**Food production shocks across land and sea**

Supplementary information

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**Figure S1 - Statistical shock detection method. a.** Local polynomial regression (LOESS) model fitted to food production time-series **b.** Regression of model residuals against lag-1 residuals **c.** Production shock in 1991 identified as outlier from regression in b using Cook’s Distance measures

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**Figure S2 – Proportion of shocks recovered or not during study period in crops, livestock, fisheries and aquaculture sectors across geographic region.**



**Figure S3 – Shock frequency through time across all sectors for a range of parameter combinations.** Light grey confidence interval represents range of plausible shock frequencies dependent on span, baseline and average type used in shock detection. Dashed black line is mean of the confidence interval frequencies. Solid red line represents parameter combination that minimizes the sum of squared residuals with the confidence interval mean (parameters selected for this analysis).

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**Figure S4– Comparisons of number of shocks detected in crop, livestock, fisheries and aquaculture time series with incremental changes to Cook’s distance values.** Lines represent either the combination of model parameters used in this study (‘Selected Model’, LOESS span = 0.6, production baseline = 7 years and average type used = median), or repeated with changes to model span, production baseline or average type.

**Table S1 – Proportion of imposed shocks detected in simulated time series for different time series standard deviations and shock size combinations.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Standard deviation | | | | | | | | | |
|  |  | **0.1** | **0.2** | **0.3** | **0.4** | **0.5** | **0.6** | **0.7** | **0.8** | **0.9** | **1** |
| Magnitude | **0** | 0.003 | 0.001 | 0.001 | 0.001 | 0.003 | 0.001 | 0.002 | 0.001 | 0.001 | 0.003 |
| **0.5** | 0.82 | 0.159 | 0.043 | 0.023 | 0.018 | 0.012 | 0.006 | 0.006 | 0.006 | 0.006 |
| **1** | 1 | 0.805 | 0.345 | 0.161 | 0.061 | 0.036 | 0.018 | 0.017 | 0.008 | 0.01 |
| **1.5** | 1 | 0.995 | 0.786 | 0.459 | 0.246 | 0.122 | 0.089 | 0.052 | 0.035 | 0.026 |
| **2** | 1 | 1 | 0.982 | 0.81 | 0.526 | 0.352 | 0.22 | 0.133 | 0.082 | 0.065 |
| **2.5** | 1 | 1 | 0.997 | 0.97 | 0.781 | 0.603 | 0.408 | 0.273 | 0.177 | 0.131 |
| **3** | 1 | 1 | 1 | 0.994 | 0.954 | 0.813 | 0.651 | 0.469 | 0.301 | 0.22 |
| **3.5** | 1 | 1 | 1 | 1 | 0.99 | 0.934 | 0.813 | 0.666 | 0.506 | 0.41 |
| **4** | 1 | 1 | 1 | 1 | 1 | 0.973 | 0.911 | 0.802 | 0.652 | 0.565 |
| **4.5** | 1 | 1 | 1 | 1 | 1 | 0.995 | 0.974 | 0.906 | 0.824 | 0.668 |
| **5** | 1 | 1 | 1 | 1 | 1 | 1 | 0.99 | 0.957 | 0.902 | 0.821 |
| **5.5** | 1 | 1 | 1 | 1 | 1 | 1 | 0.997 | 0.984 | 0.952 | 0.878 |
| **6** | 1 | 1 | 1 | 1 | 1 | 1 | 0.999 | 0.995 | 0.976 | 0.942 |

**Drivers of shocks**

**Table S2 – Identified causes for production shocks across all sectors.** Asterisks indicate possible drivers for shocks of an unknown cause.

| **Sector** | **Country** | **Year** | **Shock size**  **(tonnes)** | **Recovery time (years)** | **Driver** | **Reference** | **Category** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Crops | Afghanistan | 2001 | 1146371 | 1 | Severe droughts (1999-2001) | 1 | Climate/weather events |
| Crops | Albania | 1992 | 700580 | 16 | Transition to market-based economy in early 90s | 2 | Geopolitical/ economic events |
| Crops | Antigua and Barbuda | 1995 | 471 | 1 | Reduction in crop output associated more with damage from Hurricane Luis | 3 | Climate/ weather events |
| Crops | Australia | 2007 | 12018352 | 1 | Annual rainfall in 2006 40-60% below normal over most of the country in part caused by the 2006/07 El Niño event | 4,5 | Climate/weather events |
| Crops | Bahrain | 1981 | 30551 | 32 | Urban expansion and salinization of ground water led to significant losses in agricultural areas | 6 | Mismanagement |
| Crops | Bermuda | 1971 | 1017 | 14 | Oil price fluctuations in the US economy from 1969- 1972 | 7 | Geopolitical/ economic events |
| Crops | Bhutan | 2000 | 135694 | 4 | Heavy seasonal monsoon rainfall and flash floods across the country | 8 | Climate/weather events |
| Crops | Burundi | 2012 | 87394 | 1 | Dramatic decrease in banana production between 2007 and 2012 due to the effects of *Xanthomonas* wilt | 9 | Other |
| Crops | Cameroon | 1987 | 367152 | 1 | Severe economic crisis due to decline in world prices of oil, coffee and cocoa resulted in shrinking agricultural investment | 10,11 | Geopolitical/economic events |
| Crops | Cayman Islands | 2004 | 240 | 9 | Hurricane Ivan | 12 | Climate/weather events |
| Crops | Chile | 2007 | 986109 | 1 | Rising world food prices combined with severe winter frosts in Chile reduced yields for vegetables, pulses and some fruits | 13 | Climate/weather & geopolitical/economic events |
| Crops | Comoros | 1985 | 8250 | 1 | Effects of Cyclone Kamisy on Banana Crop\* |  | Climate/weather events |
| Crops | Cuba | 2006 | 1469850 | 7 | Restructuring in sugar industry led to systemic declines in agricultural productivity | 14 | Geopolitical/economic events |
| Crops | DPRK | 1995 | 6800710 | 18 | Torrential rainfall causing severe flooding and mudslides affecting up to 16% of agricultural areas | 15 | Climate/weather events & Mismanagement |
| Crops | DPRK | 1996 | 8298824 | 17 | As above with recurrent flooding into 1996. | 15 | Mismanagement |
| Crops | Democratic Republic of the Congo | 1995 | 3396734 | 18 | Civil unrest during the 1990s preventing agricultural investment and displacing the rural work force. | 16,17 | Geopolitical/ economic events |
| Crops | Dominica | 1979 | 11248 | 2 | Hurricane David effects on banana crop | 18 | Climate/weather events |
| Crops | Dominican Republic | 2008 | 129906 | 1 | Destruction of plantain crop by Tropical Storm Noel late 2007 | 19 | Climate/weather events |
| Crops | Ecuador | 1998 | 412931 | 1 | Heavy rains causing widespread flooding and crop failures | 20 | Climate/weather events |
| Crops | French Polynesia | 2006 | 204 | 1 | Unknown |  | Unknown |
| Crops | Gambia | 2011 | 94155 | 1 | Severe drought reducing crop production by over 50% in some crops e.g. Millet | 21 | Climate/weather events |
| Crops | Guadeloupe | 1980 | 96781 | 2 | Hurricane David in 1979 followed by Hurricane Allen in 1980 destorying the banana crop | 22 | Climate/weather events |
| Crops | Guam | 2002 | 1102 | 2 | Typhoon Pongsona causing widespread devastation in Guam \* |  | Climate/weather events |
| Crops | India | 2002 | 14092939 | 1 | Severe drought across major growing regions | 23 | Climate/weather events |
| Crops | Iran (Islamic Republic of) | 2008 | 6510785 | 1 | Drought reducing wheat production by 34% | 24 | Climate/weather events |
| Crops | Iraq | 2009 | 2134230 | 1 | Drought 2009 -10 in major wheat growing areas | 25 | Climate/weather events |
| Crops | Kiribati | 1989 | 2800 | 1 | Drought and effect largely on coconut plantations | 26 | Climate/weather events |
| Crops | Liberia | 1995 | 136526 | 1 | Liberian Civil War | 27 | Geopolitical/economic events |
| Crops | Libya | 1971 | 10307 | 1 | Dip in productivity after 1969 coup d'etat\* |  | Geopolitical/economic events |
| Crops | Libya | 1977 | 60112 | 1 | Libya-Egypt War\* |  | Geopolitical/economic events |
| Crops | Madagascar | 2013 | 484817 | 2 | Drought causes large crop and depletion of seed stores | 28 | Climate/weather events |
| Crops | Malawi | 2005 | 1600136 | 1 | Drought reduced staple harvest to only 37% of requirements | 29 | Climate/weather events |
| Crops | Maldives | 1990 | 16743 | 23 | Unknown |  | Unknown |
| Crops | Mali | 2013 | 484899 | 2 | Northern Mali Conflict displacing over 300 000 people and disrupting crop production | 30 | Geopolitical/economic events |
| Crops | Namibia | 1998 | 16707 | 1 | Severe drought affecting 25000 people\* | 31 | Climate/weather events |
| Crops | Nauru | 2007 | 272 | 6 | Significant decline of coconuts due to hispid beetles infestations | 32 | Other |
| Crops | Nauru | 2008 | 234 | 5 | Significant decline of coconuts due to hispid beetles infestations | 32 | Other |
| Crops | Nigeria | 2009 | 21555081 | 1 | Initernal conflict throughout Nigeria reducing agricultural output | 30 | Geopolitical/economic events |
| Crops | Niue | 1990 | 1217 | 6 | Banana, breadfruit, papaya and taro crops devastated by Cyclone Ofa | 33 | Climate/weather events |
| Crops | Norway | 1976 | 288148 | 1 | Precipitation deficit evident in late winter of 1975 and drought into 1976. | 34 | Climate/weather events |
| Crops | Pakistan | 2002 | 199835 | 1 | Drought from 1999 through 2002 caused 70% reduction in wheat among other crops | 35 | Climate/weather events |
| Crops | Paraguay | 2009 | 485042 | 1 | Drought | 36 | Climate/weather events |
| Crops | Peru | 1990 | 846197 | 1 | Lack of investment and structural changes in agriculture in the early 1990s through recession | 37 | Geopolitical/economic events |
| Crops | Republic of Korea | 1980 | 2202191 | 1 | Unknown |  | Unknown |
| Crops | Saint Kitts and Nevis | 1990 | 598 | 1 | Hurrican Hugo caused major damage to crops, particularly sugar towards end of 1989 | 38 | Climate/weather events |
| Crops | Saudi Arabia | 1995 | 371562 | 9 | Economic pressure forced a reduction in subsidies for wheat and barley growing | 39 | Mismanagement |
| Crops | Somalia | 1991 | 673387 | 22 | Civil war displaced over a million people and decimated agricultural production (the main livelihood for rural Somalians) | 40 | Geopolitical/economic events |
| Crops | Syrian Arab Republic | 1989 | 2443833 | 1 | Drought affecting wheat crop | 41 | Climate/weather events |
| Crops | Timor-Leste | 2011 | 96394 | 2 | Disrupted planting for 2011 due to severe La Nina flooding in 2010 | 42 | Climate/weather events |
| Crops | Togo | 2013 | 117639 | 2 | Drought | 43 | Climate/weather events |
| Crops | Tokelau | 1994 | 101 | 10 | Unknown |  | Unknown |
| Crops | Tokelau | 2006 | 8 | 2 | Unknown |  | Unknown |
| Crops | United Kingdom | 1976 | 7054926 | 1 | Major drought - lowest rainfall in the UK in over 200 years resulting 20-30% drops in potato, oilseed and wheat | 44 | Climate/weather events |
| Crops | United Republic of Tanzania | 2003 | 624231 | 1 | Drought in northern and central Tanzania affecting 2 million people. 85% of sorghum, maize and groundnuts affected | 45 | Climate/weather events |
| Crops | Vanuatu | 1995 | 3273 | 1 | Unknown |  | Unknown |
| Crops | Venezuela (Bolivarian Republic of) | 2009 | 306179 | 2 | Drought in 2009 due to El Nino event, 70-80% of Venzeuelan rice and maize affected | 46,47 | Climate/weather events |
| Crops | Wallis and Futuna Islands | 2006 | 2009 | 7 | Unknown |  | Unknown |
| Livestock | Argentina | 2003 | 1576886 | 1 | Foot and Mouth Disease outbreak in 2000 leading to further declines until 2003 | 48 | Other |
| Livestock | Bahamas | 2000 | 3997 | 13 | Hurricane Floyd with huge impact on agriculture\* | 49 | Climate/weather events |
| Livestock | Bangladesh | 1980 | 191496 | 4 | Drought over 7 major growing regions in 1980 | 50 | Climate/weather events |
| Livestock | Barbados | 1992 | 3175 | 3 | Downturn in productivity following economic recession. Agricultural output declined between 1991 and 1994 due to poorly performing export sectors - largely due to the 1990 oil price shock | 51 | Geopolitical/economic events |
| Livestock | Belize | 1989 | 6115 | 1 | Unknown |  | Unknown |
| Livestock | Bhutan | 2009 | 4471 | 4 | Agricultural damage from flash floods from cyclone Aila influenced 12 of 20 districts in Bhutan | 52,53 | Climate/weather events |
| Livestock | Bulgaria | 1991 | 742790 | 22 | Dissolution of Council for Mutual Economic Assistance (COMECON) resulted in trade disruption for Bulgarian livestock. Production output dropped nearly 15% from 1988 to 1991. By 1993 cattle inventories were down 40% and poultry 53% from 1988 levels | 54 | Geopolitical/economic events |
| Livestock | Burkina Faso | 2013 | 73220 | 1 | Floods displaced 6712 people in Burkino Faso and inundated agricultural lands | 43 | Climate/weather events |
| Livestock | Cabo Verde | 2011 | 17237 | 2 | Unknown |  | Unknown |
| Livestock | Chad | 1984 | 50096 | 2 | Severe drought aggravated by civil war in Chad. Huge livestock losses throughout Sahelian Africa | 55 | Climate/weather events |
| Livestock | China, Macao SAR | 2008 | 3239 | NA | H5N1 avian influenza outbreak across the region; poultry production decimated | 56,57 | Other |
| Livestock | Côte d'Ivoire | 1998 | 53540 | 6 | Unknown |  | Unknown |
| Livestock | Cuba | 1991 | 385299 | 22 | Loss of subsidized petroleum, fertilizer subsides and export markets from USSR dissolution Gross agrcultural output declined by 40% | 58 | Geopolitical/economic events |
| Livestock | DPRK | 1992 | 107760 | 9 | Cessation of subsidised coal and oil from USSR following demise and subsequent withdrawal of aid from China. Further declines in 1994 after China withdrew. | 15 | Geopolitical/economic events |
| Livestock | DPRK | 1997 | 164730 | 2 | Food production continued to dip until 1997 following floods 1995-96. | 15,59 | Geopolitical/economic events |
| Livestock | Dominica | 2005 | 1251 | 2 | Productivity decline during 2000s across the agricultor sector due to rural-urban migration in younger demographic | 60 | Geopolitical/economic events |
| Livestock | Falkland Islands (Malvinas) | 1996 | 808 | 17 | Ovine hytadosis prevalence from early 1990s, high slaughter in 1994-95 revealed slump in 1996 | 61 | Other |
| Livestock | Former Czechoslovakia | 1991 | 1197866 | 22 | Velvet Revolution and transition to market-based economy | 62 | Geopolitical/economic events |
| Livestock | Germany | 1991 | 5150508 | 19 | Decentralisation of agricultural production following the demise of COMECON and reunification with West Germany | 63 | Geopolitical/economic events |
| Livestock | Greenland | 1972 | 332 | 7 | Collapse of reindeers herds either a result of mass starvation over winter or possibly issues with data reporting/ management | 64 | Mismanagement |
| Livestock | Guam | 1989 | 774 | 24 | Abandonment of agricultural livelihoods in the late 1980s - number of farmers across Guam crashed in 1987 after Cyclone Lynn | 65 | Geopolitical/economic events |
| Livestock | Hungary | 1991 | 719965 | 22 | Dissolution of COMECON reduced inputs and markets for export and competition from western european countries led to a massive decline in agricultural productivity | 66 | Geopolitical/economic events |
| Livestock | Indonesia | 1998 | 395732 | 3 | Drought driven by El Nino combined with Asian economic crisis | 67 | Climate/weather events |
| Livestock | Iraq | 1991 | 549893 | 22 | Sanctions on Iraq during first Gulf War led to complete cut-off of imported feed grains. Domestic feed grain supply also decreased as it was redirected to human food. | 68 | Geopolitical/economic events |
| Livestock | Iraq | 2003 | 300858 | 10 | Invasion of Iraq during second gulf war | 68 | Geopolitical/economic events |
| Livestock | Kuwait | 1991 | 125192 | 5 | First Gulf War and Invasion of Kuwait by Iraq | 69 | Geopolitical/economic events |
| Livestock | Lebanon | 2011 | 8703 | 1 | Severe drought from 2007 through 2010 across fertile crescent | 70 | Climate/weather events |
| Livestock | Malawi | 2002 | 18307 | 2 | Malawi food crisis induced by floods in 2001 and complacency of projected food production. IMF encouraged sale (and so depletion of grain stores). Rush to sell livestock for staples leading to flooded market and a crash in livestock prices. Collapse of many rural livelihoods even migration to neighbouring Zambia. | 71 | Climate/weather events |
| Livestock | Malaysia | 1999 | 231740 | 3 | Nipah Virus in Swine Industry | 72 | Other |
| Livestock | Maldives | 2005 | 400 | 8 | 2004 Tsunami | 73 | Other |
| Livestock | Mali | 2013 | 46482 | 2 | Northern Mali Conflict displacing over 300 000 people and disrupting agriculture | 30 | Geopolitical/economic events |
| Livestock | Mauritania | 1974 | 82840 | 4 | Drought from 1968 -1972 causes large losses to pastoralists as herd numbers dwindle to 1.5 million head | 74 | Climate/weather events |
| Livestock | Mauritius | 1978 | 4688 | 8 | Severe economic crisis hindering agriculture and trade of agricultural goods | 75 | Geopolitical/economic events |
| Livestock | Mexico | 1989 | 1887191 | 2 | Successive droughts and economic crises from 1986-1989 | 76 | Climate/weather & geopolitical/economic events |
| Livestock | Mongolia | 2001 | 81647 | 7 | 20 Million head of livestock perished in two mass mortality events (dzuds) in between 2000-2002 and 2009-2010. Dzuds driven by a combination of summer droughts, heavy snowfall, high winds, and extremely low winter temperatures | 77 | Climate/weather events |
| Livestock | Mongolia | 2010 | 74802 | 1 | 20 Million head of livestock perished in two mass mortality events (dzuds) in between 2000-2002 and 2009-2010. Dzuds driven by a combination of summer droughts, heavy snowfall, high winds, and extremely low winter temperatures | 77 | Climate/weather events |
| Livestock | Montserrat | 2006 | 659 | 7 | Economic downturn induced by infrastructure damage from the eruption of Soufriere volcano in 2005 | 78 | Other |
| Livestock | Nauru | 1976 | 4 | 2 | Unknown |  | Unknown |
| Livestock | Nicaragua | 1980 | 322697 | 19 | Nicaraguan civil war causing loss of production facilities or dangerous conditions inhibiting producers livelihoods. Large production losses across the country totalling USD $ 4.3 million in 1981 | 79 | Geopolitical/economic events |
| Livestock | Niger | 1984 | 65563 | 6 | Drought reduced feed crops and fodder yielding insufficient grazing or feed for cattle in the second half of 1984 | 80 | Climate/weather events |
| Livestock | Nigeria | 2011 | 89523 | 1 | Significant floods in southern Nigeria washed away many livestock | 81 | Climate/weather events |
| Livestock | Norway | 2000 | 145906 | 13 | Subsidy system reform incentivising fewer small farms and more large scale farms causing a restructure within Norwegian agriculture | 82 | Policy change |
| Livestock | Republic of Korea | 2005 | 41664 | 1 | Outbreak of food and mouth disease | 83 | Other |
| Livestock | Saint Kitts and Nevis | 2006 | 449 | 7 | Combination of agricultural theft, insufficient grazing lands left many livestock rearers unwilling to sell livestock in 2005 onwards | 84 | Geopolitical/economic events |
| Livestock | Sao Tome | 1974 | 295 | 2 | Transitional government enroute to Independence? |  | Geopolitical/economic events |
| Livestock | Seychelles | 2002 | 1583 | 11 | Unknown |  | Unknown |
| Livestock | Sierra Leone | 2002 | 21086 | 3 | Civil war destroyed livestock, agricultural infrastructure and depressed the economy | 85 | Geopolitical/economic events |
| Livestock | Somalia | 1992 | 744596 | 3 | Famine caused by conflict exacerbating a water crisis. Livestock targeted by militia during civil war to use hunger as a weapon | 86 | Geopolitical/economic events |
| Livestock | Sri Lanka | 1986 | 102685 | 4 | Unknown |  | Unknown |
| Livestock | Sri Lanka | 1998 | 131686 | 11 | Severe drought\* | International Federation of Red Cross And Red Crescent Societies (2002) Sri Lanka: Drought 2002 Appeal No.18/2002. In ReliefWeb. Retrived from: https://reliefweb.int/report/sri-lanka/sri-lanka-drought-2002-appeal-no182002 | Climate/weather events |
| Livestock | Timor-Leste | 1997 | 1163 | 1 | Combined influence of severe El-Nino drought and Asian financial crisis led to soaring fed prices from imports | 87 |  |
| Livestock | Venezuela (Bolivarian Republic of) | 2004 | 138954 | 1 | Protests and conflict over prosposed land reform and shutdown of the oil industry major economic disturbances for agriculture | 88 | Geopolitical/economic events |
| Fisheries | Afghanistan | 2001 | 450 | 12 | Severe droughts (1999-2001) impacting inland fisheries | 1,89 | Climate/weather events |
| Fisheries | Albania | 1991 | 9165.578 | 22 | Fall of communism in Eastern Europe | 90 | Geopolitical/economic events |
| Fisheries | Angola | 1975 | 315545.3 | 38 | Independence from Portugal, withdrawal of Portugese fleet from domestic operations | 91 | Geopolitical/economic events |
| Fisheries | Anguilla | 2010 | 40.7581 | 1 | Overfishing of nearshore waters | 92 | Mismanagement |
| Fisheries | Antigua and Barbuda | 1981 | 1511.095 | 1 | Overfishing in lobster fishery, reporting change also likely as FAO data only accepted in mid 1980s | 93 | Mismanagement |
| Fisheries | Barbados | 1989 | 1325.079 | 3 | 1989 identified as a year of particularly low natural productivity followed and preceeded by years of high productivity | 94 | Other |
| Fisheries | Belgium | 1969 | 3102.253 | 2 | Drop off in capacity after governement subsidies issued between 1961 -1969 | 95 | Policy change |
| Fisheries | Belize | 2003 | 10022.06 | 4 | Overfishing | 96 | Mismanagement |
| Fisheries | Botswana | 1978 | 200 | 2 | Severe drought from 1978-1979 – Botswanan inland fisheries sensitive to environmental fluctuations | 97–99 | Climate/weather events |
| Fisheries | Bulgaria | 1978 | 16351.84 | 2 | Overfishing and eutrophication in the black sea during the 1970s resulting in dramatic decline of small pelagics | 100,101 | Mismanagement |
| Fisheries | Burundi | 1997 | 698 | 16 | Closure to landing sites on Lake Tangyanika in 1996 due to civil unrest | 102 | Geopolitical/economic events |
| Fisheries | Central African Republic | 2013 | 2000 | 1 | Political turmoil reducing fish supply by 40% due threat violence along countries rivers and the loss of fishing equipment | 103 | Geopolitical/economic events |
| Fisheries | China, Macao SAR | 1987 | 4897.452 | NA | Declining resource in polluted nearshore waters and inefficient fleet | 104 |  |
| Fisheries | Cook Islands | 2013 | 368.5621 | 1 | Unknown |  | Unknown |
| Fisheries | Dominica | 1983 | 214.9291 | 10 | Overfishing of nearshore species by mid 1980s | 105 | Mismanagement |
| Fisheries | Fiji, Republic of | 1994 | 3442.686 | 1 | Overfishing of sea cucumber stocks | 106 | Mismanagement |
| Fisheries | Former USSR | 1992 | 4947742 | 21 | Breakup of Soviet Union leading to reduced capacity and overfished stocks | 107 | Geopolitical/economic events |
| Fisheries | Germany | 1973 | 98731.97 | 40 | Collapse of mackerel stocks in North Sea in early 1970s due to overfishing | 108 | Mismanagement |
| Fisheries | Greece | 1998 | 78556.77 | 4 | Overfishing leading to general decline in total landings from the mid-1990s | 109 | Mismanagement |
| Fisheries | Greece | 2001 | 75954.02 | 1 | Overfishing leading to general decline in total landings from the mid-1990s | 109 | Mismanagement |
| Fisheries | Grenada | 1982 | 469.5915 | 1 | Political instability in Grenada disrupted tourism-based fisheries and damage from Hurricane Allen a likely contirbutor | 110 | Climate/weather & geopolitical/economic events |
| Fisheries | Guinea | 2008 | 7556.994 | 1 | Unknown |  | Unknown |
| Fisheries | Haiti | 1976 | 1469.032 | 1 | Unknown |  | Unknown |
| Fisheries | Hungary | 1991 | 10492 | 22 | Transition to market economy with significant impact on seafood production | 111 | Geopolitical/economic events |
| Fisheries | Italy | 2005 | 195668.5 | 8 | Overfishing since WWII in the Adriatic region | 112 | Mismanagement |
| Fisheries | Jamaica | 2001 | 5129.559 | 12 | Closure in conch fishery in 2000, reopened in 2001 at lower quota than pre 2000 | 113,114 | Policy change |
| Fisheries | Kenya | 2001 | 22446.6 | 10 | Intense overfishing on kenyan coral reefs and in Lake Victoria. | 115,116 | Mismanagement |
| Fisheries | Kiribati | 2000 | 14797.08 | 4 | Overfishing of mullet | 117 | Mismanagement |
| Fisheries | DPRK | 1983 | 184107.9 | 4 | High catch fluctaution in EEZ before closure of distant fleet due to oil crisis suggest overfishing | 118 | Mismanagement |
| Fisheries | Kuwait | 1991 | 7080.867 | 1 | Majority of Kuwait's fishing fleet removed during Iraq Invasion | 119 | Geopolitical/economic events |
| Fisheries | Lesotho | 2001 | 6 | 1 | Unknown driver to carp production decline |  | Unknown |
| Fisheries | Liberia | 1995 | 4335.824 | 4 | Liberian civial war | 120 | Geopolitical/economic events |
| Fisheries | Malaysia | 2006 | 1635.816 | 1 | Tsunami damage to vessels and gear on the western Peninsula coast | 121 | Other |
| Fisheries | Maldives | 2007 | 15707.75 | 6 | Overfishing of tuna stocks, increased Somali piracy in productive regions and recent increases in fuel prices | 122 | Mismanagement & geopolitical/economic events |
| Fisheries | Mayotte | 2004 | 803.2232 | 9 | Shift away from pirogue fishing in the lagoon due to decreasing catches | 123 | Mismanagement & policy change |
| Fisheries | Montserrat | 1988 | 56.39493 | 3 | Damage from Hurricane Hugo | 124 | Climate/weather events |
| Fisheries | Montserrat | 1992 | 103.7283 | 21 | Damage from Hurricane Hugo | 124 | Climate/weather events |
| Fisheries | Netherlands Antilles | 2011 | 18723.66 | 2 | Unknown |  | Unknown |
| Fisheries | New Caledonia | 1983 | 2209.096 | 1 | Large fluctuation in sea cucumber fishery, natural productivity pulse | 125 | Other |
| Fisheries | New Zealand | 1996 | 5509.09 | 1 | Reduced TAC on many fish stocks | 126 | Policy change |
| Fisheries | Niue | 2009 | 9.39722 | 4 | Stock decline reducing subsistence landings and a closure of fish processing plant in 2008 | 127 | Geopolitical/economic events |
| Fisheries | Palau | 1984 | 8151.412 | 23 | Closure of the bait fish fishery in 1982 | 128 | Policy change |
| Fisheries | Philippines | 2011 | 174619.7 | 2 | Overexploitation edpleting marine resources | 129 | Mismanagement |
| Fisheries | Romania | 1990 | 133690 | 23 | Dissolution of USSR and overfishing during soviet era | 130 | Geopolitical/economic events |
| Fisheries | Saint Lucia | 1979 | 1904.803 | 5 | Decimation of landings (particularly urchins) by Hurricane David in 1979 followed by destruction of fishing boats by Hurricane Allen in 1980 | 131,132 | Climate/weather events |
| Fisheries | Saint Vincent/Grenadines | 2003 | 12010.91 | 10 | Unknown |  | Unknown |
| Fisheries | Samoa | 1984 | 6229.257 | 1 | Overfishing of groundfish causing decline by mid 1980s coupled with a drop in tuna catch | 133 | Mismanagement |
| Fisheries | Seychelles | 2007 | 15808.66 | 2 | Steep drop in tuna catches following abnormally high years suggest previous overexploitation | 134 | Mismanagement |
| Fisheries | Solomon Islands | 2005 | 39404.7 | 1 | Dramatic decreases in sea cucumber fishery thought due to domestic tensions and resource depletion | 135 | Mismanagement |
| Fisheries | South Africa | 1970 | 151399.7 | 3 | Sardine crash following overfishing | 136 | Mismanagement |
| Fisheries | Sri Lanka | 2005 | 80016.1 | 1 | Tsunami caused extensive fishing gear and infrastructure damage | 137 | Other |
| Fisheries | St Helena | 2012 | 198.3568 | 1 | Unknown |  | Unknown |
| Fisheries | St. Pierre and Miquelon | 1993 | 25072.44 | 20 | Cod Moratorium in Atlantic | 107 | Mismanagement & policy change |
| Fisheries | Suriname | 2009 | 4956.326 | 1 | Overfishing across multiple taxa combined with very high discard rates | 138 | Mismanagement |
| Fisheries | Switzerland | 1982 | 1383 | 31 | Overfishing, pollution, water extraction from inland waters a number of possible causes | 139 | Mismanagement |
| Fisheries | Syrian Arab Republic | 2008 | 1825.426 | 5 | Shock to inland fisheries during severe drought in Syria combined with overfishing by artisanal operations at sea | 140 | Climate/weather events & mismanagement |
| Fisheries | Tanzania, United Rep. of | 2008 | 23206.06 | 1 | Overfishing evident in years leading up to 2008 | 141 | Mismanagement |
| Fisheries | Turkey | 1989 | 122755.2 | 4 | Collapse of fishery in Black Sea due to overcapacity and pollution | 142 | Mismanagement |
| Fisheries | Turks and Caicos Is. | 1987 | 1466.889 | 1 | Unknown |  | Unknown |
| Fisheries | United States of America | 2010 | 978894.5 | 1 | Quota enforcement to prevent collapse | 143 | Policy change |
| Fisheries | US Virgin Islands | 2007 | 342.983 | 6 | Unknown |  | Unknown |
| Fisheries | Venezuela, Boliv Rep of | 2005 | 106956 | 8 | Collapse of sardine fishery due to shift in plankton community combined with over exploitation in upwelling zone | 144,145 | Climate/weather events & mismanagement |
| Fisheries | Viet Nam | 1974 | 158669.1 | 9 | Displaced of Vietnamese fishing fleet during the end of Vietnamese war efforts | 146 | Geopolitical/economic events |
| Aquaculture | Albania | 1991 | 1306 | 15 | Demise of financial support from the USSR | 147 | Geopolitical/economic events |
| Aquaculture | Austria | 1990 | 874 | 23 | Unknown |  | Unknown |
| Aquaculture | Bahrain | 2001 | 0.5 | 1 | Unknown |  | Unknown |
| Aquaculture | Burundi | 2010 | 32.7 | 1 | Unknown |  | Unknown |
| Aquaculture | Congo | 1994 | 70 | 5 | Down turn in aquaculture production from prolonged internal conflict from 1993-2000 | 148 | Geopolitical/economic events |
| Aquaculture | Congo | 2000 | 74 | 13 | Down turn in aquaculture production from prolonged internal conflict from 1993-2000 | 148 | Geopolitical/economic events |
| Aquaculture | Congo, Dem. Rep. of the | 1996 | 100 | 1 | Declining productivity after cessation of US, Belgian and French cooperation projects in 1990 | 149 | Geopolitical/economic events |
| Aquaculture | Dominica | 2010 | 8 | 3 | Severe drought in 2009/2010 posing challenges for both crops and production in inland water ways combined with economic downturn in wake of the GFC | 150 | Climate/weather events |
| Aquaculture | Ecuador | 2000 | 47569 | 4 | White spot syndrome in Shrimp Industry causing huge drop in production | 151 | Other |
| Aquaculture | El Salvador | 2013 | 539 | 1 | Huge drop in freshwater fish production (largely Nile Tilapia) during severe drought across region 2013-2014 | World Bank (2014) Record drought in Central America: four countries, 40 days without rain, two million facing hunger. | Climate/weather events |
| Aquaculture | Faroe Islands | 2006 | 23970 | 2 | Infectious salmon anaemia outbreaks 2000-2005 | 152 | Other |
| Aquaculture | French Guiana | 1992 | 63 | 21 | Reduction in larval population from mangroves used for stocking in brown shrimp culture | 153 | Mismanagement |
| Aquaculture | Guadeloupe | 2005 | 9.639 | 8 | Unknown |  | Unknown |
| Aquaculture | Guam | 2003 | 60.5 | 10 | Unknown |  | Unknown |
| Aquaculture | Guyana | 2008 | 316 | 5 | Unknown |  | Unknown |
| Aquaculture | Guyana | 2009 | 97.04 | 4 | Unknown |  | Unknown |
| Aquaculture | Hungary | 1984 | 5477 | 29 | Transition from centralized to market-driven economy | 111 | Geopolitical/economic events |
| Aquaculture | Iraq | 2013 | 3881 | 1 | Iraqi insurgency and ensuing conflict destroying boats, equipment and fish ponds | 154 |  |
| Aquaculture | Jamaica | 2003 | 581 | 1 | Severe flooding in 2002 with inland systems prone to damage from fish farm flooding and infrastructure damage | Selvaraju, R., Trapido, P.J., Santos, N., Del Mar Polo Lacasa, M. and Hayman, A.A., 2013. Climate change and agriculture in Jamaica: Agricultural sector support analysis. FAO. | Climate/weather events |
| Aquaculture | Jordan | 2004 | 28 | 1 | Unknown |  | Unknown |
| Aquaculture | Kiribati | 2007 | 4825 | 5 | Poor on-farm management and warm waters cited as unfavourable conditions for seaweed but high freight costs and poor currency exchanges rates contributing factors | 155 | Mismanagement & geopolitical/economic events |
| Aquaculture | DPRK | 1994 | 262961 | 19 | Withdrawal of Chinese subsidised imports in 1994 | 15 | Geopolitical/economic events |
| Aquaculture | Madagascar | 2009 | 580.5 | 1 | Expensive shrimp products unable to compete in export markets against cheaper alternatives from EU and political crisis causing economic hardship and farm closures. | 156,157 | Geopolitical/economic events |
| Aquaculture | Mali | 2012 | 21 | 1 | Violent conflict disrupting fishing and aquaculture operations | 30 | Geopolitical/economic events |
| Aquaculture | Malta | 2005 | 817 | 1 | Capture-based culture of Bluefin Tuna - overfishing of Bluefin reported by International Commission for the Conservation of Atlantic Tunas leading to implementation of strict quotas | 158 | Mismanagement & policy change |
| Aquaculture | Martinique | 1995 | 10 | 8 | Financial crisis in Martinique | 159 | Geopolitical/economic events |
| Aquaculture | Mexico | 2010 | 6794 | 1 | Recurrent vibriosis outbreaks in shrimp production in western Mexico since 2005 | 57,160 | Other |
| Aquaculture | Morocco | 2000 | 183 | 5 | Declining competitiveness in foreign markets as fish prices decrease but Morocco is still dependent on expensive European feed producrs | 161 | Geopolitical/economic events |
| Aquaculture | Morocco | 2006 | 728 | 7 | Declining competitiveness in foreign markets as fish prices decrease but Morocco is still dependent on expensive European feed producrs | 161 | Geopolitical/economic events |
| Aquaculture | Pakistan | 2000 | 2179 | 1 | Severe drought and pollution slowing production in early 2000s | 162 | Climate/weather events |
| Aquaculture | Palau | 2012 | 0.105 | 2 | Typhoon Yolanda/ Haiyan\* |  |  |
| Aquaculture | Panama | 1999 | 2778.5 | 4 | White spot disease in shrimp farming | 163 | Other |
| Aquaculture | Panama | 2000 | 3326.5 | 3 | White spot disease in shrimp farming | 163 | Other |
| Aquaculture | Philippines | 2013 | 34312.1 | 2 | Super Typhoon Yolanda/ Haiyan | 164 | Climate/weather events |
| Aquaculture | Poland | 1993 | 7342 | 2 | Transition to market economy from centralized system | 165 | Geopolitical/economic events |
| Aquaculture | Réunion | 1996 | 28 | 1 | Rapid development of non-native species for overseas markets in offshore French territories |  | Policy change |
| Aquaculture | Saint Lucia | 2000 | 10 | 1 | Large fluctuations likely a function of embryonic stages of algae farming development\* |  | Unknown |
| Aquaculture | Saudi Arabia | 2013 | 6810 | 1 | White spot disease in shrimp farming | FAO (2015) Updated 6 November 2015. [Cited 10 February 2018]. | Other |
| Aquaculture | Singapore | 2007 | 524 | 6 | Unknown |  | Unknown |
| Aquaculture | South Africa | 2001 | 1318 | 1 | Unknown |  | Unknown |
| Aquaculture | Spain | 1993 | 121296 | 4 | Harmful algal blooms | 166 | Other |
| Aquaculture | Trinidad and Tobago | 2003 | 6 | 1 | Economic turndown during political uncertainty\* https://www.finance.gov.tt/wp-content/uploads/2013/11/pub19.pdf | Commonwealth Secretariat (2018) Trinidad and Tobago: Economy. Accessed at: http://thecommonwealth.org/our-member-countries/trinidad-and-tobago/economy | Geopolitical/economic events |
| Aquaculture | Uruguay | 2001 | 8.5 | 2 | Low brood stock in key nursery waterways | 167 | Mismanagement |
| Aquaculture | Venezuela, Boliv Rep of | 2009 | 3918.6 | 1 | Large declines in shrimp production following the introduction of Taura syndrome virus in 2005/06 | 57,168 | Other |
| Aquaculture | Venezuela, Boliv Rep of | 2010 | 537.27 | 1 | Large declines in shrimp production following the introduction of Taura syndrome virus in 2005/06 | 57,168 | Other |

**References**

1. FAO. *FAO/WFP Crop and food supply assessment mission to Afghanistan. Global Information and Early Warning Systems on Food and Agriculture World Food Programme*. (2002).

2. FAO. *Nutrition Country Profile - Republic of Albania. Food and Agricultural Organisation of the United Nations, Rome.* (2005).

3. IICA. *Agriculture in Antigua and Barbuda 1991-1995 and beyond. Working Document. Socioeconomic policy and trade programme. Inter-American Institute for Cooperation on Agriculture*. (1997).

4. Australian Bureau of Statistics. Feature article: 2006 Drought. *1301.0 - Year Book Australia, 2008* http://www.abs.gov.au/ausstats/abs@.nsf/a9ca4374ed (2008). Available at: http://www.abs.gov.au/ausstats/abs@.nsf/a9ca4374ed453c6bca2570dd007ce0a4/ccc8ead2792bc3c7ca2573d200106bde!OpenDocument.

5. Australian Bureau of Meterology. Short-term relief but long-term drought persists. *Reports and Summaries* http://www.bom.gov.au/climate/drought/archive/2007 (2007). Available at: http://www.bom.gov.au/climate/drought/archive/20070604.shtml.

6. FAO. *Bahrain Irrigation in the Middle East region in figures – AQUASTAT Survey 2008*. (2008).

7. Hamilton, J. *Historical Oil Shocks Working Paper 16790. NBER Working Paper Series, National Bureau of Research, Massachusetts*. (2011).

8. Lotay, Y. *Country Report - Bhutan Disaster Management. Visiting Researcher Program. Asian Disaster Reduction Center, Japan.* (2015).

9. Niragira, S. *et al.* Options and Impact of Crop Production Specialization on Small-Scale Farms in the Noth of Burundi. in *4th International conference of the African Association of Agircultural Economists* 1–26 (2013).

10. Fambon, S. *et al.* Slow Progress in Growth and Poverty Reduction in Cameroon. *Growth and Poverty in Sub-Saharan Africa* 293 (2016).

11. Sunderlin, W. D. *et al.* Economic crisis, small-scale agriculture, and forest cover change in southern Cameroon. *Environ. Conserv.* **27,** 284–290 (2000).

12. ECLAC. *The Impact of Hurricane Ivan in the Cayman Islands Part I*. (2004).

13. OECD. *Review of Agricultural Policies: Chile*. (2008). doi:http://dx.doi.org/10.1787/9789264042247-en

14. Mesa-Lago, C. The Cuban Economy in 2006-2007. in *ASCE Association for the Study of the Cuban Economy* (2007).

15. Noland, M. Famine and Reform in North Korea. *Asian Econ. Pap.* **3,** 1–40 (2004).

16. Akitoby, B. & Cinyabuguma, M. Sources of growth in the Democratic Republic of the Congo: a cointegration approach. International Monetary Fund. *IMF Work. Pap.* (2004).

17. FAO. *Special Report: Crop and food supply in Kinshasa and the provinces of Bas-Congo and Bandundu of the Deomcratic Republic of the Congo. FAO Global Information and Early Warning System on Food and Agriculture. Food and Agricultural Organization of the UN, Ro*. (2000).

18. Mohan, P. The economic impact of hurricanes on bananas: A case study of Dominica using synthetic control methods. *Food Policy* **68,** 21–30 (2017).

19. World Bank. *Climate Change Aspects in Agriculture Dominican Republic Country Note.* (2008).

20. Bayer, A. M. *et al.* The 1997–1998 El Niño as an unforgettable phenomenon in northern Peru: a qualitative study. *Disasters* **38,** 351 (2014).

21. Yaffa, S. *Loss and damage from drought in the North Bank Region of The Gambia. Loss and Damage in Vulnerable Countries Initiative, case study report. Bonn: United Nations University Institute for Environment and Human Security.* (2013).

22. FAO. *The World Banana Economy, 1970-1984: Structure, Performance, and Prospects. Rome: Food and Agriculture Organization of the United Nations*. (1986).

23. Lal, B., Das, H. P., Samui, R. P. & Kashyapi, A. Impact of Drought on Kharif Crops in Southern India during 2002 as Compared with Kharif 2003. *Water Energy Abstr.* **14,** 14–15 (2004).

24. USDA. *USDA Foreign Agricultural Service. Iran: Crop Progress Report. FAS - Office of Global Analysis*. (2009).

25. USDA Foreign Agricultural Service. IRAQ: Drought & Irrigation Shortages Decimate Wheat Harvest in 2009/10. Commodity Intelligence report. United States Department of Agriculture. Accessed at:https://ipad.fas.usda.gov/highlights/2 (2009).

26. Oakes, R., Milan, A. & J, C. Kiribati: CLimate change and migration - Relationships between household vulnerability, human mobility and climate change. Report No. 20. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS). (2016).

27. FAO WFP. Crop and food supply assessment mission to Liberia Special Report. FAO global Information and Early Warning System on Food and Agriculture World Food Programme. Food and Agricultural Organization of the United Nations. Accessed at: http://www.fao.org/docrep/004/x9208e/ (2000).

28. FAO WFP. Special Report: CROP AND FOOD SECURITY ASSESSMENT MISSION TO MADAGASCAR. http://www.fao.org/docrep/018/aq115e/aq115e.pdf (2013).

29. Makoka, D. *The impact of drought on household vulnerability: The case of rural Malawi. MPRA Paper No. 15399. University of Bonn, Centre for Development Research (ZEF)*. (2008).

30. Kimenyi, M. *et al.* *The Impact of Conflict and Political Instability on Agricultural Investments in Mali and Nigeria. Afrca Growth Initiative. Working Paper 17.* (2014).

31. CRED. EM-DAT: The Emergency Events Database. *D. Guha-Sapir,Université catholique de Louvain (UCL)* www.emdat.be (2009). Available at: www.emdat.be. (Accessed: 9th December 2017)

32. FAO. Nauru and FAO Partnering to improve food security and income-earning opportunities. http://www.fao.org/3/a-av263e.pdf (2015).

33. Crocombe, M. *et al.* Polynesia in Review: Issues and Events, 1 July 1989 to 30 June 1990. *Contemp. Pac.* **3,** 191–211 (1991).

34. European Drought Centre. Drought of 1975-1976. Central and Northern Europe. *Major Drought Events* http://www.geo.uio.no/edc/droughtdb/edr/DroughtEve (2013).

35. FAO WFP. Special Report: FAO WFP Crop and food supply assessment mission to Pakistan. http://www.fao.org/docrep/004/Y1260e/Y1260e00.htm (2001).

36. IFRC. *Paraguay Drought DREF operation no. MDRPY007 Glide No. DR-2009-000104-PRY Update no. 1.* (2009).

37. Velazco, J. *Agricultural Production in Peru (1950-1995): Sources of Growth*. (2001).

38. Berke, P. & Wenger, D. *Linking Hurricane Disaster Recovery to Sustainable Development Strategies in Saint Kitts and Nevis, West Indies*. (1991).

39. Elhadj, E. *Camels don’t fly, deserts don’t bloom: an assessment of Saudi Arabia’s experiment in desert agriculture. Occasional Paper No 48 Water Issues Study Group School of Oriental and African Studies (SOAS)/King’s College London University of London*. (2004).

40. Jeilani, O. The impact of civil war on crop production in Somalia. in *ICAS VII Seventh International Conference on Agricultural Statistics. Rome* 315–317 (2016). doi:10.1481/icasVII.2016.a06d

41. Al-Khalidi, S. & El Dahan, M. War-ravaged Syria may face worst wheat harvest in 40 years. *Reuters* https://www.reuters.com/article/us-syria-wheat-cro (2014).

42. Tran, P. La Niña blow to crops. *IRIN* http://www.irinnews.org/report/90624/timor-leste-l (2010).

43. OCHA. *2013 Rainy Season Overview West and Central Africa. United Nations Office for Coordination Humanitarian Affairs*. (2013).

44. Wreford, A. & Neil Adger, W. Adaptation in agriculture: Historic effects of heat waves and droughts on UK agriculture. *Int. J. Agric. Sustain.* **8,** 278–289 (2010).

45. OCHA. PWS&D responds to drought in Tanzania. *ReliefWeb - United Nations Office for Coordination of Humanitarian Affairs* https://reliefweb.int/report/united-republic-tanza (2003).

46. Rojas, O., Li, Y. & Cumani, R. *Understanding the drought impact of El Niño on the global agricultural areas: An assessment using FAO’s Agricultural Stress Index (ASI)*. (2014).

47. Anon. El Niño intensifies Latin American drought. *The Telegraph* https://www.telegraph.co.uk/expat/expatnews/661392 (2009).

48. Mattion, N. *et al.* Reintroduction of foot-and-mouth disease in Argentina: characterisation of the isolates and development of tools for the control and eradication of the disease. *Vaccine* **22,** 4149–4162 (2004).

49. The Bahamas Environment Science and Technology Commission. *First National Communication on Climate Change*. *Submitted to the Secretariat of the United Nations Framework Convention on Climate Change for Presentation to the Conference of Parties. Nassau, New Providence, The Bahamas* (2001).

50. Keka Israt, A., Matin, I., Rahman, M. & Banu, D. A. Analysis of Drought in Eastern Part of Bangladesh. *20 DAFFODIL Int. Univ. J. Sci. Technol.* **7,** 20–27 (2012).

51. IICA. *Working Paper: Agriculture in Barbados: 1991 -1995 and Beyond*. (1997).

52. UNESCAP. Bhutan Country Presentation. in *Regional Capacity Development Workshop: Mainstreaming DRR in Sustainable Development Planning. United Nations Economic and Social Comission for Asia and the Pacific* http://www.unescap.org/sites/default/files/Bhutan% (2016).

53. Austrian Development Agency. SUPPORT TO MITIGATE DISASTER CAUSED BY FLOODS IN BHUTAN. *Projects* http://www.entwicklung.at/en/projects/detail-en/pr (2009).

54. Schmitz, A., Moulton, K., Buckwell, A. & Davidova, S. *Privatization of agriculture in new market economies: lessons from Bulgaria*. **6,** (Springer Science & Business Media, 2012).

55. Kamm, H. Drought spreads death across Africa. *The New York Times* https://www.nytimes.com/1984/11/04/world/drought-s (1984).

56. WHO. H5N1 avian influenza: Timeline of major events. World health Organisation. http://www.who.int/influenza/human\_animal\_interfac (2011).

57. FAO. FAOSTAT. (2017). Available at: http://www.fao.org/faostat/en/.

58. Riera, O. & Swinnen, J. Cuba’s agricultural transition and food security in a global perspective. *Appl. Econ. Perspect. Policy* **38,** 413–448 (2016).

59. Noland, M., Robinson, S. & Wang, T. Famine in North Korea: Causes and Cures. *Econ. Dev. Cult. Change* **49,** 741–767 (2001).

60. FAO. *Country Report on the State of Plant Genetic Resources for Food and Agriculture: Dominica*. (2008).

61. Molyneux, D. H. Control of Human Parasitic Diseases: Context and Overview. *Adv. Parasitol.* **61,** 1–45 (2006).

62. Chloupkova, J. *Czech Agricultural Sector: Organisational Structure and its Transformation.* *The Royal Veterinary and Agricultural University. Food and Resource Economic Institute* (2002).

63. Petrick, M. *Modernizing Russia’s cattle and dairy Sectors under WTO conditions: Insights from East Germany*. *Discussion Paper, Leibniz Institute of Agricultural Development in Transition Economic* **150,** (2014).

64. Cuyler, C. Success and failure of reindeer herding in Greenland. *Rangifer Rep.* 81–92 (1999).

65. Bucayu-laurent, C. & Hollyer, J. R. *Some History and Trends of Agriculture on Guam: Data from the U.S. Census of Agriculture and Other Sources, 1920-2007. Agricultural data 01. College of Natural and Applied Sciences. University of Guam.* (2016).

66. Lanzsky, I. & Komives, T. Changing agriculture in Eastern Europe : Hungary as an example. *Agro Food Ind. Hi Tech* 31–33 (1994).

67. FAO. Update on FAO’s activities in relation to the 1997/98 El Niño and La Niña. *Newsroom - Food and Agricultural Organisation of the UNited Nations* (1998).

68. Schnepf, R. *CRS Report for Congress. Iraq Agriculture and Food Supply: Background and Issues*. (2004).

69. FAO. *The State of Food and Agriculture. No 25 Food and Agricultural Organisation of the United Nations. Rome*. (2002).

70. Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R. & Kushnir, Y. Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proc. Natl. Acad. Sci.* **112,** 3241–3246 (2015).

71. Devereux, S. The Malawi famine of 2002. *IDS Bull.* **33,** 70–78 (2002).

72. Looi, L. M. & Chua, K. B. Lessons from the Nipah virus outbreak in Malaysia. *Malays. J. Pathol.* **29,** 63–67 (2007).

73. World Bank Asian Development Bank UN. *Maldives Tsunami: Impact and Recovery. Joint Needs Assessment by World Bank-ADB-UN System*. (2004).

74. International Bank for Reconstruction and Development. *The Current tconomic Situation And Prospects of Mauritania*. (1974).

75. Gupte, P. Indian Ocean Nation of Mauritius Struggles Through Economic and Political Crisis. *The New York Times* https://www.nytimes.com/1979/11/20/archives/indian (1979).

76. Liverman, D. Vulnerability and adaptation to drought in México. *Nat. Resour. J.* **39,** 99–115 (1999).

77. Rao, M. P. *et al.* Dzuds, droughts, and livestock mortality in Mongolia. *Environ. Res. Lett.* **10,** (2015).

78. Pollard, W. & Christ, N. *Caribbean Region: Review of Economic Growth and Development. U . S . International Trade Commission. Investigation Number 332 - 496*. (2008).

79. Prévost, G. The" Contra" War in Nicaragua. *J. Confl. Stud.* **7,** (1987).

80. Swinton, S. M. Drought survival tactics of subsistence farmers in Niger. *Hum. Ecol.* **16,** 123–144 (1988).

81. Agbola, B. S., Ajayi, O., Taiwo, O. J. & Wahab, B. W. The August 2011 flood in Ibadan, Nigeria: Anthropogenic causes and consequences. *Int. J. Disaster Risk Sci.* **3,** 207–217 (2012).

82. Forbord, M., Bjørkhaug, H. & Burton, R. J. F. Drivers of change in Norwegian agricultural land control and the emergence of rental farming. *J. Rural Stud.* **33,** 9–19 (2014).

83. Park, J. *et al.* Reemergence of Foot-and-Mouth Disease, South Korea, 2000–2011. *2158 Emerg. Infect. Dis.* **20,** 5–8 (2014).

84. Caribbean Development Bank. St . Kitts and Nevis. *Annu. Econ. Rev.* 91–102 (2005).

85. Kaldor, M. & Vincent, J. Evaluation of UNDP Assistance to Conflict-Affected Countries. Case Study: Sierra Leone. *United Nations Dev. Program. Eval. Off.* 1–39 (2006). doi:10.1002/ejoc.201200111

86. Majid, N. & McDowell, S. Hidden dimensions of the Somalia famine. *Glob. Food Sec.* **1,** 36–42 (2012).

87. OCHA. FAO/WFP crop and food supply assessment mission to Indonesia. *ReliefWeb - United Nations Office for Coordination of Humanitarian Affairs* https://reliefweb.int/report/indonesia/faowfp-crop (1998).

88. Wilpert, G. in *Promised Land: Competing Visions of Agrarian Reform* (eds. Rosset, P., Patel, R. & Courville, M.) 249–176 (2006).

89. FAO. *Fisheries and Aquaculture Country Profiles. The Islamic Republic of Afghanistan*. (2015).

90. Moutopoulos, D., Bradshaw, B. & Pauly, D. Reconstruction of Albania fishery catches by fishing gear. *Fish. Cent. Work. Pap. Ser.* **12,** (2015).

91. Belhabib, D. & Divovich, E. in *Fisheries catch reconstructions: West Africa, Part II. Fisheries Centre Research Reports vol.23(3)* **23,** 115–128 (2015).

92. Ramdeen, R., Zylich, K. & Zeller, D. Reconstruction of Total Marine Fisheries Catches for Anguilla (1950-2010). *Fish. catch Reconstr. Islands, Part IV* **22,** 1–8 (2014).

93. Georges, J., Ramdeen, R., Zylich, K. & Zeller, D. Reconstruction of total marine fisheries catch for Antigua and Barbuda (1950-2010). *Work. Pap. Ser. Fish. Centre, Univ. Br. Columbia* 17 (2015).

94. Mohammed, E., Lindop, A., Parker, C. & Willoughby, S. Reconstructed fisheries catches of Barbados, 1950-2010. *Work. Pap. Ser. Fish. Centre, Univ. Br. Columbia* **86,** 6–9 (2015).

95. Lescrauwaet, A. K., Fockedey, N., Debergh, H., Vincx, M. & Mees, J. Hundred and eighty years of fleet dynamics in the Belgian sea fisheries. *Rev. Fish Biol. Fish.* **23,** 229–243 (2013).

96. Zeller, D., Graham, R. & Harper, S. Reconstruction of Total Marine Fisheries Catches. *Too Precious to Drill Mar. Biodivers. Belize* **19,** 142–151 (2011).

97. Belbase, K. & Morgan, R. Food security and nutrition monitoring for drought relief management: The case of Botswana. *Food Policy* **19,** 285–300 (1994).

98. Masih, I., Maskey, S., Mussá, F. E. F. & Trambauer, P. A review of droughts on the African continent: A geospatial and long-term perspective. *Hydrol. Earth Syst. Sci.* **18,** 3635–3649 (2014).

99. Kolding, J., van Zwieten, P., Marttin, F. & Poulain, F. *FISHERIES IN THE DRYLANDS OF SUB-SAHARAN AFRICA “ Fish come with the Rains ” Building resilience for fisheries-dependent livelihoods to enhance food security and nutrition in the drylands. FAO Fisheries and Aquaculture Circular No.1118*. **1118,** (2016).

100. Battaglini, E. *The Black Sea — A Dramatic Recovery. Environment Matters Annual Review. World Bank*. (2008).

101. Keskin, Ç. *et al.* The Marine Fisheries in Bulgaria’s Exclusive Economic Zone, 1950–2013. *Front. Mar. Sci.* **4,** 1–10 (2017).

102. FAO. *Information on Fisheries Management in the Republic of Burundi*. (1999).

103. FAO. Central African Republic: farming and families hit by insecurity. *Food and Agriculture Organization of the United Nations* http://www.fao.org/news/story/en/item/263271/icode (2014).

104. Springer, K. A 400 year old port - with no boats. *BBC Travel* http://www.bbc.com/travel/story/20151110-preservin (2015).

105. Ramdeen, R., Harper, S. & Zeller, D. Reconstruction of total marine fisheries catches for Dominica (1950-2010). *Fish. Catch Reconstr. Islands, Part IV. Fish. Cent. Res. Reports. Sea Around Us Fish. Centre, Univ. Bristish Columbia* **22(2),** 33–41 (2014).

106. Ram, R., Chand, R. V. & Southgate, P. C. An overview of sea cucumber fishery management in the Fiji islands. *Su Ürünleri Derg.* **11,** 191–205 (2016).

107. Gephart, J. A., Deutsch, L., Pace, M. L., Troell, M. & Seekell, D. A. Shocks to fish production: Identification, trends, and consequences. *Glob. Environ. Chang.* **42,** 24–32 (2017).

108. Beare, D. J. *et al.* Long-term increases in prevalence of North Sea fishes having southern biogeographic affinities. *Mar. Ecol. Prog. Ser.* **284,** 269–278 (2004).

109. Moutopoulos, D. K. & Stergiou, K. I. Spatial disentangling of Greek commercial fisheries landings by gear between 1928-2007. *J. Biol. Res.* **18,** 265–279 (2012).

110. Mohammed, E. & Lindop, A. Grenada: Reconstructed Fisheries Catches, 1950-2010. *Fish. Cent. Res. Reports, Univ. Br. Columbia* **86,** 6–9 (2006).

111. FAO. *National Aquaculture Sector Overview. Hungary. National Aquaculture Sector Overview Fact Sheets. Text by Varadi, L. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 1 January 2003.* (2003).

112. Piroddi, C. *et al.* Reconstruction of Italy’s marine fisheries catches (1950-2010). *Fish. Cent. Work. Pap. Ser.* **22,** 1–41 (2014).

113. FAO. *Fishery Country Profile. Jamaica - Structure and Characteristics of the Fishing Industry. Food and AGricultural Organization of the United Nations*. (2005).

114. Aiken, K., Kong, A., Smikle, S., Appeldoorn, R. & Warner, G. Managing Jamaica’s queen conch resources. *Ocean Coast. Manag.* **49,** 332–341 (2006).

115. Ojuok, J. E., Njiru, M., Ntiba, M. J. & Mavuti, K. M. The effect of overfishing on the life-history strategies of Nile tilapia, Oreochromis niloticus (L.) in the Nyanza Gulf of Lake Victoria, Kenya. *Aquat. Ecosyst. Heal. Manag.* **10,** 443–448 (2007).

116. McClanahan, T. R., Hicks, C. C. & Darling, E. S. Malthusian overfishing and efforts to overcome it on Kenyan coral reefs. *Ecol. Appl.* **18,** 1516–1529 (2008).

117. SPREP Pacific Regional Environment Programme. *State of the environment report. Government of the Republic of Kiribati*. (2004).

118. Shon, S., Harper, S. & Zeller, D. Reconstruction of Marine Fisheries Catches for the Democratic People’s Republic of Korea (North Korea) from 1950-2010. *Fish. Cent. Work. Pap. Ser. Univ. Br. Columbia* **20,** 1–11 (2010).

119. Mathews, C. P., Kedidi, S., Fita, N. I., Al-Yahya, A. & Al-Rasheed, K. Preliminary assessment of the effects of the 1991 Gulf War on Saudi Arabian prawn stocks. *Mar. Pollut. Bull.* **27,** 251–271 (1993).

120. Pauly, D. & Zeller, D. *So long, and thanks for all the fish: The Sea Around Us, 1999-2014 A Fifteen-Year Retrospective*. *Fisheries Centre, University of British Columbia* (2016).

121. FAO NACA SEAFDEC BOBP-IGO. *Tsunami Impact on Fisheries and Aquaculture in Malaysia*. (2005).

122. Adam, M. Declining Catches of Skipjack in the Indian Ocean – Observations from the Maldives. in *Proceedings of the 10th Meeting of the Working Party on Tropical Tuna, Indian Ocean Tuna Commission* 1–2 (2010).

123. Doherty, B., Herfaut, J., Manach, F. Le, Harper, S. & Zeller, D. Reconstructing domestic marine fisheries in Mayotte from 1950-2010. *Fish. catch Reconstr. West. Indian Ocean. 1950-2010* 53–66 (2015).

124. Ramdeen, R., Ponteen, A., Harper, S. & Zeller, D. in *Fisheries catch reconstructions: Islands, Part III. Fisheries Centre Research Reports 20(5). Fisheries Centre, University of British Columbia* 69–78 (2012).

125. Harper, S., Frotté, L., Bale, S., Booth, S. & Zeller, D. in *Fisheries catch reconstructions: Islands, Part I. Fisheries Centre Research Reports 17 (5). Fisheries Centre, University of British Columbia* (eds. Zeller, D. & Harper, S.) 67–76 (2009).

126. Clark, M. Are deepwater fisheries sustainable? — the example of orange roughy (*Hoplostethus atlanticus*) in New Zealand. *Fish. Res.* **51,** 123–135 (2001).

127. Zylich, K., Harper, S., Winkler, N., and Zeller, D. in *Fisheries catch reconstructions: Islands, Part III. Fisheries Centre Research Reports 20(5). Fisheries Centre, University of British Columbia* (eds. Harper, S. et al.) 77–86 (2012).

128. Lingard, S., Harper, S., Ota, Y. & Zeller, D. in *Fisheries catch reconstructions: Islands, Part II. Fisheries Centre Research Reports 19(4). Fisheries Centre, University of British Columbia* (eds. Harper, S. & Zeller, D.) 73–84 (2011).

129. Anticamara, J. A. & Go, K. T. B. Spatio-Temporal Declines in Philippine Fisheries and its Implications to Coastal Municipal Fishers’ Catch and Income. *Front. Mar. Sci.* **3,** 1–10 (2016).

130. Bӑnaru, D., Manach, F. Le, Färber, L., Zylich, K. & Pauly, D. From bluefin tuna to gobies: a reconstruction of the fisheries catch statistics in Romania, 1950-2010. *Fish. Cent. Work. Pap. Ser.* 11 (2015).

131. Mohammed, E., Lindop, A. & Lucia, S. St. Lucia: Reconstructed fisheries catches, 1950 -2010. *Fish. Cent. Work. Pap. Ser. Univ. Br. Columbia* **53,** 1950–2010 (2015).

132. Pena, M., Oxenford, H. A., Parker, C. & Johnson, A. Biology and fishery management of the white sea urchin, Tripneustes ventricosus, in the eastern Caribbean. *FAO Fisheries and Aquaculture Circular No 1056* 1–43 (2010).

133. Itano, D. G. Small-scale fisheries for bottomfish in American Samoa (1961-1987). *SPC Fish. Newsl. #77* 28–32 (1996).

134. Martin, J. I. Fisheries in the Seychelles and Fisheries Agreements with the EU. D. *Directorate-General for Internal Policies of the Union. Policy Department B: Structural and Cohesian Policies* 64 (2011).

135. Doyle, B., Harper, S., Jacquet, J. & Zeller, D. in *Fisheries catch reconstructions: Islands, Part III. Fisheries Centre Research Reports 20(5). Fisheries Centre, University of British Columbia [ISSN* (eds. Harper, S. et al.) **20,** 2080 (2014).

136. Baust, S., Teh, L., Harper, S. & Zeller, D. in *Fisheries catch reconstructions in the Western Indian Ocean, 1950-2010* (eds. Le Manach, F. & Pauly, D.) **23(2),** 129–150 (2015).

137. De Silva, D. A. M. & Yamao, M. Effects of the tsunami on fisheries and coastal livelihood: A case study of tsunami-ravaged southern Sri Lanka. *Disasters* **31,** 386–404 (2007).

138. Hornby, C., Harper, S., MacDonald, J. & Zeller, D. Reconstruction of Suriname’S Marine Fisheries Catches From 1950-2010. *Fish. Cent. Work. Pap. Ser. Univ. Br. Columbia* **49,** 1–29 (2015).

139. Burkhardt-Holm, P., Peter, A. & Segner, H. Decline of fish catch in switzerland: Project fishnet: A balance between analysis and synthesis. *Aquat. Sci.* **64,** 36–54 (2002).

140. Ulman, A., Saad, A., Zylich, K., Pauly, D. & Zeller, D. in *Global Atlas of Marine Fisheries: A Critical Appraisal of Catches and Ecosystem Impacts* (eds. Pauly, D. & Zeller, D.) 406 (sland Press, Washington DC, USA., 2017).

141. Jacquet, J. & Zeller, D. in *Reconstruction of marine fisheries catches for key countries and regions (1950- 2005)* (eds. Zeller, D. & Pauly, D.) **15(2),** 49–60 (2007).

142. Ulman, A. *et al.* From bonito to anchovy: A reconstruction of Turkey’s marine fisheries catches (1950-2010). *Mediterr. Mar. Sci.* **14,** 309–342 (2013).

143. Morell, V. Can Science Keep Alaska’s Bering Sea Pollock Fishery Healthy? *Science (80-. ).* **326,** 1340–1342 (2009).

144. Taylor, G. T. *et al.* Ecosystem responses in the southern Caribbean Sea to global climate change. *Proc. Natl. Acad. Sci.* **109,** 19315–19320 (2012).

145. Rueda-Roa, D. *et al.* Spatial variability of Spanish sardine (Sardinella aurita) abundance as related to the upwelling cycle off the southeastern Caribbean Sea. *PLoS One* **12,** 1–25 (2017).

146. Teh, L., Zeller, D., Zylich, K., Nguyen, G. & Harper, S. Reconstructing Vietnam’s Marine Fisheries Catch 1950-2010. *Fish. Cent. Work. Pap. Ser. Univ. Br. Columbia* **17,** 1–37 (2014).

147. FAO. *National Aquaculture Sector Overview. Albania. Text by Cobani, M. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2015).

148. FAO. National Aquaculture Sector Overview. Congo. National Aquaculture Sector Overview Fact Sheets. *In: FAO Fisheries and Aquaculture Department [online]. Rome. Text by Ebounaka, H. . Updated 2 May 2005. [Cited 9 February 2018]* (2005).

149. FAO. *National Aquaculture Sector Overview. Democratic Republic of Congo. National Aquaculture Sector Overview Fact Sheets. Text by Kombozi, G.L.B. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2006).

150. FAO. *Drought characteristics and management in the Caribbean. Food and Agriculture Organization of the United Nations*. (2016).

151. FAO. *National Aquaculture Sector Overview. Ecuador. National Aquaculture Sector Overview Fact Sheets. Text by Schwarz, L. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

152. Christiansen, D. H., Østergaard, P. S., Snow, M., Dale, O. B. & Falk, K. A low-pathogenic variant of infectious salmon anemia virus (ISAV-HPR0) is highly prevalent and causes a non-clinical transient infection in farmed Atlantic salmon (Salmo salar L.) in the Faroe Islands. *J. Gen. Virol.* **92,** 909–918 (2011).

153. Artigas, L. F., Vendeville, P., Leopold, M., Guiral, D. & Ternon, J. Marine Biodiversity in French Guiana : Estuarine, Coastal, and Shelf Ecosystems Under the Influence of Amazonian Waters. *Gayana* **67,** 302–326 (2003).

154. FAO. *Iraq: Agriculture And Livelihoods Needs Assessment In the Newly Liberated Areas of Kirikuk, Ninewa and Salahadin. Food and Agricultural Organization of the United Nations.* (2016).

155. Ponia, B. *A review of aquaculture in the Pacific Islands 1998-2007*. *SPC Aquaculture Technical Papers* (2010).

156. UNEP. Integrated Assessment of Trade-related Policies and Biological Diversity in the Agricultural Sector in Madagascar. in *Integrated Assessment of Trade-related Policies and Biological Diversity in the Agriculture Sector Capacity Building Workshop* https://unep.ch/etb/initiatives/Executive%20Summar (2006).

157. The World Bank. Reducing Disease Risk In Aquaculture. *World Bank. Agric. Environ. Serv.* 119 (2014).

158. FAO. *National Aquaculture Sector Overview. Malta. National Aquaculture Sector Overview Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2003).

159. Iborra Martin, J. Fisheries in Martinique. *Policy Dep. Struct. Cohesioan Policies. Dir. Gen. Intern. Policies Union* 18 (2007).

160. Soto-Rodriguez, S. A., Gomez-Gil, B. & Lozano, R. ‘Bright-red’ syndrome in Pacific white shrimp Litopenaeus vannamei is caused by Vibrio harveyi. *Dis. Aquat. Organ.* **92,** 11–19 (2010).

161. FAO. *National Aquaculture Sector Overview. Morocco. National Aquaculture Sector Overview Fact Sheets. Text by Abdellatif, O.; El- Ahdal, M. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

162. FAO. *National Aquaculture Sector Overview. Pakistan. National Aquaculture Sector Overview Fact Sheets. Text by Hayat, M. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

163. FAO. *National Aquaculture Sector Overview. Panamá. National Aquaculture Sector Overview Fact Sheets. Text by Pretto Malca, R. In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

164. Andriesse, E. & Lee, Z. Viable insertion in agribusiness value chains? Seaweed farming after Typhoon Yolanda (Haiyan) in Iloilo Province, the Philippines. *Singap. J. Trop. Geogr.* **38,** 25–40 (2017).

165. FAO. in *In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

166. FAO. *Review of the State of World Aquaculture.* *FAO Inland Water Resources and Aquaculture Service, Fishery Resources Division. FAO Fisheries Circular. No. 886, Rev.1. Rome* (1997).

167. FAO. in *In: FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).

168. FAO. National Aquaculture Sector Overview. Visión General del Sector Acuícola Nacional - Venezuela (República Bolivariana de). National Aquaculture Sector Overview Fact Sheets. *FAO Fisheries and Aquaculture Department [online]. Rome.* (2005).