1. Introduction: navigating multilevel governance in aquaculture

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This volume of essays examines the legal and related policy issues associated with the development of the aquaculture sector, principally in relation to marine aquaculture or mariculture operations. There is little doubt about the current and future global importance of aquaculture. The United Nations Food and Agriculture Organization’s (FAO) report on *The State of World Fisheries and Aquaculture* (2014) notes that global fish production has grown steadily ‘with food fish supply growing at an average annual rate of 3.2 per cent, outpacing world population growth at 1.6 per cent’.1 However, most observers consider that the capture fishery is unlikely to grow2 and thus, if overall fish production is to continue to outpace population growth and contribute to increased availability of food protein and food security, this enhanced production will need to come from the aquaculture sector.

The importance of fish-based protein production for food security can hardly be overestimated. According to the FAO, ‘[f]ish protein can represent a crucial nutritional component in some densely populated countries where total protein intake levels may be low’.3 The global capture fishery in marine waters was 82.6 million tonnes in 2011 and 79.7 million tonnes in 2012 (with the difference principally due to a decline in the anchoveta catch).4 The total aquaculture production in 2013 (both marine and inland) was about 97.2 million tonnes, including close to 70.2 million

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1 United Nations Food and Agriculture Organization (FAO), *The State of World Fisheries and Aquaculture, Opportunities and Challenges* (FAO 2014) 3.
2 The FAO, for example, notes (ibid 10) that the overall level of the capture fishery is ‘generally stable’ with some variations up and down both regionally and by fish stocks. See also at 37 et seq suggesting that the world’s marine fisheries have ‘exhibited a general declining trend’ since peaking at 86.4 million tonnes in 1996.
3 ibid 4.
4 ibid 10.
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tonnes of food fish and 27 million tonnes of aquatic plants (principally seaweeds).\textsuperscript{5} Inland aquaculture operations continue to dominate. Of the 70.2 million tonnes of food fish production, close to 44.7 million tonnes is attributable to inland aquaculture.\textsuperscript{6} However, finfish grown in mariculture operations generally have a higher unit value than species grown in inland aquaculture operations. Thus, broken down by value, food fish from mariculture operations contribute about 44 per cent of the total; broken down by production such operations contribute nearly 36 per cent.\textsuperscript{7} The growth in the aquaculture sector has been both rapid and dramatic. Thus, while aquaculture contributed 43.1 per cent of total production in 2013,\textsuperscript{8} it was only 5 per cent in 1962 and 37 per cent in 2002.\textsuperscript{9}

The top ten aquaculture-producing countries are China, Indonesia, India, Vietnam, Philippines, Bangladesh, Republic of Korea, Norway, Egypt and Thailand.\textsuperscript{10} China dwarfs all other producing countries with 58.8 per cent of total production; Indonesia, the next largest producer, has only a 13.5 per cent share.\textsuperscript{11} The vast majority of aquaculture by production (not value) comes from Asia. In 2012, Asia was responsible for over 88 per cent of world total production with the Americas contributing 4.78 per cent, Europe 4.32 per cent and Africa 2.23 per cent.\textsuperscript{12}

A wide range of species are cultivated in aquaculture. Over 600 aquatic species are raised, including finfishes, molluscs, crustaceans, amphibians, reptiles, aquatic invertebrates and algae.\textsuperscript{13} A total of 575 aquatic species and their groups have been registered in the FAO Global Aquaculture Production statistics database.\textsuperscript{14}

Both the capture fishery and farmed fish operations are a significant source of employment and livelihood for millions of people globally, on both a full- and part-time basis. For example, some 14 million people were employed in fisheries activities in China (9.2 million in the capture fishery and 5.2 million in aquaculture).\textsuperscript{15} There are additional jobs in the secondary sector including fish processing and marketing. As some of the

\textsuperscript{5} FAO, \textit{Global Aquaculture Production Statistics Database Updated to 2013: Summary Information} (FAO 2015) 1.
\textsuperscript{6} ibid.
\textsuperscript{7} ibid, Tables 1 and 2.
\textsuperscript{8} ibid 1.
\textsuperscript{9} FAO (n 1) 64.
\textsuperscript{10} FAO (n 5) Table 4.
\textsuperscript{11} ibid.
\textsuperscript{12} FAO (n 1) 20, Table 6.
\textsuperscript{13} ibid 24.
\textsuperscript{14} FAO (n 5) 1.
\textsuperscript{15} FAO (n 1) 30, Table 12.
chapters in this volume demonstrate, aquaculture operations, specifically mariculture operations, offer employment opportunities in remote coastal areas and thus contribute to the sustainability of those communities.16

At the same time, expansion of the aquaculture industry is not without its critics and challenges. There are serious concerns about the biodiversity and environmental implications of intensive fish farming operations including ‘benthic enrichment, eutrophication of the water column, escapes and aesthetic loss’.17 The potential impacts of disease or parasite outbreaks on wild populations and the use of fish-based feeds in aquaculture and their potentially detrimental effects on poorly managed wild fish stocks are other issues.18 Release of veterinary drugs and biocides to the environment from fish farms is another concern.19 The use of genetically modified organisms in aquaculture also looms as a potential challenge.20 The effects of aquaculture on climate change through energy consumption and by location in areas of high carbon sequestration value, such as mangroves and seagrass beds, are further considerations.21

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This volume highlights the multilevel governance reality surrounding aquaculture with global, regional and national dimensions.22 The first part, Global Perspectives, comprising three chapters, provides the international

16 See, for example, the chapters by Slater (Scotland), Myklebust (Norway) and Jóhannsdóttir (Iceland) in this volume.
19 ibid 19.
22 For a review of the opportunities and challenges surrounding multilevel governance, see Inger Weibust and James Meadowcroft (eds), Multilevel Environmental Governance: Managing Water and Climate Change in Europe and North America (Edward Elgar 2015).
law and policy context for aquaculture. The first chapter in this part (VanderZwaag) canvasses the treatment of aquaculture operations under the main law of the sea provisions, as well as the FAO’s Code of Conduct on Responsible Fisheries\textsuperscript{23} and its technical guidelines. VanderZwaag also discusses a range of multilateral environmental agreements (MEAs) that have implications for mariculture operations including the Convention on Biological Diversity (CBD)\textsuperscript{24} and the Ramsar Wetlands Convention.\textsuperscript{25} Next Whitsitt and Bankes examine the relevance of international trade law instruments for aquaculture as well as relevant trade-related MEAs (specifically the Convention on International Trade in Endangered Species of Wild Fauna and Flora\textsuperscript{26} and the Cartagena Protocol on Biosafety\textsuperscript{27} to the CBD). Rounding out this part, Humphries examines global instruments dealing with intellectual property and access and benefit-sharing issues in the aquaculture sector, including the Nagoya Protocol.\textsuperscript{28}

The second part of the volume, Regional Perspectives, considers regional issues in the context of aquaculture. Long’s chapter considers the development of law and policy in the European Union as it relates to aquaculture, while Dahl’s chapter considers how regional fisheries management organizations and other regional science-based organizations, such as the International Council for the Exploration of the Sea, have dealt with aquaculture issues. While such organizations have traditionally focused on capture fisheries, there is some evidence that they are increasingly addressing mariculture operations as well. A case in point examined by Dahl is that of the North Atlantic Salmon Conservation Organization.

Part three of the volume, National Perspectives, by far the largest part, comprises a set of national studies of the legal and policy framework for the aquaculture sector in 12 different jurisdictions. These chapters cover the following jurisdictions: Australia, Canada, Chile, China, Iceland, India, New Zealand, Norway, Philippines, United Kingdom and Scotland, South Africa and the United States. Clearly this coverage is not universal, but we do claim that it is reasonably representative. It includes developed and

\begin{itemize}
  \item\textsuperscript{23} FAO 1995.
  \item\textsuperscript{24} 5 June 1992, 1760 UNTS 79.
  \item\textsuperscript{25} Convention on Wetlands of International Importance especially as Waterfowl Habitat, 2 February 1971, 996 UNTS 245.
  \item\textsuperscript{26} 3 March 1973, 993 UNTS 243.
  \item\textsuperscript{27} Cartagena Protocol on Biosafety to the Convention on Biodiversity, January 29, 2000, 2226 UNTS 208.
  \item\textsuperscript{28} Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, 29 October 2010, UNEP/CBD/COP/DEC/X/1.
\end{itemize}
developing countries from the north and south. It includes major producers and exporters (China and India) and it includes major consuming states and blocs such as the EU and the United States. It also includes federal states (e.g., India, the United States, Australia and Canada\textsuperscript{29}) and unitary states (e.g., New Zealand and Norway) and states with legal systems grounded in the common law, civil law, Roman-Dutch law and Marxist legal theory.\textsuperscript{30} While these chapters are principally concerned with marine aquaculture operations, several of the chapters (especially those covering China, India and the Philippines) do refer to freshwater operations and in particular discuss aquaculture operations in brackish water involving the interface between salt water and fresh water, especially in the context of mangrove areas.

While not prescriptive as to form, and recognizing that not all headings would be appropriate for each jurisdiction and chapter, the editors of the volume did invite the authors of the country chapters to address a number of common issues. Thus, authors were invited to

- provide an overview of the aquaculture industry covering issues such as the type of species cultivated and volume and value of production and the future of the sector;
- discuss the overall law and policy framework for aquaculture development and management, and in federal jurisdictions address the division of responsibility as between federal and sub-federal units;
- review key judicial cases relevant to aquaculture and identify what seem to have been the most contentious issues;
- assess, where relevant, how the aquaculture regime accommodates or addresses the rights and interests of indigenous peoples;
- discuss how the jurisdiction has translated (or not) key international legal principles such as integrated management, marine spatial planning, sustainable development, the ecosystem approach, precaution, public participation, social equity and the use of environmental

\textsuperscript{29} And see Glazewski (this volume) describing South Africa as a quasi-federal state, a description which some would find equally applicable to the European Union.

\textsuperscript{30} See also the classification adopted in Hishamunda and others (n 17) 6–7, referring to three different governance models for aquaculture hierarchical governance (e.g., China), market governance (dominant in Europe but where the excesses of the market are modified by domestic regulations on environmental protection, health and safety), and participatory governance models (referring to the growth of community partnerships and neighbourhood models in jurisdictions such as Chile and Scotland).
impact assessments and strategic environmental assessments into domestic law and policy relating to aquaculture; and
● examine, where appropriate, examples of aquaculture siting disputes and resolution successes.

The volume concludes with a summary of common themes emerging from the chapters and lessons to be learned. Common themes include diversity in scales and ambitions for aquaculture; provision for licensing, environmental impact assessments and ecological limits; concerns over climate change and ocean acidification; competition for ocean space and marine spatial planning and zoning; siting decisions and appeals; consideration of indigenous communities and benefit sharing; federalism and subsidiarity; risk management; private standard setting; and the role of courts and quasi-judicial bodies.

This volume adds substantially to the quite limited aquaculture law and policy literature, especially in the field of comparative legal analysis. Previous studies stand out for the limited number of country comparisons or the broad nature of governance reviews.

Before launching into the complexities raised by multilevel law and policy governance, readers should be aware of some of the definitional issues relating to aquaculture. National jurisdictions and international entities and organizations define aquaculture in different ways. The FAO, for example, defines aquaculture as

the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture.\footnote{FAO Fisheries Department, \textit{Aquaculture Development} (FAO Technical Guidelines for Responsible Fisheries No 5, FAO, 1997) 6.}

\footnote{See, for example, David L VanderZwaag and Gloria Chao (eds), \textit{Aquaculture Law and Policy: Towards Principled Access and Operations} (Routledge 2006) exploring approaches in Canada, Australia, New Zealand and the United States; Helen Glenn and Hannah White, ‘Legal Traditions, Environmental Awareness, and a Modern Industry: Comparative Legal Analysis and Marine Aquaculture’ (2007) 38 Ocean Dev & Int’l L 71, comparing governance in Scotland, Greece, Slovenia and Israel.}

\footnote{See Hishamunda and others (n 17); Patrice Talla Takoukam and Katrine Erikstein, \textit{Aquaculture Regulatory Frameworks: Trends and Initiatives in National Aquaculture Legislation} (FAO Legal Papers Online No 91, FAO, July 2013).}

\footnote{FAO Fisheries Department, \textit{Aquaculture Development} (FAO Technical Guidelines for Responsible Fisheries No 5, FAO, 1997) 6.}
Canadian policy documents have adopted a similar definition. EU law defines aquaculture to mean ‘the rearing or cultivation of aquatic organisms using techniques designed to increase the production of the organisms in question beyond the natural capacity of the environment; the organisms remain the property of a natural or legal person throughout the rearing or culture stage, up to and including harvesting’.

These definitions reference two important concepts: enhanced cultivation over a natural baseline and property rights. As to the first, the definitions emphasize cultivation and enhancement beyond what might be achieved in the natural environment thereby suggesting the parallels between the agricultural and aquaculture sectors. But the definitions also address the distinctive property and ownership treatment of aquaculture operations and the product of those operations. This serves to draw attention to the fact that while capture fisheries are typically, if not universally, subject to the rule of capture and the freedom to capture (i.e. fisheries are open to all, or to a category of licensees, and there is no ownership interest in the target stock until reduced to possession), aquaculture operations are characterized by private ownership of the stock from rearing to harvest. This suggests that the creation of new mariculture operations may have significant distributional and social justice implications especially where such operations effectively foreclose access by others to what was previously an open access space and resource. This emerges as a significant theme in several chapters in this volume, especially the chapter on India, and clearly points to the important role that law plays in clarifying these property rights and thereby facilitating investment.

These common understandings about the ownership of the products of aquaculture operations seem to inform all of the jurisdictions canvassed in this volume with the additional idea that the exclusive right to conduct mariculture operations in any particular part of the marine space typically requires some sort of grant of lease or licence from the state. This grant of property rights is distinct and separate from any regulatory permit or authorization that an operator might require to commence operating an aquaculture facility.

These definitions evidently exclude traditional hatchery operations,

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34 Fisheries and Oceans Canada, Aquaculture Policy Framework (Government of Canada 2008).
36 See Hishamunda and others (n 17) 4, ‘Aquaculture is a form of agriculture with similar private property rights . . . ’.
which are generally targeted at enhancing wild populations (or even introducing new species into the wild). These operations are excluded since they typically involve the release of juvenile fish that can then be freely captured by others. Thus there is no continuous chain of ownership as there is in the case of the typical aquaculture operation.\textsuperscript{37} By contrast, cultured shellfish operations (e.g., for oysters) will generally fall within the definitions reproduced above\textsuperscript{38} as will operations designed to grow and harvest marine plants. Ranching operations (in which young fish are caught in the wild and then reared to harvest in cages) also have a plausible claim to be included within these definitions of aquaculture.\textsuperscript{39} Other definitions are broader and more general and explicitly include ranching in the definition of aquaculture. Thus the United States defines aquaculture as ‘the propagation and rearing of aquatic species in controlled or selected environments, including, but not limited to, ocean ranching’.\textsuperscript{40}

Finally, while the term ‘aquaculture’ generally includes both marine and freshwater operations (unless qualified), the term mariculture is confined to marine aquaculture operations which are, as noted above, the focus (but not exclusively) of this volume.

\textsuperscript{37} For reference to hatchery operations in this volume see Haward (Australia).
\textsuperscript{38} Most of the chapters in this volume discuss shellfish operation as part of mariculture operations.
\textsuperscript{39} For discussion of ranching operations in this volume see Haward (Australia, for salmon and tuna) and Humphries. The rearing of captured fish may also be referred to more generally as ‘grow-out’ operations.
\textsuperscript{40} 16 USC § 2802(1) (2012).