | East Sea | 38.84 | 135 | 2010 | - | | 61 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, East volusia | 29.1 | -80.93 | 2010 | *Chiropsalmus quadrumanus* | | 50 | Voyleys PD., 2010 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Bonita beach | 26.28 | -81.84 | 2010 | *Chrysaora* sp. | | multiple | Statts E., 2010 (in Graham et al., 2014) |
| North Pacific Ocean | 10. Insular Pacific-Hawaiian | US | Hawaii | 21.29 | -157.85 | 2010 | Cubozoan | | multiple | Essoyan S., 2010 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Georgia, Tybee Island | 32 | -80.84 | 2010 | *Cyanea capillata* | | 1391 | Landers M., 2010 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 12. Caribbean Sea | Jamaica | St. Ann | 17.84 | -77.37 | 2010 | - | | 3 | Anonymous, 2010 (in Graham et al., 2014) |
| Southeast Pacific Ocean | 13. Humboldt Current | Chile | Osorno, Bahia Mansa | -40.58 | -73.74 | 2010 | - | | multiple | Go K., 2010 (in Graham et al., 2014) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland, Agnes water beach | -24.21 | 151.91 | 2011 | Irukandji | | 1 | Downey K., 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Volusia country beach | 29.24 | -81.01 | 2011 | - | | multiple | Anonymous, 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Volusia country beach | 29.24 | -81.01 | 2011 | *Aurelia* sp. | | 2000 | Daily Mail Reporter, 2011 July 6 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Georgia, Tybee Island | 32 | -80.84 | 2011 | - | | 894 | Franklin G., 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Palm beach | 26.12 | -80.1 | 2011 | *Physalia physalis* | | 820 | Swaine J., 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Orlando | 28.43 | -80.56 | 2011 | - | | 100 | Anonymous, 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Orlando | 28.43 | -80.56 | 2011 | - | | multiple | Anonymous, 2011 (in Graham et al., 2014) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | France | Aquitaine coast | 44.35 | 0 | 2011 | *Physalia physalis* | | 885 | Labadie et al., 2012 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2011 | *-* | | 49 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan | 35.1 | 129.4 | 2011 | - | | 84 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Jeju Island | 33.29 | 126.29 | 2011 | - | | 26 | Health Insurance Review and Assessment service Korea, 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Namhae, southern Sea of Korea | 34.83 | 127.89 | 2011 | - | | 236 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2011 | - | | 59 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | East Sea | 38.84 | 135 | 2011 | - | | 42 | Health Insurance Review and Assessment service Korea, 2016 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Canaveral | 28.32 | -80.61 | 2011 | *Pelagia noctiluca* | | 800 | Griff, 2011 (in Graham et al., 2014) |
| Indo-Pacific region | 32. Arabian Sea | UAE | Dubai beaches | 25.19 | 55.23 | 2011 | - | | multiple | Hosn DA., 2011 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | US | Florida, Galveston | 29.29 | -94.79 | 2011 | - | | 65 | Anonymous, 2011 (in Graham et al., 2014) |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2012 | *-* | | 28 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan | 35.1 | 129.4 | 2012 | - | | 1317 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Jeju Island | 33.29 | 126.29 | 2012 | - | | 217 | Health Insurance Review and Assessment service Korea, 2014 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Langkawi Island | 6.21 | 99.48 | 2012-2014 | *-* | | 759 | Mohd et al., 2016 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2013 | *-* | | 41 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Busan | 35.1 | 129.4 | 2013 | - | | 105 | Kim et al., 2014 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Jeju Island | 33.29 | 126.29 | 2013 | - | | 260 | Health Insurance Review and Assessment service Korea, 2014 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 2013 | mainly *Chironex yamaguchii*\* | | 48 | Hifumi et al., 2020 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2014 | *-* | | 23 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 36. South China Sea | Taiwan | Taiwan, Hengchun peninsula | 22 | 120 | 2014 | *Aurelia aurita, Physalia physalis* | | more than 20 per day | Tsai and Pan, 2014 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Krakal, Sepanjang, Kukup beaches, Bantul District, Special region of Yogyakarta Province | -8.13 | 110.57 | 2014 | *Physalia* spp. | | >10 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | South Korea | Jeju Island | 33.29 | 126.29 | 2014 | - | | 118 | Ko, Y. J., 2016 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 2014 | mainly Chironex yamaguchii | | 41 | Hifumi et al., 2020 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Balekambang beach, Malang district, East Java Province | -8.4 | 112.53 | 2014-2015 | *-* | | 10 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | 6 Thai provinces | 15 | 101 | 2015 | *-* | | 194 | Jacob D., 2019 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2015 | *-* | | 18 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Parangtritis beach, Bantul district, Special region of Yogyakarta Province | -8.02 | 110.32 | 2015 | *-* | | 278 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Entire sea of South Korea | 36 | 128 | 2015 | - | | 536 | Health Insurance Review and Assessment service Korea, 2019 |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Korea, Yellow Sea | 35 | 123 | 2015 | - | | 11 | Ko, Y. J., 2016 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 2015 | mainly Chironex yamaguchii | | 17 | Hifumi et al., 2020 |
| Indo-Pacific region | 35. Gulf of Thailand | Malaysia | Sabah, Tanjung Aru beach, Kota kinabalu | 5.22 | 115.14 | 2016 | *-* | | 22 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2016 | *-* | | 42 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 36. South China Sea | Taiwan | Kenting | 21.98 | 120.79 | 2016 | *Physalia physalis* | | several | Kuo, C. and Elaine, H., 2016 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Parangtritis beach, Bantul district, Special region of Yogyakarta Province | -8.02 | 110.32 | 2016 | *-* | | 5 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Entire sea of South Korea | 36 | 128 | 2016 |  | | 1318 | Health Insurance Review and Assessment service Korea, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 2016 | mainly Chironex yamaguchii | | 31 | Hifumi et al., 2020 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Khiri Khan | 11.48 | 99.47 | 2017 | *Chrysaora* sp. | | 8 | Chaiwat S., 2017 |
| Northwest Pacific Ocean | 36. South China Sea | Singapore | Sentosa Island | 1.24 | 103.83 | 2017 | *-* | | 15 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Balekambang beach, Malang district, East Java Province | -8.4 | 112.53 | 2017 | *-* | | 10 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Sepanjang beach, Bantul District, Special region of Yogyakarta Province | -8.13 | 110.56 | 2017 | *-* | | 20 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Cabarita beach | -28.2 | 153.34 | 2017 | *Physalia physalis* | | 20 | Aisling, B., 2017 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Queensland | -23 | 143 | 2017 | Cubozoan | | 10 | Rachel, C., 2017 |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Entire sea of South Korea | 36 | 128 | 2017 | - | | 854 | Ministry of Oceans and Fisheries, Republic of Korea, 2019 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref. | 26.24 | 127.84 | 2017 | mainly Chironex yamaguchii | | 67 | Hifumi et al., 2020 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | US | Florida, Volusia country beach | 29.24 | -81.01 | 2017 | - | | 176 | Christal H., 2017 |
| Indo-Pacific region | 35. Gulf of Thailand | Thailand | Songkhla Province | 7.12 | 100.35 | 2018 | *Physalia physalis* | | 23 | Anonymous, 2018 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Balekambang beach, Malang district, East Java Province | -8.4 | 112.53 | 2018 | *-* | | 13 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Southern beaches of Bantul district, Special Region of Yogyakarta Province | -8.02 | 110.33 | 2018 | *Physalia* spp. | | 92 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Indo-Pacific region | 38. Indonesian Sea | Indonesia | Southern beaches of Purworejo district, Central Java Province | -7.86 | 109.92 | 2018 | *-* | | 10 | Harmful Jellyfish Country Report in Western Pacific, 2019 |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Entire sea of South Korea | 36 | 128 | 2018 | - | | 1305 | Ministry of Oceans and Fisheries, Republic of Korea, 2019 |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Entire sea of South Korea | 36 | 128 | 2019 | - | | 1252 | Ministry of Oceans and Fisheries, Republic of Korea, 2019 |
|  |  |  |  |  |  |  |  | |  |  |

\* These locations are currently Pula, Croatia.

\*\*Busan, South Korea, was sorted as LME East China Sea following the Korea Hydrographic and Oceanographic Agency.

Table C.2 Record of sting envenomation from 1961 to 2019. Reports are uncertain or incomplete.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marine region** | **Location** | **Year** | ***Identified species*** | **No. affected person** | **Reference** |
| Indo-Pacific Ocean | Malaysia, Batu Ferringhi | continue | - | Many severe stings | Burnett et al., 1994 (in Fenner 1997) |
| Indo-Pacific Ocean | Malaysia, Penang | pre- | - | neurological complication of stings | Williamson et al., 1988; Peel and Kander, 1990 (in Fenner 1997) |
| Indo-Pacific Ocean | Maldives, Chagos, Oman, West Indian coast, Eastern Africa | unknown | *Sanderia malayensis* | Many severe stings | Fenner, 1997 |
| Indo-Pacific Ocean | Thailand | unknown | Cubozoan | severe scarring stings | Raupp et al., 1996 (in Fenner, 1997) |
| Indo-Pacific Ocean | Thailand, Bangkok | 1987 | *Chirodropid* sp. | many cases each week in Siriraj Hospital | Fenner, 1997 |
| Indo-Pacific Ocean | Vietnam, Da Nang city and Phu Quoc Island | unknown | named "fire-jellyfish" | few cases | Harmful Jellyfish Country Report in Western Pacific. 2019 |
| Indo-Pacific region | Gulf of Oman, Zanzibar coast | unknown | - | few stings | M Richmond, 1996, pers. comm. (in Fenner 1997) |
| Indo-Pacific region | Indonesia, Sanur Beach, Denpasar city, Bali Province | 2005 | *-* | - | Harmful Jellyfish Country Report in Western Pacific. 2019 |
| Indo-Pacific region | Pakistan, Karachi | unknown | *Physalia* spp. (both *P. utriculus* and *P. physalis*) | 29 | Dr. Junaid M Alam, 1995. pers. comm. (in Fenner 1997) |
| Northeast Atlantic Ocean | Adriatic Sea | 2010 | *Pelagia noctiluca* | - | Nastasi, 2010 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Adriatic Sea, Trieste | 1978-1983 | *Pelagia noctiluca* | - | Malej and Vuković,1984; UNEP, 1991; Maretić et al.,1987 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | coast of the British Island, Penzance, and Cornwall area | unknown | *Physalia* spp. | few serious stings | Paul Cornelius, 1996. P.J. Fenner pers. comm. (in Fenner 1997) |
| Northeast Atlantic Ocean | Croatia, Pula | 1978 | *Pelagia noctiluca* | ±50 % of bathers affected | Maretić, 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Eastern Mediterranean | 1980 (after) | *Rhopilema nomadica* | - | Gusmani et al., 1997 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | France, La Réinion | unknown | *Physalia* spp. | up to 150 during weekend | N Gravier-Bonnet, 1995. pers. comm. (in Fenner, 1997) |
| Northeast Atlantic Ocean | Istrian coast | 1977-1978 | *Pelagia noctiluca* | - | Legović, 1991 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Italy | 1976 | *Pelagia noctiluca* | - | UNEP, 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Italy | 2008 | *Pelagia noctiluca* | - | Mariottini et al., 2008 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Mediterranean Sea | unknown | - | 1, severe anaphylactic shock | Dr. Franco Kokelj (in Fenner, 1997) |
| Northeast Atlantic Ocean | Mediterranean Sea | 2011 | *Pelagia noctiluca* | - | Bernard et al., 2011 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Portotoz (Slovenia) | 1983 | *Pelagia noctiluca* | - | Malej and Vuković, 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | Spain, coastal lagoon | 1993 (since) | *Cotylorhiza tuberculata, Rhizostoma pulmo* | NA | Lotan et al., 1993 (in Purcell et al., 2007) |
| Northwest Atlantic Ocean | Bonaire | unknown | *Tamoya ohboya* | 3 | Anonymous, 2011 Mar 16 (in Graham et al., 2014) |
| Northwest Atlantic Ocean | Caribbean Sea, Isla de providencia | unknown | *Physalia* spp. | 1 | Halstead, 1988 (in Fenner, 1997) |
| Northwest Atlantic Ocean | Southern California coast | many years | *Pelagia noctiluca* | thousand | Russell, 1965 (in Maretić et al., 1980) |
| Northwest Atlantic Ocean | US, Chesapeake Bay | annual | *Chrysaora quinquecirrha* | | Burnett, 2001 (in Purcell et al., 2007) |
| Northwest Atlantic Ocean, Southwest Atlantic Ocean | US (southeast coast) and Brazil | annual | *Linuche unguiculata* | eruption to bathers | Segura-Puertas et al., 2001 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | Japan, east coast of Honshu | late summer | *Physalia* spp. | - | Japan Surf Live Saving, 1992 (in Fenner, 1997) |
| Northwest Pacific Ocean | Japan, Honshu | unknown | *Gonionemus oshoro* | numerous sting | Pigulevsky and Michalev, 1969; Otsuru et al., 1974 (in Fenner, 2007) |
| Northwest Pacific Ocean | Japan, Okinawa | each year | *Chiropsalmus quadrigatus* | hundreds of minor stings | Y Araki, 1995, pers. comm. (in Fenner, 1997) |
| Southwest Pacific Ocean | Northern coast of Australia | many years | *Pelagia noctiluca* | thousand | Barnes, 1965. pers. comm. (in Maretić et al., 1980) |
| Southwest Pacific Ocean | Whole coastal area around Bueno Aires | unknown | *Olindias sambaquiensis* | 500 - 1000 bathers | Mianzan (in Fenner, 1997) |

Table C.3 List of reference of sting envenomation by jellyfish from 1961 to 2019.

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**Appendix D. Records of impairing industrial fisheries**

Table D.1 Record of impairingindustrial fisheries impact from 1920 to 2018.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Marine region** | ***LME*** | **country** | ***Location*** | ***Lat. (°N)*** | ***Long. (°E)*** | ***Year(s)*** | ***Identified species*** | **Type of damage** | **Note** | **Reference** |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Hokuriku and Tohoku districts | 36.32 | 136.33 | 1920 | *Nemopilema nomurai* | Fisheries | Oct. - Dec., large fix shore net for yellow tail fish, drag net, and trawl net | Kihinouye, 1922; Yasuda,1988 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Hokuriku districts | 36.32 | 136.33 | 1922 | *Nemopilema nomurai* | Fisheries | Set net | Kihinouye, 1922; Yasuda,1988 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Otomi coast | 35.8 | 135.91 | 1922 | *Nemopilema nomurai* | Fisheries | Nov., large and small fixed shore net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay | 35.8 | 135.91 | 1924 | *Nemopilema nomurai* | Fisheries | Large and small fixed shore net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Akita Pref. | 39.43 | 140.6 | 1935 | *Nemopilema nomurai* | Fisheries | Sailfin sandfish net | Yasuda, 2003 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Aomori Pref., Ōhata | 40.49 | 140.44 | 1937 | *Nemopilema nomurai* | Fisheries | July, diverse fishing nets | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Japan coast\*\*\* | ?\* | ? | 1938 | *Nemopilema nomurai* | Fisheries | January | Yasuda, 2003 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Aomori Pref., Fukaura | 40.38 | 139.55 | 1942 - 1943 | *Nemopilema nomurai* (?) | Fisheries | - | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay | 35.8 | 135.91 | 1948 | *Aurelia aurita* (?) | Fisheries | Fixed shore net and small drag net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Akita Pref., Lake Hachirōgata | 39.91 | 39.91 | 1950 | *Aurelia aurita (s. l.) or Salp.* | Aquaculture | Mass mortality of fish, bivalves, sea birds, and freshwater diatom | Yasuda, 2003 (in Purcell et al., 2007; Purcell et al., 2013) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Ishikawa Pref., Nanao Bay | 37.02 | 136.58 | 1950 | *Aurelia aurita (s. l.) or Salp.* | Aquaculture | Mass mortality of fish (*Pennahia argentata*) | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Aomori Pref., Fukaura | 40.38 | 139.55 | 1950 | *Nemopilema nomurai* | Fisheries | Trawl net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref | 37.96 | 139.03 | 1951 - 1952 | *Nemopilema nomurai* | ? | - | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Western wakasa Bay | 35.8 | 135.91 | 1952 | *Aurelia aurita* | Fisheries | Large and small fixed shore net | Yasuda, 1988; Yasuda, 2003 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Ishikawa Pref., Kanaiwa | 37.02 | 136.35 | 1953 - 1955 | *Aurelia aurita* | ? | - | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Ishikawa Pref., Wajima, Toyama Pref., Toyama Bay | 37.23 | 136.53 | 1955 - 1956 | *Nemopilema nomurai* | Fisheries | May - Aug., Oct. - Dec., Large and small fixed shore net | Yasuda, 2003 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Norwegian coastal waters | 60.28 | 8.28 | 1955 | Salpa fusiformis CUVIER | Aquaculture | Pause all fishing activities | Båmstedt et al., 1998 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Uchiura Bay, Takahama | 35.8 | 135.91 | 1955 - 1956 | *Nemopilema nomurai* | Fisheries | May - Aug., Oct. - Dec., Large and small fixed shore net | Yasuda, 2003 |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | USA | Matagorda bay | 28.33 | -96.18 | 1955 - 1956 | *Chiropsalmus quadrigatus* | Fisheries | Stings to fishermen | Guest, 1959 (in Nagata et al., 2009) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Aomori Pref., Ōhata, Yamagata Pref., Sakata | 38.54 | 139.5 | 1957 | *Aurelia aurita* | Fisheries | Apr. - June., Small fixed shore net and trawl net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref., Miyazu Bay | 35.32 | 135.12 | 1957 | *Nemopilema nomurai* | Fisheries | Apr. - June., Small fixed shore net and trawl net? | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Yamaga Pref., Fukui Pref. | 35.8 | 135.91 | 1957 | *Nemopilema nomurai* | Fisheries | Oct. - Nov., Small fixed shore net and trawl net (?) | Yasuda, 2003 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tsugaru strait and entire the Pacific Sea, Hachinohe, Kagoshima coast | 41.37 | 140.69 | 1958 | *Nemopilema nomurai, Aurelia aurita* | Fisheries | Damage to all kind of net, living cost support owing to heavy damage to trawl nets. | Shimomoura, 1959; Nishimura, 1959, 1961 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Toyama Pref., Toyama Bay, Ishikawa Pref., Nanao Bay | 37.23 | 136.53 | 1968 | *Aurelia aurita* | Fisheries | June - Dec., small drag net, jar-shape net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Western coastal Wakasa Bay | 35.8 | 135.91 | 1971 - 1972 | *Aurelia aurita* | Fisheries | July - Oct., large and small fixed-shore net, small drag net | Yasuda, 2003 |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Estuaries of Georgia | 31.27 | -81.17 | 1972 | *Stomolophus meleagris* | Fisheries | Apr.-May, clog fishing nets, reduction of trawling time, etc. | Kraueter and Setzler, 1975 (in Nagata et al., 2009) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Western coastal Wakasa Bay | 35.8 | 135.91 | 1975 | *Aurelia aurita* | Fisheries | May - Sep., large and small fixed-shore net, small drag net | Yasuda, 2003 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref. | 36.3 | 136.13 | 1976 - 1977 | *Aurelia aurita* | Fisheries | Trawl net | Yasuda, 1988 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 62. Black Sea | - | Black sea | 44 | 35 | 1976 - 1988 | *Aurelia* sp. | Fisheries | Clogging fishing nets and trawls | Zaitsev and Hamaev 1997 (in Gershwin 2013) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref., Miyazu Bay | 35.32 | 135.12 | 1976 | *Aurelia aurita* | Fisheries | Apr. - July, Small fixed shore net, drag net, and gillnet | Yasuda, 2003 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Istrian coast | 45.16 | 13.53 | 1977 | - | Fisheries | Net clogging | Malej and Vukovic', 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Istrian coast (Yugoslavia) | 45.16 | 13.53 | 1977 - 1980 | - | Fisheries | Sting, boat engine clogging from 1977 to 1980 | Malej and Vukovic', 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Pula | 44.86 | 13.84 | 1978 | - | Fisheries | Net clogging, stinging | Maretić, 1984 (in Canepa et al., 2014) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Kumamoto Pref., Yatsushiro bay | 32.3 | 130.36 | 1980 | *Chrysaora pacifica* | Fisheries | May - Aug., small-sized fix shore net, pound net, gill net etc. | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Okinawa Pref., Chatan coast | 26.19 | 127.45 | 1981 | *Chiropsalmus quadrigatus\*,* *Aurelia aurita* (Yasuda 2003) | Fisheries | Set net | Yamaguchi, 1982 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Uchiura Bay | 35.8 | 135.91 | 1981 | *Aurelia aurita* | Fisheries | May - Aug., Gill net | Yasuda, 2003 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Okayama Pref. | 34.42 | 133.51 | 1981 | *Aurelia aurita* | Fisheries | May - Aug., small-sized fix shore net and dragnet | Yasuda, 2003 |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Kumamoto Pref., Yatsushiro bay | 32.3 | 130.36 | 1981 | *Bargmannia amoena* (in Yasuda, 2003, ヘビクラゲ by author) | Fisheries | May - Aug., small-sized fix shore net, gill net, etc. | Yasuda, 2003 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Gulf of Trieste (Adriatic Sea) | 45.4 | 13.35 | 1983 | - | Fisheries | Bycatch and economic impact | Axiak et al., 1991 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Croatia | Portoroz (Slovenia) | 45.3 | 13.35 | 1983 | - | Fisheries | Net clogging, capture damage | Malej and Vukovic', 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Adriatic Sea | 43 | 15 | 1983 - 1984 | - | Fisheries | Net clogging | Legović, 1991; Malej and Malej, 2004 (in Canepa et al., 2014) |
| Northwest Pacific Ocean | 47. East China Sea | Japan | Kumamoto Pref., Yatsushiro bay | 32.3 | 130.36 | 1983 - 1985 | *Aurelia aurita* | Fisheries | May - Aug., small-sized fix shore net, gill net, etc. | Yasuda, 2003 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Shetland Isles | 60.54 | -1.38 | 1984 | *Phialella quadrata* | Aquaculture | 15000 fish killed within 4 days | Bruno and Ellis, 1985 (in Rodger et al., 2011) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Gulf of Trieste (Adriatic Sea) | 45.66 | 45.66 | 1985 | *-* | Fisheries | 700 fishers were stung over a period of 192 days of fishing | Axiak et al., 1991 (in Canepa et al., 2014) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Kyoto Pref., Kurita Bay, Fukuoka Pref., | 35.01 | 135.45 | 1985 | *Nemopilema nomurai* | Fisheries | Aug. - Sep., gill net and small drag net | Yasuda, 2003 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Møre coast | 60.38 | 5.33 | 1986 | *Bolinopsis\*\* infundibulum* | Aquaculture | Heavy loss | Karl Tangen, pers. comm. (in Båmstedt et al., 1998) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Gulf of Trieste (Adriatic Sea) | 45.4 | 13.35 | 1987 | - | Fisheries | Capture damage | Axiak et al., 1991 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Mediterranean Sea | 35 | 18 | 1987 | *-* | Fisheries | Sting | Maretić 1984 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Ligurian Sea | 43.3 | 9 | 1987 | *-* | Fisheries | Indirect predation on fish eggs and larvae | Morand et al., 1987 (in Canepa et al., 2014) |
| Southeast Atlantic Ocean | 29. Benguela Current | Namibia | Northern Benguela | -17.15 | 11.28 | Since 1988, 1998-2003, 1990-1997 | *Chrysaora hysoscella, Aequorea forskalea* | Fisheries | Reduced and spoiled catches | Lynam et al. 2006 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Hiroshima Pref. | 34.23 | 132.27 | 1989 | *Bolinopsis mikado\*\** | Fisheries | Damaged nets | S. Uye pers. comm. (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 62. Black Sea | Turkey | Black sea | 44 | 35 | 1989-1998 | *Mnemiopsis leidyi\*\** | Fisheries | Decreased 80% of Turkish anchovy fisheries within 3 years | Kideys, 1994 |
| Northeast Pacific Ocean | 1. East Bering Sea | - | Bering Sea | 58 | -178 | 1990 - 1999 | *Chrysaora melanaster* | Fisheries | Clog fishing nets, fishing vessels shunned area | Brodeur et al., 2002 (in Nagata et al., 2009) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Adriatic Sea | 43 | 15 | 1991 | *-* | Fisheries | Capture damage, sting, indirect predation on fish eggs and larvae | Legović, 1991 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Adriatic Sea | 43 | 15 | 1991 | *-* | Fisheries | capture damage | Legović, 1991 (in Canepa et al., 2014) | |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Hyōgo Pref., Kasumi, Fukuoka Pref. | 35.38 | 134.38 | 1994 | *Chrysaora pacifica* | Fisheries | Autumn - Winter | Yasuda, 2003 |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | USA | Louisiana and Maryland, USA | 38.97 | -76.47 | 1994 - 1997 | *Moerisia lyonsi* | Aquaculture | Killed decapods; ≤ 13.6 med. L−1 | Purcell et al., 1999 (in Purcell et al., 2007) |
| Arctic Ocean | 21. Norwegian Sea | Norway | Søgne in southern Norway | 58.5 | 7.47 | 1994 - 1995 | *Aurelia aurita* | Aquaculture | Heavy loss, stung by ephyra | Karl Tangen, pers. comm. (in Båmstedt et al., 1998) |
| Arctic Ocean | 21. Norwegian Sea | Norway and Sweden | Loch Fyne, Scotland | 55.87 | -5.31 | 1998 | *Cyanea capillata* | Aquaculture | Bycatch | Jack.Matthews, pers. comm. (in Båmstedt et al., 1998) |
| Northwest Pacific Ocean | 47+49+50 | Japan | Japan coast\*\*\* (Aomori and Yamaguchi Pref.), Iwate Pref., Kamai | 35.42 | 139.42 | 1995 | *Nemopilema nomurai, Salpa* | Fisheries | Sep. - Dec., damaged 50 million ¥, partial harmful effect coupling with *Pterotrachea coronate* (gastropod) and jellyfish | Yasuda, 2003; Kurada et al., 2000 (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Chiba Pref., Tateyama | 34.59 | 139.52 | 1995 | *Nemopilema nomurai* | Fisheries | July - Aug., gill net | Yasuda, 2003 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | France | Brittany, France | 48.2 | -2.93 | 1995 | *Pelagia noctiluca* | Aquaculture | Salmon and trout | Merceron et al., 1995 (in Purcell et al., 2007; Rodger et al., 2011; Purcell et al., 2013) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Loch Fyne, Scotland | 55.87 | -5.31 | 1996 | *Cyanea capillata* | Aquaculture | Salmon killed, ₤250000 economic loss. | Anonymous, 1996 (in Purcell et al., 2007; Purcell et al., 2013) |
| Arctic Ocean | 21. Norwegian Sea | Norway | Lofoten area south of Senja | 69.17 | 17.38 | 1997 | *Cyanea capillata* (L.) | Aquaculture | Marginal loss | Karl Tangen, pers. comm. (in Båmstedt et al., 1998) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Shetland Isles, Scotland | 60.54 | -1.38 | 1997 | *Solmaris corona* | Aquaculture | At least one farm lost its whole stock | Steve Hay, pers. comm. (in Båmstedt et al., 1998) |
| Arctic Ocean | 21. Norwegian Sea | Norway | Shetland | 59.91 | 10.45 | 1997 | *Aurelia aurita* | Aquaculture | Stung the fishes in the gills by ephyra | Steve Hay, pers. comm. (in Båmstedt et al., 1998) |
| Northwest Pacific Ocean | 47+49+50 | Japan | Japan coast\*\*\* | 35.42 | 139.42 | 1997 | *Aurelia aurita, Chrysaora pacifica* (in Yasuda 2003) | Fisheries | Mar. - Jun., large and small fixed shore net, drag net, trawl, fishing, and gill nets | Kurada et al., 2000 (in Purcell et al., 2007) |
| Arctic Ocean | 21. Norwegian Sea | Norway | West coast of Norway | 60.38 | 5.33 | 1997 - 1998 | *Apolemia uvaria* | Aquaculture | Killed salmon | Båmstedt et al., 1998 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Hitra to Altatjorden | 59.55 | 10.45 | 1998 | *Cyanea capillata* (L.) | Aquaculture | Loss for the salmon farm | Jack.Matthews, pers. comm. (in Båmstedt et al., 1998) |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Huon estuary in southern Tasmania | -43.13 | 146.72 | 1998 | *Aurelia* sp. | Aquaculture | Lost 25000 salmon | Gershwin, 2013 |
| Southwest Pacific Ocean | 46. New Zealand Shelf | New Zealand | Stewart island | -46.98 | 168.11 | 1998 | *Aurelia* sp. | Aquaculture | 56000 salmon killed within 30 mins (Nov) | Gershwin, 2013 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Hyōgo Pref., Takeno | 35.8 | 135.91 | 1998 | *Aurelia aurita* | Fisheries | May - Dec., large and small fixed shore net, small drag net | Yasuda, 2003 |
| Southwest Pacific Ocean | 40. Northeast Australian Shelf | Australia | Tasmania, Australia | -41.45 | 145.97 | 1998 - 2001 | *Aurelia* sp. | Aquaculture | Atlantic salmon | Tasmanian aquaculture and fisheries institute, 2003 (in Purcell et al., 2013) |
| Northwest Pacific Ocean | 47. East China Sea | China | Middle south Zhejiang province | 30.9 | 121.14 | 1999 | *Cyanea* sp.*, Nemopilema nomurai* | Fisheries | Interference with fisheries | Dong, 2000 (in Dong et al., 2010) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Japan coast\*\*\*(Fukui and Fukuoka Pref.) | 35.42 | 139.42 | 1999 | *Aequorea coerulescens*, *Aurelia aurita, Chrysaora pacifica* (in Yasuda 2003) | Fisheries | Apr. - Aug., large and small fixed shore net, drag net, trawl, fishing, and gill net | Kurada et al., 2000 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Scotland and including Shetland | 60.54 | -1.38 | 1999- 2005 | noticed jellyfish | Aquaculture | 5700 tons of fish deaths | Marine Scotland science (in Lucas et al., 2014) |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | USA | Northern Gulf of Mexico | 25 | -90 | 2000 | *Phyllorhiza punctata* | Fisheries | May- Sept., Fouled gear, reduced harvest, predation on bivalve larvae, US $10 million loss | Graham et al., 2003 (in Purcell et al., 2007; Nagata et al., 2009; Gershwin, 2013) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Kyoto, Western coastal Wakasa Bay | 35.02 | 135.86 | 2000 | *Porpita porpita, Nemopilema nomurai* (in Yasuda 2003) | Aquaculture | Aug. - Oct., Mortality of penned fish | Yasuda, 2003 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Seto inland sea | 34.4 | 133.17 | 2000 - 2002 | *Aurelia aurita, Bolinopsis mikado, Chrysaora melanaster* | Fisheries | Set, trawl, and gill nets | Uye and Ueta, 2004 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Mediterranean Sea | 35 | 18 | 2001 | - | Fisheries | Indirect Predation on fish eggs and larvae, sting | CIESM, 2001 (in Nagata et al., 2009; Gershwin, 2013; Canepa et al.,2014) | |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Scotland | 58 | -6 | 2001 | *Apolemia uvaria* | Aquaculture | Sep. 1st, 200 mortalities in fishing farms | Marine Scotland Science, 2008 (in Nickell et al., 2010) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Isle of Lewis in the outer Hebrides | 58.24 | 58.241 | 2001 - 2002 | *Solmaris corona* | Aquaculture | 2747680 salmon killed in 11 incidents, ₤5 mil. loss | Johnson, 2002 (in Purcell et al., 2007; Purcell et al., 2013) |
| Northwest Pacific Ocean | 47+49+50 | Japan | Japan coast\*\*\* (Aomori and Fukuoka Pref.), Shimane Pref. | 35.42 | 139.42 | 2002 | *Aurelia aurita, Nemopilema nomurai* | Fisheries | Aug. - Dec., Large and small fixed shore net | Yasuda, 2003 |
| Southeast Pacific Ocean | 13. Humboldt Current | Chile | Quemchi area of sourthern Chile | -42.14 | -73.47 | 2002 | *-* | Aquaculture | lost 120000 fish (March) | Carvajal, 2002 (in Gershwin, 2013) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Scotland | 58 | -6 | 2002 | *Solmaris corona* | Aquaculture | Aug. 2nd, 7500000 mortalities in fishing farms | Marine Scotland science 2008 (in Nickell et al., 2010); Hay and Murray 2008 (in Rodger et al., 2011) |
| Northeast Atlantic Ocean | 32. Arabian Sea | - | Gulf of Oman, Persian Gulf | 24.42 | 58.44 | 2002 | *Crambionella orsini* | Fisheries | Decreased catch, damage to gear | Daryanabad and Dawson, 2008 (in Purcell et al., 2007) |
| Arctic Ocean | 21. Norwegian Sea | Norway | Norwegiean coastal waters | 58.09 | -6.39 | 2002 | *Muggiaea atlantica* | Aquaculture | <100000 salmon killed | Fosså et al., 2003, Hellberg et al., 2003 (in Rodger et al., 2011) |
| Southeast Pacific Ocean | 13. Humboldt Current | Chile | Chiloé | 42.4 | -73.59 | 2002 | *Chrysaora plocamia* | Aquaculture | Damage to salmon aquaculture | Palma et al., 2007; Bravo et al., 2011 (in Mianzan et al. 2014) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Scottish region of skye and the outer hebride | 57.32 | 6.13 | 2002 - 2005 | - | Aquaculture | Mortalities 17% of fish biomass | UK web achive (in Lucas et al., 2014) |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tsugaru strait, Pacific coast of northern Japan | 41.37 | 140.69 | 2002 - 2006 | *Nemopilema nomurai* | Fisheries | Trawl, clog/burst fishing net, lower catches and high mortality of finfish, sting to fishermen, and higher risk of capsizing trawl boats | Kawahara et al., 2006 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Northwest Ireland, | 54.42 | -9.11 | 2003 | *Muggiaea atlantica* | Aquaculture | 1000000 salmon killed off | Cronin et al., 2004 |
| Arctic Ocean | 21. Norwegian Sea | Norway | West coast of Norway | 60.38 | 5.33 | 2003 | *Apolemia uvaria* | Aquaculture | Killed salmon | Heckmann, 2004 (in Purcell et al. 2007; Nagata et al. 2009; Gerwshin 2013) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Aomori Pref., Fukui Pref., Echizen | 35.54 | 136.1 | 2003 | *Aurelia aurita, Nemopilema nomurai* | Aquaculture | Damage to fish (flat fish, tiger puffer) over 1 million ¥ cost loss | Yasuda, 2007 |
| Northwest Pacific Ocean | 47. East China Sea | China | Yangtze river estuary | 31.23 | 121.58 | 2003 - 2004 | *Cyanea* sp. | Fisheries | Comprised 85.47% in 2003, 98.44% in 2004 of the total catch of fisheries | Xian et al., 2005 (Dong et al., 2010) |
| Southwest Atlantic Ocean | 15. South Brazil Shelf | Brazil | Southern Brazil coast | -27 | -48 | 2003 - 2004 | *Lychnorhiza lucerna* | Fisheries | Clog fishing nets, shorten the duration of trawl hauls, displacing hauls further away from the landing ports. | Nagata et al., 2009 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Ireland | 53.25 | -8 | 2003 - 2005 | *-* | Aquaculture | Gill disorders for salmon farming industry, Mortality of 12% | Rodger et al., 2011 (in Lucas et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Adriatic Sea | 43 | 15 | 2004 | *-* | Fisheries | Predation on fish food | Malej and Malej, 2004 (in Canepa et al., 2014) | |
| Northwest Pacific Ocean | 47. East China Sea | China | Yangtze river estuary | 31.23 | 121.58 | 2004 | *Sanderia malayensis* | Fisheries | Trawl nets | Xian et al., 2005 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Scotland | 53.25 | -8 | 2004 | *Cyanea capillata* | Fisheries | Farmed salmon 90000 mortalities | Rodger pers. obs. (Rodger et al., 2011) |
| Northwest Pacific Ocean | 47+49+50 | Japan | - | ? | ? | 2004 | *Aurelia aurita, Nemopilema nomurai* | Fisheries | Fixed net | Yasuda, 2007 |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Ehime Pref. | 33.85 | 132.7 | 2004, 2006 - 2007 | *Pelagia noctiluca* | Aquaculture | Mortality of penned fish | Uye and Ueta, 2004 (in Purcell et al., 2007; Purcell et al., 2013) |
| Northwest Pacific Ocean | 49+50 | Japan | Aomori Pref., Fukui Pref., Echizen, Mihama Pref., Ishikawa Pref. | 35.54 | 136.1 | 2005 | *Aurelia aurita, Nemopilema nomurai* | Fisheries | 30- 40 million ¥ (Fukui), 25 million ¥ (Mihama), >500 million ¥ (Ishikawa) cost loss | Yasuda, 2007 |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Huludao, Liaoning province | 40.42 | 120.5 | 2005, 2007 | *Nemopilema nomurai* | Fisheries | Interference with fisheries | Hua, 2007 (in Dong et al., 2010) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | France | Coastal lagoons | 43.24 | 3.37 | 2006 | *Aurelia aurita, Rhizostoma pulmo, Mnemiopsis leidyi\*\** | Fisheries | Fouled fishing gear | Anonymous, 2006 (in Purcell et al., 2007) |
| Indo-Pacific region | 32. Arabian Sea | India | Goa, India | 15.17 | 74.12 | 2006 | *Rhizostoma* sp. | Aquaculture | Shrimp | R.A. Sreepada pers. comm. (in Purcell et al., 2007) |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Tottori Pref., | 35.8 | 135.91 | 2006 | *Aurelia aurita, Nemopilema nomurai* | Fisheries | over 100 million ¥ cost loss, more huge damage than 2005 | Yasuda, 2007 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Mediterranean Sea | 35 | 18 | 2007 | *-* | Aquaculture | Fish mortality | Purcell et al. 2007 (in Canepa et al., 2014) | |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Mediterranean Sea | 35 | 18 | 2007 | *-* | Fisheries | Net clogging | Purcell et al. 2007 (in Canepa et al., 2014) | |
| Northwest Pacific Ocean | 48. Yellow Sea | China | Yantai, Shandong province | 37.27 | 121.26 | 2007 | *Aurelia aurita* | Aquaculture | Interference with aquaculture | Su, 2007 (in Dong et al., 2010) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Scotland | 58 | -6 | 2007 | *Pelagia noctiluca, Solmaris corona* | Aquaculture | Nov. 7th, Two locations, 15~20% (by Pelagia noctiluca) and 65% mortalities (by Solmaris corona) in fisheries farms | Marine Scotland science, 2008 (in Nickell et al., 2010) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Western Ireland | 51.89 | -8.49 | 2007 | *Pelagia noctiluca* | Aquaculture | Approx. 250000 fish killed | Doyle et al., 2008 (in Rodger et al., 2011) |
| Southeast Pacific Ocean | 13. Humboldt Current | Peru | Pisco | -13.42 | -76.12 | 2007- 2009 | *Chrysaora plocamia* | Fisheries | Jellyfish by-catch | Dr. Valdivia IMARPE pers. comm. Javier Quiñones (in Mianzan et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Adriatic Sea | 43 | 15 | 2008 | *-* | Fisheries | Sting | Mariottini et al., 2008 (in Canepa et al., 2014) | |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Shetland Isles, Scotland | 60.54 | -1.38 | 2008 | *Phialella quadrata* | Aquaculture | Damage to gills of farmed Atlantic salmon | Ferguson et al., 2010 |
| Northeast Atlantic Ocean | 62. Black Sea | Turkey | Black sea | 44 | 35 | 2008 | *Aurelia aurita* | Fisheries | By catch of trawl fisheries | Özdemir et al., 2014 |
| Southeast Pacific Ocean | 13. Humboldt Current | Peru | Ilo | 17.38 | -71.2 | 2008-2009 | *Chrysaora plocamia* | Fisheries | Economic loss over 200,000 US$ within 35 days of fishing | Mianzan et al., 2014 |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Italy | Chioggia | 45.13 | 12.16 | 2008-2009 | *Aurelia aurita, Chrysaora hysoscella, Cotylorhiza tuberculata, Pelagia noctiluca, Rhizostoma pulmo* | Fisheries | Annual economic loss over €460000 to fisheries, damage to extra fishing gears | Palmieri et al., 2013 |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Chiba Pref. | 35.36 | 140.07 | 2009 | *Nemopilema nomurai* | Fisheries | Nov. Capsized fishing trawler | Ryall. J., 2009. |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Western Ireland | 53.2 | -9.46 | 2009 | *Solmaris corona, Muggiaea atlantica* | Aquaculture | Severe gill damage and potential mortalities in Atlantic salmon | Baxter et al., 2011 (in Purcell et al., 2013) |
| Northwest Atlantic Ocean | 5. Gulf of Mexico | - | Gulf of Mexico | 25 | -90 | 2009, 2011 | *Aurelia* sp. | Fisheries | Clogging nets for fishers and shrimper | Dugan, 2011 (in Gershwin, 2013) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | Mediterranean Sea | 35 | 18 | 2010 | - | Aquaculture | Stinging in aquaculture | Nastasi, 2010 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | - | NW Mediterranean Sea | 35 | 18 | 2010 | - | Fisheries | Predation on fish larvae and fish food | Sabatés et al., 2010 (in Canepa et al., 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | | Mediterranean Sea | 35 | 18 | 2010 | - | Aquaculture | Stinging in aquaculture | Nastasi, 2010 (in Canepa et al., 2014) | |
| Southwest Pacific Ocean | 46. New Zealand Shelf | New Zealand | - | -41.45 | 145.97 | 2010 | *Aurelia* sp. | Aquaculture | Lost 2000 salmon (Nov.) | J. Handlinger, pers. comm. (in Gershwin, 2013) |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Korean peninsular | 35.54 | 127.46 | 2010 | - | Fisheries | Damage value approx. 68812 million. KRW (￦) | Kim et al., 2014 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Northwest Ireland | 54.42 | -9.11 | 2010 | *Aurelia aurita* | Aquaculture | Acute gill lesions and mortality in Atlantic salmon | Mitchell pers. obs. (in Rodger et al., 2011) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Spain | Spanish coast | 35 | 18 | 2011 | *-* | Aquaculture | Capture damage in aquaculture | Baxter et al., 2011 (in Canepa et al., 2014) |
| Arctic Ocean | 21. Norwegian Sea | Norway | Kaldfjord, Tromsø | 69.76 | 18.68 | 2011 | *-* | Aquaculture | Sunk a salmon net cage, resulting in an approx. 30-ton loss of fish | Jessicaluo (2013 November 19) |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Korean peninsular | 35.54 | 127.46 | 2011 | *-* | Fisheries | Damage value approx. 30685 million KRW (￦) | Kim et al., 2014 |
| Southeast Pacific Ocean | 13. Humboldt Current | Peru | El Callo harbour | -12.2 | -77.8 | 2012 | *Chrysaora plocamia* | Fisheries | Fishing operation clogging | Federico Iriarte, pers. comm. (in Mianzan et al. 2014) |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Israel | Israel coast | 31.2 | 34.51 | 2012 | - | Fisheries | Bycatch and economic impact, loss of 46.3% gillnet profit and of 8% trawl fish profit | Nakar et al., 2012 (in Canepa et al., 2014) |
| Northwest Pacific Ocean | 47+48+50 | South Korea | Korean peninsular | 35.54 | 127.46 | 2012 | - | Fisheries | Damage value approx. 141233 million. KRW (￦) | Kim et al., 2014 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Ryggefjord, Finmark | 70.92 | 25.03 | 2012 | *Dipleurosoma typicum* | Aquaculture | Dense bloom in Sept., overlapping with high mortalities of farmed fish | Halsband et al., 2018 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Clare island | 53.8 | -9.99 | 2013 | - | Aquaculture | Up to 20,000 farmed salmon have been loss | Marcos-López et al. 2014 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Glenarm Bay in Co Antrim | 54.96 | -5.95 | 2013 | *Pelagia noctiluca* | Aquaculture | Economic loss over US$ 1.2 million, 100,000 salmons killed | Practical, 2014 (in Bolsh-Belmar et al., 2020) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Red Bay | 55.06 | -6.05 | 2014 | *Pelagia noctiluca* | Aquaculture | 1,500 smolt salmon lost | Practical, 2014 (in Bolsh-Belmar et al., 2020) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | North Uist (Western Islands) | 57.36 | -7.2 | 2014 | *Pelagia noctiluca* | Aquaculture | Economic loss US$ 1.9 million, 300,000 salmon killed | BBC, 2014 (in Bolsh-Belmar et al., 2020) |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | UK | Lochmaddy | 57.6 | -7.16 | 2014 | *Pelagia noctiluca* | ? | 300,000 salmon loss | Bosch-Belmar et al. 2017 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Ryggefjord, Finmark | 70.92 | 25.03 | 2012 | *Dipleurosoma typicum* | Aquaculture | Dense bloom in Sept., overlapping with high mortalities of farmed fish | Halsband et al., 2018 |
| Arctic Ocean | 21. Norwegian Sea | Norway | Ryggefjord, Finmark | 70.92 | 25.03 | 2012 | *Dipleurosoma typicum* | Aquaculture | Dense bloom in Sept., overlapping with high mortalities of farmed fish | Halsband et al., 2018 |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Ireland | Galway, Mayo and Cork regions | 53.25 | -8 | 2017 | *Pelagia noctiluca, Muggiaea atlantica* | Aquaculture | over 200,000 salmon killed | O'Sullivan, 2017 (in Bolsh-Belmar et al., 2020) |
| Southwest Pacific Ocean | 42. Southeast Australian Shelf | Australia | Tasmania, Huon River and D'Entrecasteaux Channel | -43.13 | 147.17 | 2018 | *Aurelia* spp. | Aquaculture | Economic loss US$ 7.1 million, thousands of salmon killed | Ford, 2019 (in Bolsh-Belmar et al., 2020) |

\**Chiropsalmus quadrigatus = C. yamaguchi*

\*\*Phylum Ctenophora

\*\*\*Coordinate of entire Japan coast corresponds to Tokyo in this study.

Table D.2 Record of impairing industrial fisheries from 1920 to 2018. Reports are uncertain or incomplete.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Marine region** | **Location** | **Year** | ***Identified species*** | **Type of damage** | **Note** | **Reference** |
| Arctic Ocean | Norway, Lurefjord | Late of 1940s, since 1973 | *Periphylla periphylla* | Fisheries | Clog fishing nets, impeding trawl operations | Fosså, 1992 (in Nagata et al., 2009; Gershwin, 2013) |
| Arctic Ocean | Scotland, Shetland | ? | *Aurelia aurita* | Fisheries | Farmed salmon | Bruno and Poppe, 1996 (in Rodger et al., 2010) |
| Indo-Pacific region | Australia, New south wales | ? | *Catostylus mosaicus* | Fisheries | Restrict trawling (Oct.-May) | Broadhurst and Kennelly 1996 (in Gershwin 2013) |
| Indo-Pacific region | Australia, Northern Australia | ? | *-* | Fisheries | Sporadic, split prawn trawls | Rawlinson and Brewer, 1995 (in Purcell et al., 2007) |
| Indo-Pacific region | India | Pre 1995 | *-* | Aquaculture | Giant tiger prawns | Rajagopal et al., 1995 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | Black Sea | ? | *Rhizostoma octopus* | Fisheries | Clog fishing nets | Netchaerff and Neu, 1940; Russell, 1970 (in Nagata et al., 2009) |
| Northeast Atlantic Ocean | Black Sea | 1970s | *Aurelia aurita* | Fisheries | Decline of anchovy | Hobson, S. and Mee, L. D.,1999 |
| Northeast Atlantic Ocean | Eastern Mediterranean Sea, Israel coast | Since 1990 | *Chrysaora plocamia* | Fisheries | Decreased economic value | Nakar et al., 2011 |
| Northeast Atlantic Ocean | Eastern Mediterranean Sea | After 1980 | *Rhopilema nomadica* | Fisheries | Clog fishing nets | Lotan et al., 1993 (in Pucell et al., 2007) |
| Northeast Atlantic Ocean | Israel, Mediterranean | Since mid of 1980's | *Rhopilema nomadica* | Fisheries | Clog fishing nets, impeding trawl operations | Lotan et al., 1992, Galil and Zenetos, 2002 (in Nagata et al., 2009; Gershwin, 2013) |
| Northeast Atlantic Ocean | Mediterranean Sea | ? | *Pelagia noctiluca* | Fisheries | Clog fishing nets | Bernard et al., 1988 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | North Atlantic of UK | ? | *Aurelia* sp. | Fisheries | Clog/Brust fishing net (-Aug.) | Russell, 1970 (in Nagata et al., 2009; Gershwin, 2013) |
| Northeast Atlantic Ocean | Scotland | ? | *Pelagia noctiluca* | Fisheries | Mortalities in farmed fish | Sourd pers. comm. (in Rodger et al., 2010) |
| Northeast Atlantic Ocean | Scotland, Ireland | ? | *Aurelia aurita* | Fisheries | Farmed salmon | Mitchell pers. obs. (in Rodger et al., 2010) |
| Northeast Atlantic Ocean | Scotland, Ireland | ? | *Velella velella* | Fisheries | Skin and gill pathology observed | Rodger pers. obs. (in Rodger et al., 2010) |
| Northeast Atlantic Ocean | Scotland, Ireland | ? | *Pelagia noctiluca* | Fisheries | - | O’Connor 2002; Hay and Murray 2008 (in Rodger et al., 2010) |
| Northeast Atlantic Ocean | Turkey | On going | Unspecified jellyfish | Fisheries | Affecting to the anchovy, horse mackerel, bluefish and bonito fisheries. | Özdemir, 2007, 2009 (in Gershwin, 2013) |
| Northwest Atlantic Ocean | USA, Louisiana and Maryland | 1970s | *Moerisia lyonsi* | Aquaculture | Killed decapods; ≤ 13.6 med. L−1 | Sandlifer et al., 1974 (in Purcell et al., 2007; Purcell et al., 2013) |
| Northwest Pacific Ocean | China, Yangtze estuary | Since 2003 | *Cyanea capillata* | Fisheries | Clog fishing nets | Xian et al., 2005 (in Nagata et al., 2009; Gershwin, 2013) |
| Northwest Pacific Ocean | China, Yellow and east China sea | Mid.- late of 1990s | *Aequorea* sp., *Cyanea* sp. | Fisheries | Trawl nets | Ding and Cheng, 2005, Cheng et al., 2005, Xian et al., 2005 (in Pucell et al., 2007) |
| Northwest Pacific Ocean | Japan, Seto inland Sea | Annually, summer | *Aurelia* sp. | Fisheries | Clog/burst fishing net, reducing catches quality, sting to fishermen | Uye and Ueta, 2004; Uye and Shimauchi, 2005 (in Nagata et al., 2009; Gershwin, 2013) |
| Southeast Atlantic Ocean | Namibia, Northern Benguela | 1960s | *Chrysaora hysoscella, Aequorea forskalea* | Fisheries | Collapsed pelagic fish stock | Venter, 1988; Brierley et al., 2001 (in Lynam et al., 2006) |
| Southwest Atlantic Ocean | Northern Argentina coast | Annually | *Lychnorhiza lucerna* | Fisheries | Clog/damage fishing nets, reduce fishing captures and catch quality (Dec-May) | Schiariti et al. 2008 (in Nagata et al., 2009; Gershwin, 2013) |
| Southwest Atlantic Ocean | Southern Brazil - Northern Argentina coast | ? | *Olindias sambaquiensis* | Fisheries | Clog fishing nets, stings to fishmen, shrimp move away | Vannucci, 1951; Nagata et al., 2009 (in Gershwin, 2013) |

Table D.3 List of reference of impairingindustrial fisheries by jellyfish from 1920 to 2018.

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**Appendix E. Records of powerplant operation damage**

Table E.1 Record of powerplant operation damage from 1960 to 2013.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Marine regions** | **LME** | **Country** | **Location** | **Lat. (°N)** | **Long. (°E)** | **Year (s)** | **No. disturbing (Shut down) \*** | **Note** | **Identified sp.** | **Reference** |  |
| Northwest Atlantic Ocean | 7. Northeast US Continental Shelf | USA | Chesapeake Bay | 38.33 | -76.41 | 1960 |  | July, Calvert Cliffs Nuclear Power Plant | *Chrysaora quinquecirrha* (in Purcell et al. 2007) | Delano, 2006 (in Purcell et al., 2007) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Osaka Pref., Osaka Bay, Harima Nada, Seto Inland Sea | 34.3 | 138.37 | 1960 - 1967 |  |  | *Aurelia aurita (s. l.)* | Matsueda, 1969 (in Purcell et al., 2007) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokyo Bay: Yokosuka | 35.52 | 139.94 | 1962 | 1(1) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokyo Bay: Yokosuka, Yokohama, Kawasaki, Chiba Pref., Tokyo Bay: Chiba, Goi | 35.52 | 139.94 | 1963 | 35 (25) | May - Sept. Damage to rotary screen and limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokyo Bay: Yokosuka, Yokohama, Kawasaki Chiba Pref., Tokyo Bay: Chiba, Goi | 35.52 | 139.94 | 1964 | 7 (1) | Apr. - Sept. Damage to rotary screen and limit output | *Aurelia aurita* | Kuwabara et al., 1969 (in Purcell et al., 2007); Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Mie Pref., Ise-wan Bay, Owase | 34.45 | 136.45 | 1964 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Kagawa Pref., Seto inland Sea | 34.16 | 133.57 | 1964 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Oksa Pref., Osaka Bay, Tanagawa | 34.3 | 138.18 | 1964 | 1 (0) | June - July, separate rotary screen, break shaft | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Oksa Pref., Osaka Bay, Tanagawa. Hyōgo Pref., Seto Inland Sea, Himeji | 34.41 | 136.1 | 1965 | 4 (1) | June - Aug., damage to rotary screen and shut-down | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokyo Bay: Yokosuka, Kawasaki. Chiba Pref., Tokyo Bay, Goi | 35.52 | 139.94 | 1966 | 7(1) | May - July, damage to rotary-screen and output limit | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Osaka Pref., Osaka Bay, Sakai | 34.3 | 135.18 | 1966 | 8 (3) | Apr. - Aug., damage to rotary screen, condenser reflux, damage to screen filter, output limit and shut-down | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokusima Pref., Kii suido Strait | 33.96 | 134.87 | 1966 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Fukuyama Bay, Fukuyama | 34.29 | 133.22 | 1966 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Toyama Pref., Toyama Bay | 36.5 | 137.1 | 1966 | 1 (1) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Saga Pref., Genkai Sea | 33.4 | 130 | 1966 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Osaka Pref., Osaka Bay: Hyogo Pref., Himeji | 34.3 | 135.18 | 1967 | 16 (7) | May - Sept., Break rotary screen, cutting chains, incapacity of rotation, limit output, and shut-down | *Aurelia aurita* | Matsueda, 1969 (in Purcell et al., 2007); Yasuda, 2003 |  |
| Indo-Pacific region | 41. East-Central Australian Shelf | Australia | Tuggerah Lakes, New South Wales | -33.06 | 151.29 | 1967-1971 |  |  | *Catostylus mosaicus* | Pulley, 1971 in Scott, 1999 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Hyōgo Pref., Seto Inland Sea | 34.41 | 136.1 | 1968 | 3 (3) | June - Aug., Break rotary screen, limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Shizuoka Pref., Enshu Sea | 34.27 | 137.38 | 1971 | 5 (5) |  | *Aurelia aurita* | Yasuda 2003; Yasuda 2007 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Aichi Pref., Atsumi | 34.97 | 136.79 | 1971 | 7 (5) | June - July, Break rotary screen, limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Turuga Bay | 35.8 | 135.91 | 1971 | 9 (5) | June - Oct., break the axis of rotary screen, cutting chain, and limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Tokyo Bay, Yokohama | 35.52 | 139.94 | 1972 | 1+ (1+) | July, incapacity of rotation and shutdown | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Aichi Pref., Atsumi | 34.97 | 136.79 | 1972 | 5 (3) | June - July, break rotary screen, cutting chain, and limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Fukuyama Bay, Fukuyama | 34.29 | 133.22 | 1972 | 1+ (1+) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Shizuoka Pref., Enshu Sea | 34.27 | 137.38 | 1972 | 3 (3) | Limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Aichi Pref., Atsumi | 34.97 | 136.79 | 1973 | 10 (7) | Jun- July, limit output | *Aurelia aurita, Rhopilema esculenta* (in Yasuda, 2007) | Yasuda 2003; Yasuda 2007 |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Shizuoka Pref., Enshu Sea, Hamaoka | 34.27 | 137.38 | 1973 | 1+ (1+) | Aug., Limit output (?) | *Aurelia aurita* | Yasuda, 2003 |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 1974 |  |  | *-* | Verner, 1983; Andermo, 1977 (in Gershwin, 2013) |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 1975 |  |  | *-* | Verner, 1983; Andermo, 1977 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Uchiura Bay, Takahama | 35.8 | 135.91 | 1975 | 3 (3) | May - Sep., limit output | *Cyanea nozakii* | Yasuda, 2003 |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 1976 |  | 14 - 15 July | - | Verner, 1983; Andermo, 1977 (in Gershwin, 2013) |  |
| Indo-Pacific region | 45. Northwest Australian Shelf | Australia | Karratha, Western Australia | -20.76 | 116.84 | 1977 |  | Cape lambert power plant, clogging, and shutdown | Red jellyfish | L. Marsh, per. comm. (in Gershwin, 2013) |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 1977 |  |  | - | Verner, 1983; Andermo, 1977 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Shimane Pref., Kashima | 35.13 | 132.4 | 1977 | 1 - 2+ | June, limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay: Takahama, Ōi | 35.43 | 135.39 | 1977 | 1 - 2+ | June - July, limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 1978 |  |  | *-* | Verner, 1983; Andermo, 1977 (in Gershwin, 2013) |  |
| Indo-Pacific region | 32. Arabian Sea | India | New Delhi | 28.61 | 77.2 | 1983 |  | Nov. | *-* | Ludlam, 2012 (in Gershwin, 2013) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Hutchinson Island, Florida | 27.17 | -80.12 | 1983 |  | Blocked cooling water supply | | Lochbaum, 2011 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Kagawa Pref., Seto Inland Sea, Takamatsu | 34.16 | 133.57 | 1983 -1984 | 4 (4) | Aug. - Nov., limit out put | *Aurelia aurita* (Yasuda 2003), *Cyanea nozakii* (in Purcell et al., 2007; Graham et al 2014) | Yasuda, 2003 |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Hutchinson Island, Florida | 27.17 | -80.12 | 1984 |  | August | - | Reuters, 1984 (in Gershwin, 2013) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Hutchinson Island, Florida | 27.17 | -80.12 | 1984 |  | Sept. 1st | - | Lochbaum, 2011 (in Gershwin, 2013) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Florida City, Florida | 25.27 | -80.29 | 1984 |  | Sept. 3rd | - | Lochbaum, 2011 (in Gershwin, 2013) |  |
| Indo-Pacific region | 32. Arabian Sea | India | Madras | 12.62 | 80.19 | 1988 |  | Blocking and station closure in the Madras Atomic Power Station | *Aurelia aurita* | Rajagopal et al., 1989; Masilamoni et al., 2000 (in Purcell et al., 2007) |  |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Hunterston, Clyde Sea | 55.97 | -2.41 | 1991 |  | Aug. 21st | - | Nuclear news, 1991 (in Gershwin, 2013) |  |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Hunterston, Clyde Sea | 55.97 | -2.41 | 1992 |  | Shutdown | *Rhizostoma* sp. | Houghton et al., 2006 (in Gershwin, 2013) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Hutchinson Island, Florida | 27.17 | -80.12 | 1993 |  | Sep. 18th and 20th | | Lochbaum, 2011 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | Uljin, Gyeongsangbuk-do | 37.05 | 129.23 | 1996 |  | Sep. 13th- 25th, nuclear power plant | - | Lee et al., 2005; Anonymous, 2006 (in Graham et al., 2014) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Shimane Pref. | 35.46 | 133.05 | 1997 | 1?2? | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref | 35.8 | 135.91 | 1997-2000 |  | Jun. - Sep., power reduction | *Chrysaora melanaster* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | Uljin, Gyeongsangbuk-do | 37.09 | 129.42 | 1998 | 2 | Jan. 1st - 4th (132 ton of jellyfish) and Aug. 1st (3454 ton of jellyfish) | - | Lee et al., 2005 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref | 37.96 | 139.03 | 1998-2000 |  | Power reduction | *Aurelia aurita (s. l.)* | Aoki, pers. comm. (in Purcell et al., 2007) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Ehime Pref | 33.87 | 132.7 | 1998-2002 |  | Apr. - Nov., power reduction. | *Aurelia aurita (s. l.)* | H. Takeoka pers. comm. (in Purcell et al., 2007) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref., Kashiwazaki | 37.22 | 138.33 | 1999 | 1 - 2+ | July 7th (Takizawa 2005), June - July, limit output (Yasuda 2003) | *Aurelia aurita* | Yasuda, 2003; Takizawa, 2005 (in Graham et al., 2014) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Shiraki, Urasoko | 35.8 | 135.91 | 1999 | 1 - 2+ (1) | Sep., limit output | *Chrysaora pacifica* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 36. South China Sea | Philippines | Island Luzon, Sual powerplant | 16 | 121 | 1999 |  | Dec. 16th, blackout half of country | *Aurelia aurita* | Anonymous, 1999 (in Purcell et al., 2007); Graham, 2013 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Shiraki | 35.8 | 135.91 | 2000 | 1+ | Feb., limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Ōi, Urasoko | 35.8 | 135.91 | 2000 | 6+ | June - Aug., limit output | *Aurelia aurita* | Yasuda, 2003 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref., Kashiwazaki | 37.22 | 138.33 | 2000 | 1 |  |  | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Tsugaru Bay | 35.8 | 135.91 | 2000 | 14 | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 36. South China Sea | Philippines | Luzon | 16.13 | 120.1 | 2000 |  | Dec. | *-* | Lopez, C., Symonds, P., 2000 (in Graham et al., 2014) |  |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Israel | Hadera | 32.45 | 34.88 | 2001 |  | Summer | *-* | Brahic, 2008; Waldoks, 2010; Galil et al., 2010 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Tsugaru Bay | 35.8 | 135.91 | 2001 | 1 | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | Uljin, Gyeongsangbuk-do | 37.09 | 129.42 | 2001 | 2 | Aug. 11th (5100 ton of jellies) and 26th (1500 ton of jellies), shutdown | *Aurelia aurita* | Lee et al., 2005 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Tsugaru Bay | 35.8 | 135.91 | 2002 | 5 | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref., Kashiwazaki | 37.22 | 138.33 | 2002 | 1 | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Indo-Pacific region | 32. Arabian Sea | Arabian Peninsula | Qatar | 25.21 | 51.62 | 2003 | - | Apr. Damage to intake system | *Crambionella orsini* | Vaidya, 2005 (in Purcell et al., 2007) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref., Kashiwazaki | 37.22 | 138.33 | 2003 | 1 | Limit output | *Aurelia aurita, Nemopilema nomurai* | Yasuda, 2007 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | South Korea | Uljin, Gyeongsangbuk-do | 37.09 | 129.42 | 2003 |  | Jun. | *Aurelia aurita* | Lee et al., 2005 |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Niigata Pref., Kashiwazaki | 37.22 | 138.33 | 2004 | 1 | Limit output | *Aurelia aurita* | Yasuda, 2007 |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Gothenburg | 57.42 | 11.58 | 2005 |  | Aug. 25th | *-* | Environmental News Network AP, 2005 (in Gershwin, 2013) |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Oskarshamn | 57.42 | 16.67 | 2005 |  | Aug. | *-* | Anonymous, 2005 (in Graham et al., 2014) |  |
| Southwest Atlantic Ocean | 14. Patagonian Shelf | South Africa | Cape Town | -33.9 | 18.48 | 2005 |  | May, Koeberg nuclear power station | - | Maposa S, 2005 (in Graham et al., 2014) |  |
| Indo-Pacific region | 32. Arabian Sea | Saudi Arabia | Arabian Gulf | 29.37 | 47.81 | 2006 |  | May, blocked intake screens | - | Azis et al., 2000 (in Purcell et al., 2007) |  |
| Northwest Atlantic Ocean | 7. Northeast US Continental Shelf | USA | Chesapeake Bay | 38.47 | -76.66 | 2006 |  | - | *Chrysaora quinquecirrha* (in Purcell et al. 2007) | Delano, 2006 (in Purcell et al., 2007; Graham et al., 2014) |  |
| Northwest Atlantic Ocean | 7. Northeast US Continental Shelf | USA | Calvert Cliffs, Maryland, Chalk point | 38.25 | -76.26 | 2006 |  | Jun. - Jul. 2006 | - | Delano, 2006 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Shizuoka Pref. | 34.95 | 138.43 | 2006 |  | Jul. 20th, Hamaoka Nuclear Power Plant | | Anonymous, 2006 (in Gershiwin, 2013; Graham et al., 2014) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Fukui Pref., Wakasa Bay, Tsugaru Bay | 35.8 | 135.91 | 2007 | 1?2? | Limit output | *Aurelia aurita*, Salpa | Yasuda, 2007 |  |
| Northeast Pacific Ocean | 3. California Current | USA | San Luis Obispo, California | 35.21 | -120.86 | 2008 |  | Oct., diablo canyon nuclear power plant | - | Di Savino, 2008 (in Gershwin, 2013); Stewart E, 2008 (in Graham et al., 2014) |  |
| Northwest Pacific Ocean | 48. Yellow Sea | South Korea | Yeonggwang-gun, Jeollanam-do | 35.42 | 126.42 | 2009 |  | Korea hydro and nuclear power corporation | - | Sang-jin K. and Sun yoon H., 2009 (in Graham et al., 2014) |  |
| Southwest Pacific Ocean | 42. Southeast Australian Shelf | Australia | Melbourne | -37.81 | 144.96 | 2009 |  | Mar. - Apr. | - | P Fitzgerald. pers. comm. (in Graham et al., 2014) |  |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Israel | Asdod | 31.8 | 34.65 | 2010 |  | July 5th |  | Weiss, 2010 (in Graham et al., 2014) |  |
| Northeast Atlantic Ocean | 26. Mediterranean Sea | Israel | Hadera | 32.45 | 34.88 | 2011 |  | July 5th, Orot Rabin Electric Power Station | - | Cameron KL, 2011 (in Graham et al., 2014) |  |
| Northeast Atlantic Ocean | 24. Celtic-Biscay Shelf | Scotland | Lothian | 55.54 | -2.4 | 2011 |  | Jun. 28th, Torness nuclear power station | - | Anonymous, 2011 (in Gershwin, 2013; Graham et al., 2014) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | St Lucie, Florida | 27.5 | -80.3 | 2011 |  | Aug., nuclear power plant | - | Stapleton C, 2011 (in Graham et al., 2014) |  |
| Northwest Atlantic Ocean | 6. Southeast US Continental Shelf | USA | Hutchinson Island, Florida | 27.17 | -80.12 | 2011 |  | Aug., St. Lucie nuclear power plant, shutdown | | Huffington Post, 2011 (in Gershwin, 2013) |  |
| Northwest Pacific Ocean | 50. East Sea (Sea of Japan) | Japan | Western Japan, Shimane Pref. | 35.46 | 133.05 | 2011 |  | Jun. | - | O.Tsukimori, N. Macfie, 2011 (in Graham et al., 2014) |  |
| Northeast Pacific Ocean | 3. California Current | USA | San Luis Obispo, California | 35.16 | -120.39 | 2012 |  | Apr. | Salpa | Eng J, 2012 (in Graham et al., 2014) |  |
| Northwest Pacific Ocean | 49. Kuroshio Current | Japan | Mie Pref., Ise-wan Bay\*\* | 34.45 | 136.45 | 2012 |  | Jul. |  | Chunichi Shimbun, 2011 (in Gershwin, 2013) |  |
| Northeast Atlantic Ocean | 23. Baltic Sea | Sweden | Oskarshamn | 57.27 | 16.45 | 2013 |  | Sep., nuclear power plant | | Mengewien J, 2013 (in Graham et al., 2014) |  |

|  |
| --- |
| \* Shut down is the limited power including the stopping operation among the number of damages that is referred from Yasuda, 2007. |
| \*\*We keep the old-town nomination following the original note (e.g., Ise-wan Bay). |

Table E.2 Record of powerplant operation damage from 1960 to 2013. Reports are uncertain or incomplete.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Marine region** | **Location** | **Year** | **Identified sp.** | **Reference** |
| Arctic Ocean | Denmark | pre-1983 | - | Verner, 1983 (in Gershwin, 2013) |
| Arctic Ocean | Sweden, Barsebäsk | pre-1983 | - | Verner, 1983 (in Gershwin, 2013) |
| Arctic Ocean | Sweden, Ringhals | various, pre-1983 | - | Möller, 1984 (in Gershwin, 2013) |
| Indo-Pacific region | Malaysia, Manjung, Perak | pre-2012 | - | Yee LH, 2012 (in Graham et al., 2014) |
| Indo-Pacific region | Malaysia, Perak | pre-2009 | - | Raj, 2011; Wan Maznah, 2011 (in Gershwin, 2013) |
| Indo-Pacific region | Saudi Arabia, Arabian Gulf | annually between Mar. and Jul. | - | Aziz et al., 2000 (in Gershwin, 2013) |
| Northeast Atlantic Ocean | Baltic Sea | unknown | *Aurelia aurita* | Möller, 1984 (in Purcell et al., 2007) |
| Northeast Atlantic Ocean | Germany | pre-1983 | *-* | Verner, 1983 (in Gershwin, 2013) |
| Northeast Atlantic Ocean | Germany, Kiel | various, pre-1983 | *Aurelia aurita* | Möller, 1984 (in Gershwin, 2013) |
| Northeast Atlantic Ocean | Gulf of Oman | unknown | - | Daryanbard R. and Dawson MN., 2008 (in Graham et al., 2014) |
| Northwest Pacific Ocean | Japan, Niigata | pre-2007 | - | Matsuura et al., 2007 (in Gershwin, 2013) |
| Northwest Pacific Ocean | Japan, Tanagwa | pre-1986 | - | Kawabe and Traplin, 1986 (in Gershwin, 2013) |
| Northwest Pacific Ocean | Japan, Tokasago | pre-1989 | - | Rajagopal et al., 1989 (in Gershwin, 2013) |
| Northwest Pacific Ocean | Japan, Wakasa Bay | monitored |  | Matsumura et al., 2005 (in Purcell et al., 2007) |
| Southeast Pacific Ocean | Peru | various, pre-1983 | *Chrysaora* sp. | Möller, 1984 (in Gershwin, 2013) |

Table E.3 List of reference of powerplant operation damage from 1960 to 2013.

Gershwin, L. A., 2013. Stung!: On jellyfish blooms and the future of the ocean. University of Chicago Press.

Graham, W. M., Gelcich, S., Robinson, K. L., Duarte, C. M., Brotz, L., Purcell, J. E., Madin, L. P., Mianzan, H., Sutherland, K. R., Uye, S. -I., Pitt, K. A., Lucas, C. H., Bøgeberg, M., Brodeur, R. D., Condon, R. H., 2014. Linking human well‐being and jellyfish: ecosystem services, impacts, and societal responses. Frontiers in Ecology and the Environment, 12(9), 515-523.

Lee, S.B., Chae, J., Choi, H.W., Lee, J. -H., 2005. Performance analysis and improvement scheme of intake screens in power plants against mass impingement of marine organisms. The Korean Association of Ocean Science and Technology Societies, Joint academic conference 2005 (in Korean).

Purcell, J. E., Uye, S. I., Lo, W. T., 2007. Anthropogenic causes of jellyfish blooms and their direct consequences for humans: a review. Marine Ecology Progress Series, 350, 153-174.

Yasuda, T., 2003. Jellyfish, UFO in the Sea–Occurrence, Ecology, and Measure. Koseisha Koseikaku Co., Ltd, Tokyo. (translated title: 바다의 UFO해파리). co-translated by Y.S. Kang, M-S. Park, and Y. T. Park: South Korea, Academybooks, publishing in 2009. 244 p. Republic of Korea. (in Korean).

Yasuda, T., 2007. The giant jellyfish and the moon jellyfish (original title.: エチゼンクラゲとミズクラゲ : その正体と対策). Seizando-shoten Co. Ltd, Tokyo. (translated title: 해파리의 경고: 아름답고 불가사의한 생물). translated by Y. H. Yoon, Chonpa Kwahak Sa, publishing in 2009. 187 p. Republic of Korea. (in Korean).

**Appendix F. The summary of jellyfish hazards from 1884 - 2019**

Figure F.1 (a) Decadal changes of LMEs experienced the jellyfish hazard and jellyfish total records, (b) number of LMEs affected by each jellyfish hazard per decade from 1880 to 2010, (c) annual sum of existed records by jellyfish hazard types period 1884- 2019.

**텍스트, 지도이(가) 표시된 사진

자동 생성된 설명**

**Appendix G. The pace of jellyfish hazards changes in Anthropocene**

Table G.1 Dataset of anthropogenic variables used for human imprint

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Variable** | **Unit** | **Time series** | **Source** |
| Anthropogenic factors | Sea surface temperature | °C (degree Celsius) | 1960 – 2010 | GISTEMP Team, 2019: GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies. Dataset accessed 11 December 2019 at https://data.giss.nasa.gov/gistemp/. |
| Lenssen, N., G. Schmidt, J. Hansen, M. Menne, A. Persin, R. Ruedy, and D. Zyss, 2019: Improvements in the GISTEMP uncertainty model. J. Geophys. Res. Atmos., 124, no. 12, 6307-6326, doi:10.1029/2018JD029522. |
| Marine fish capture | Mt (Metric tons in millions) | 1960 – 2010 | Global marine fishes capture production. Data are from the FAO Fisheries and Aquaculture Department online database (Food and Agriculture Organization-FIGIS (FAO-FIGIS), 2013). Dataset accessed 11 December 2019 at http://www.fao.org/fishery/statistics/global-production/en |
| Global aquaculture production | Mt (Metric tons in millions) | 1960 – 2010 | FAO Yearbook of Fishery Statistics - Aquaculture Production, FAO 2020. Dataset accessed 11 December 2019 at https://data.worldbank.org/indicator/ER.FSH.AQUA.MT?end=2016&start=1960&view=chart. |
| Nitrogen in coastal zone | Mt (Metric tons in millions) | 1960 – 2010 | Mackenzie, F. T., Ver, L. M., Lerman, A., 2002. Century-scale nitrogen and phosphorus controls of the carbon cycle. Chemical Geology, 190(1-4), 13-32. https://doi.org/10.1016/S0009-2541(02)00108-0  Dataset accessed 11 July 2019 at http://www.anthropocene.info/ga-es9.php. |
| World seabone trading economic (maritime transport) | Mt (Metric tons in millions) | 1970 – 2010 | United nations conference on trade and development. World seaborne trade by types of cargo and by group of economies. Dataset accessed 11 December 2019 at https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx?sCS\_ChosenLang=en. |

Table G.2 Principal Component Analysis coefficients relative to Principal Component 1 (PC1).

|  |  |
| --- | --- |
| **Variable** | **PC1 (92%)** |
| Sea surface temperature | 0.703 |
| Marine fish capture | 0.410 |
| Global aquaculture production | 0.851 |
| Nitrogen in coastal zone | 0.315 |
| World seabone trading economic | 0.841 |

Figure G1. Detrending time series of cumulative annual jellyfish hazards record in 1960 – 2010. The detrended time series shows that regardless the increase of reports in recent decades, there is a significant upward trend from the 1990s, compared with an irregular pattern showed over the period 1960s-1980s.

Chart, scatter chart

Description automatically generated