***Overview of Global Water & Fisheries Issues -*** *John Wibberley[[1]](#footnote-1) SW TAA* [**www.taa.org,uk**](http://www.taa.org,uk) *2017*

The 2017 declared famine in parts of Nigeria, South Sudan, Somalia and Yemen is in part attributed to conflict but much exacerbated by drought with increasingly erratic rains. Improved resource management of both water and fisheries are significant long-term requirements. UN Development Goal No.14 (2015) states, ‘*Conserve and sustainably use the oceans, seas and marine resources*’. While water and fish scarcity (both freshwater and sea species) are challenges, so are floods and means of slowing flows! Thus both water and fish-stock management are themes of this overview.

**Water:** The term ‘resource wars’ entered the international management vocabulary around 1980. Capture and control of water catchments is seen as motivating land grabs. Some 89% of the world’s people have access to ‘improved’ water supplies, with huge variations from 93% in India - meaning that 90M people there do NOT have such access, to 33% in Somalia where 6.5M people do NOT have access to improved water sources. Arguably, water security is the priority within ecosystem security along with food, energy, livelihoods and geopolitical security. It is the most crucial element within natural capital and its judicious management for both quantity and quality.

Diarrhoea is associated with poor water, defective sanitation and inadequate hygiene, with some 4 billion cases/year resulting in 1.8bn deaths (90% children under 5 years old). Basic home improvements such as pit latrines and adjacent tip-taps for washing hands with soap can cut deaths by 33%. Alongside this is protecting water sources by such measures as spring-capping. By contrast with both chronic and acute water shortages in remoter rural areas is the huge wastage of water in hotels and profligate forms of tourism and irrigation. Since some 70% of the world’s water is used for irrigation, it is vital that this is efficient. On a smaller scale, such more careful irrigation may include collecting roof-water, building local small-scale dams – notably sand-dams (Lasage *et al*, 2008), using bucket-lines with drip irrigation for vegetables, and micro-catchment rainwater harvesting. On a larger field scale, drip irrigation as developed in Israel during the 1960s and 1970s offers a means of effective water rationing, along with some of the pioneering precision agriculture now much vaunted by agritech proposals. Impressive field-level doubling or more of yields is being achieved on a huge scale through Conservation Farming, the effectiveness of which is substantially based on water conservation within the soil, coupled with disciplined crop management.

Integral water management can supply domestic and agricultural water requirements while simultaneously yielding fish from reservoirs, energy via hydro-electricity and supporting sustainable tourism including sport fishing. Some 72% of earth’s surface is ocean and some two-thirds of this historically classified as ‘high seas’ where no nation is designated to manage it. Ezekwesili (2016) urges support for the UN Global Ocean Commission and the IMO (International Marine Organisation), and for initiatives such as 2015-25 Decade of African Seas & Oceans, which seeks to regenerate oceans for the benefit of all, including regulating illegal & exploitative industrial fishing.

**Fisheries:** There are too many fishing boats chasing too few fish, necessitating international monitoring, policies and management (Ezekwesili, 2016). Clover (2005) presented a comprehensive overview of the global fishing situation, inspired (p.88) by one of his fishing heroes, Michael Graham once of Lowestoft Laboratory UK, who proposed ‘The Great Law of Fishing’ – *Fisheries that are unlimited become unprofitable*, echoed by Hardin (1968). The 1992 collapse of Newfoundland cod fisheries well-illustrated this truth. Possible fishery management alternatives may include:-

1. Continued trawl fishing guided by increasingly sensitive precision fish locators: beware!
2. Large-scale ocean aquaculture for world markets, including coastal cage-fisheries: caution.
3. Smaller-scale aquaculture via communal and farm-based fish ponds: manage well.
4. Selective line-caught fishing to ensure more discriminating and slower offtakes: monitor.
5. Regulated fishing at sea, on rivers and lakes via local management agreements: collaborate.

India proposed in 1990 to provide some 8 million new jobs by 2000 through developing aquaculture around its coasts, a feat it achieved with parallel loss of protective mangrove swamps while capturing the lead in global prawn exports. While challenging FAO’s rather simplistic prognosis that ‘more aquaculture’ is the likely solution to overfishing (though it has been!), Clover (2005, p.188) complimented their analysis of the pressures affecting world fisheries. Iceland, with its use of ITQs (Individual Transferable Fishing Quotas) and severe penalties for illegal fishing gets better marks from Clover (pp.195-202) than most other administrations of fisheries – especially the EU. However, New Zealand’s pioneering of marine reserves is acclaimed by Clover (Chapter 14) and commended for other coastal waters to provide integrated fish-stock management, ecosystem renewal and sustainable tourism. UK’s Marine Nature Reserve around Lundy Island gets only passing mention.

**Fish Farming in Africa**: The present writer’s interest in fish farming began in the mid-1970s when we lived close to the Panyam Fish Farm, Nigeria, then said to be Africa’s largest at 309 ha. Under Government control since its establishment in the 1950s by Austrians using *Cyprinus carpio*, it became so moribund by 2016 that the Plateau State Government entered a Public-Private Partnership with Solbec Ltdin an attempt to resuscitate the internally generated revenue (IGR) of Plateau State Government. It is reckoned to have the capacity to produce about 4.9 tonnes of fish per hectare and over 10 million fingerlings annually. Plateau State also has about 20 dams and reservoirs with an estimated water surface area of 673 hectares, as well as 12 natural lakes with a water surface area of about 365 hectares. In addition, of over 1,000 abandoned mining ponds in the State, already 24 have been certified fit for fish production.

Fish farming observed and encouraged elsewhere, in both East and Southern Africa and India, has featured notably Tilapia. Tilapia are warm-water finfish native to West and Central Africa which have spread widely throughout Africa and elsewhere in the tropics where water temperatures are around 25ᵒC and they can reach marketable size of 200-400 g each in six months. Unlike salmon, they are non-carnivorous and can grow on simple diets of algae and zooplankton in ponds. Tilapia can be cooked whole or filleted; they can be smoked, dried or frozen. Tilapia are very adaptable being tolerant of poor water quality - high turbidity, low oxygen tensions (they can gulp air at the surface for limited periods); they must be protected from predators such as monitor lizards and fish-eating birds. Tilapia are now classified into 3 genera *- Tilapia, Sartherodon and Oreochromis;* the last two are mouth-brooders and females of 300g can brood from 200-400 fry (baby fish). Most of the species farmed are of the genus *Oreochromis;* according to Arrignon & Dickson (1998) *O.niloticus* is regarded as the best for most fish farms being able to feed omnivorously on both plankton and larger, supplementary food particles (such as rice bran and soya, groundnut or cottonseed cake. They note that all Tilapia tend to breed at small sizes when their population densities are high but *O.niloticus* shows this tendency to a lesser extent and only breeds at larger sizes. Strategic introduction of small numbers of predatory *Gymnarchus* fish can also help to overcome the problem of some Tilapia overcrowding with size limitation. Production for pond systems fertilised (with compost or manures), with water above 22ᵒC and unsexed fish stocked at 1-2 per square metre can be around 3-4 t/ha/yr, up to 5 t/ha/yr with supplementary feed (precision fed). These yields can be doubled with all male fish and with partial removal of fish to avoid overcrowding. Addition of fresh water to dilute accumulating ammonia plus aeration with solar-electric-operated paddle wheels can intensify production even further to achieve stocking rates of around 40,000 fish per hectare yielding some 20t/ha/year. Self-cleaning tanks prevent Tilapia breeding and enhance growth rates yet faster.

Tilapia can be grown in combination with deep-water padi rice, or with retted cassava (soaked to remove its toxins) when Tilapia can yield 4t/ha/yr. A rice padi can also be a good nursery for growing fry to 30g. Animal pens can be built over ponds to supply manures - pigs and poultry being both commonly used so that Tilapia suit integrated farming systems of various sorts, as done long ago in traditional Chinese farming systems (King, 1911)! Let’s integrate water and fish better now!

**References & Further Reading**

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