A STEWARDSHIP APPROACH TO 'LEGITIMATE INTERESTS' IN DEEP SEA GENETIC RESOURCES FOR USE IN AQUACULTURE

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I INTRODUCTION

Aquaculture's exchange and use of genetic resources sourced from areas beyond national jurisdiction (the deep sea) is emerging in a regulatory vacuum. Under the *United Nations Convention on the Law of the Sea* ('*UNCLOS*'), the deep sea includes the high seas water column ('High Seas')[1] and living resources in the seabed and ocean floor and subsoil below the water column ('The Area').[2] There is no comprehensive regime of access and benefit sharing for this area under *UNCLOS*. Instead there is a patchwork of technology and knowledge sharing obligations. The regulatory vacuum for a comprehensive access and benefit sharing regime is well documented[3] but there is less attention on how it relates to the sharing of deep sea resources for developing new aquaculture strains and technologies both within national jurisdictions and on the High Seas. While no country can make sovereign claims over deep sea genetic resources,[4] patent claims can generate private interests that may control the use of knowledge or biological samples that are important for the development of research tools and breeding materials used for genetic improvement of aquatic plant and animal species in aquaculture.[5] This raises important questions about how to balance the 'legitimate interests' of creators of genetic resource technology inventions with the public interest in sharing the knowledge or materials to create other technologies and aquatic strains. States have the opportunity to address these issues over the coming years through the proposed

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1 *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994) pt VII ('*UNCLOS*').

2 *UNCLOS* pt XI.

3 See, eg, Thomas Greiber, 'Access and Benefit Sharing in Relation to Marine Genetic Resources from Areas beyond National Jurisdiction: A Possible Way Forward' (Study Paper, Federal Agency for Nature Conservation, 2011).

4 *UNCLOS* arts 86, 89, 135.

5 See Fran Humphries, 'The Rising Tide of Access and Benefit Sharing in Aquaculture' in Nigel Bankes, Irene Dahl and David L VanderZwaag (eds), *Aquaculture Law and Policy: Global, Regional and National Perspectives* (Edward Elgar, 2016) 63 ('ABS in Aquaculture').

legally binding instrument under *UNCLOS* on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (the 'New Instrument').[6] While it is clear that this New Instrument will address issues including the sharing of benefits, capacity building and the transfer of marine technology,[7] it is less clear whether it will address aquaculture in the deep sea. The regulatory gaps may challenge policy and law makers to look to other areas of law such as patent law as well as broader principles such as human rights and equity to achieve an appropriate balance for access and benefit sharing of deep sea genetic resources for use in aquaculture.

A delegate of the Informal Working Group ('IWG'),[8] which is a body involved in developing the New Instrument, suggested that existing *UNCLOS* provisions on knowledge sharing, capacity building and transfer of marine technology 'could be incorporated mutatis mutandis in an international instrument'.[9] These provisions, however, are said to be *UNCLOS*'s 'gravest implementation gap'.[10] Jørem and Tvedt point out this is partly because the technology transfer obligations are subject to having 'due regard to all legitimate interests'.[11] Their reasoning is that patents may be a legitimate interest preventing the transfer to developing states because these exclusive rights trump the obligation to 'endeavour to foster' technology transfer in a case of conflict.[12] Given the relatively low number of patents over deep sea resources that have been claimed to date,[13] the problem concerning the regulatory vacuum that this article seeks to resolve is largely a theoretical one. This means that the implementation gap is arguably based on perceived rather than actual cases of conflict. *UNCLOS* defines neither 'legitimate interests' nor 'legitimate uses' for the purposes of its technology and knowledge sharing provisions. This article argues that the implementation gap for technology transfer obligations could be lessened by an appropriate legal benchmark for the standard of 'legitimacy' when it comes to determining whether a public or private interest in a given genetic resource falls under a current transfer obligation. A benchmark for 'legitimacy' is

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6 *Development of an International Legally-Binding Instrument under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction*, GA Res 69/292, UN GAOR, 69th sess, 96th plen mtg, Agenda Item 74(a), Supp No 49, UN Doc A/RES/69/292 (6 July 2015, adopted 19 June 2015) ('*New Instrument Resolution*').

7 Ibid para 2.

8 Ad Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable use of Marine Biological Diversity beyond Areas of National Jurisdiction ('IWG').

9 Ad Hoc Open-Ended Informal Working Group, *Letter Dated 25 July 2014 from the Co-Chairs of the Ad Hoc Open-Ended Informal Working Group to the President of the General Assembly*, 69th sess, Agenda Item 75(a), UN Doc A/69/177 (23 July 2014) [75].

10 Ad Hoc Open-Ended Informal Working Group, *Letter Dated 30 June 2011 from the Co-Chairs of the Ad Hoc Open-Ended Informal Working Group to the President of the General Assembly,* 66th sess, Agenda Item 77(a), UN Doc A/66/119 (30 June 2011) [36].

11 Ane Jørem and Morten Walløe Tvedt, 'Bioprospecting in the High Seas: Existing Rights and Obligations in View of a New Legal Regime for Marine Areas beyond National Jurisdiction' (2014) 29 *International Journal of Marine and Coastal Law* 321, 342.

12 Ibid, quoting Ad Hoc Open-ended Informal Working Group, *Letter Dated 30 June 2011*, above n 10, [36].

13 See Paul Oldham et al, 'Valuing the Deep: Marine Genetic Resources in Areas beyond National Jurisdiction' (Final Report, Department of Environment, Food and Rural Affairs (UK), July 2014) 31.

arguably also the key for balancing both interests and uses under proposed *UNCLOS* access and benefit sharing obligations as extraction and use of deep sea genetic resources becomes more common.

This article begins with a brief overview of the regulatory gaps concerning access and benefit sharing of deep sea genetic resources for use in current domestic aquaculture as well as future High Seas aquaculture. Part II introduces technologies derived from deep sea shrimp and tuna to illustrate a number of gaps in the regulation of the use of genetic resources in aquaculture. Part III outlines *UNCLOS*'s technology transfer obligations and knowledge sharing and capacity building obligations. It highlights how the key barrier to fulfilling these obligations is finding an adequate benchmark for a patentee's 'legitimate interests' and 'legitimate use' respectively. Part IV outlines technology transfer obligations under the United Nations' *International Covenant on Economic, Social and Cultural Rights* ('*Covenant*').[14] It gives insight into the human rights approach to balancing legitimate interests of the creators of genetic resource inventions on the one hand and the legitimate interests of humankind in equitably sharing the benefits of scientific progress and applications on the other. Part V gives insight into how 'legitimacy' is determined under the World Trade Organization's ('WTO') *Agreement on Trade-Related Aspects of Intellectual Property Rights* ('*TRIPS*')[15] for the purpose of determining *TRIPS*-compliant patent law defences that may facilitate technology transfer of patented genetic resource inventions. Part VI brings together human rights, patent law and law of the sea to formulate a consistent stewardship approach to benchmarking 'legitimacy'. The article concludes that the current practice of using 'geographical origin' as a benchmark under national access and benefit sharing regimes is not practical for technologies based on trans-jurisdictional deep sea genetic resources and suggests an alternative or supplementary benchmark for triggering technology transfer obligations.

II DEEP SEA GENETIC RESOURCES AND AQUACULTURE – REGULATORY VACUUMS

There are at least two sides to the regulatory vacuum relating to deep sea aquaculture. The first relates to access and benefit sharing of genetic resources originating from deep sea areas for uses within national jurisdictions including aquaculture research, breeding or product development. The second relates to managing genetic resource use in future aquaculture on the High Seas. These regulatory gaps are interrelated because the extraction of deep sea resources for farming in the High Seas is foreseeable in the near future.

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14 *International Covenant on Economic, Social and Cultural Rights*, opened for signature 16 December 1966, 993 UNTS 3 (entered into force 3 January 1976) ('*Covenant*').

15 *Marrakesh Agreement Establishing the World Trade Organization*, opened for signature 15 April 1994, 1867 UNTS 3 (entered into force 1 January 1995) annex 1C ('*Agreement on Trade-Related Aspects of Intellectual Property Rights*') ('*TRIPS*').

The first regulatory vacuum relates to emerging interests in deep sea genetic resources. In light of high costs and access difficulties associated with working in the deep sea, marine natural product research mainly concentrates on organisms *within* national jurisdictions whereas interest in deep sea organisms has only recently emerged.[16] Negotiations surrounding the New Instrument are therefore focused more on the potential economic value of marine genetic resources rather than their actual economic value.[17] Nevertheless, at the core of the debate are questions of equity. The current situation is a 'free-for-all' that benefits those who can afford the high costs of deep sea exploration. In other words, genetic resources are starting to be extracted by well resourced countries that will benefit from proprietary interests (for example patents) over new technologies arising out of their use. This leaves poorer countries with potential technological disadvantages. The trend is significant for aquaculture given that 80 per cent of globally farmed product for human consumption comes from developing countries.[18] For the aquaculture sector, the balancing of proprietary and public interests is likely to arise in the context of indirect use of biotechnology research tools derived from deep sea genetic resources (for example luciferase derived from the deep sea shrimp) and to a lesser extent direct use of the resources (for example tuna) for farming and breeding.

Conflicts over biotechnology are likely to arise where knowledge or physical specimens needed for breeding may become tied up in the race to discover and patent lucrative tools, traits, processes or derivatives associated with deep sea genetic resources. Patents have been claimed over genetic resources originating from the deep seabed in The Area (for example deep sea bacteria) as well as, more commonly, those in the High Seas (for example micro-organisms, floating sargassum weed, fish and krill).[19] This article uses bioluminescence technologies that are based on the genetic material of the deep sea shrimp (*Oplophorus gracilirostris*) to illustrate some legal issues around balancing 'legitimate interests'. Bioluminescence occurs when luciferin (a photon-emitting substrate) is oxidised by enzymes called luciferases.[20] The deep sea shrimp secretes luciferase in luminous clouds as a defence mechanism against predation.[21] Luciferases function as reporter genes in a variety of molecular

16 Oldham et al, above n 13, 13.

17 Ibid. The IWG noted that it remained difficult to assess whether the potential of genetic resources of areas beyond national jurisdiction was different from that of genetic resources of areas within national jurisdiction: Ad Hoc Open-Ended Informal Working Group, 'Intersessional Workshops Aimed at Improving Understanding of the Issues and Clarifying Key Questions as an Input to the Work of the Working Group in Accordance with the Terms of Reference Annexed to General Assembly Resolution 67/78' (Summary of Proceedings, advanced, unedited version, Ad Hoc Open-Ended Informal Working Group, 19–23 August 2013) ('Intersessional Workshops') [10].

18 Devin M Bartley et al, 'The Use and Exchange of Aquatic Genetic Resources for Food and Agriculture' (Background Study Paper No 45, Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations, September 2009) 6.

19 *Oceans and the Law of the Sea: Report of the Secretary-General*, 66th sess, Agenda Item 77(a), UN Doc A/66/70 (22 March 2011) [63].

20 Mary P Hall et al, 'Engineered Luciferase Reporter from a Deep Sea Shrimp Utilizing a Novel Imidazopyrazinone Substrate' (2012) 7 *ACS Chemical Biology* 1848, 1848.

21 Ibid 1849.

research techniques[22] and can be an important tool for aquaculture product development.[23] Researchers have patented a recombinant luciferase derived from the deep sea shrimp[24] while others have applied for patents over an engineered luciferase called NanoLuc®.[25] This article explores the legal vacuum concerning the connection between deep sea genetic material and synthetic research tools from which they are derived and whether the latter may fall within the scope of *UNCLOS* technology and knowledge sharing obligations.

In relation to the direct use of deep sea biological resources in aquaculture, conflicts may arise over proprietary interests in breeding processes and the genetic resource products they produce. With the exception of a selective breeding program in Japan,[26] current farming of bluefin tuna mostly involves the capture and fattening of wild fish (ranching) which is limited by capture fishery quotas and sustainability concerns.[27] While in the past decade captive broodstock have been induced to spawn, the long maturation period (for example 10 years for southern bluefin tuna) and other difficulties with breeding the species in captivity[28] have led researchers to investigate germ cell transplantation surrogate technology.[29] For example, the gametes from Pacific bluefin tuna can be transferred to a host surrogate, such as the eastern little tuna, so that the fingerlings can be produced by hosts that are easier to raise and faster to mature (for example two years).[30] While the application of this technology to tuna is still in experimental phases, it has already been applied to other species that spend some parts of their lifecycles in the deep sea such as steelhead trout gametes for production in masu salmon.[31] Researchers may seek proprietary interests over various parts of the breeding process such as patenting a method for confirming whether the transplanted germ cells of a donor tuna fish have been functionally incorporated into the genital gland of a host using a recombinant vasa gene vector.[32]

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22 Oldham et al, above n 13, 163.

23 See, eg, T M Butler and G L Fletcher, 'Promoter Analysis of a Growth Hormone Transgene in Atlantic Salmon' (2009) 72 *Theriogenology* 62.

24 Satoshi Yokohama Research Centre Inouye, 'Oplophorus luciferase' (Europe Patent No 1,156,103B1, published on 11 August 2010).

25 Carolyn W Hitko et al, 'Recognition of Cellular Target Binding by a Bioactive Agent Using Intracellular Bioluminescence Resonance Energy Transfer' (Europe Patent No 2,932,267A1, published on 21 October 2015).

26 Tomoko Nagata, *The World's First Farm-Raised Bluefin Tuna* (July 2015) Public Relations Office, Government of Japan <http://www.gov-online.go.jp/eng/publicity/book/hlj/html/201507/201507_05_en.html>.

27 Ido Bar et al, 'Assessment of Yellowtail Kingfish (*Seriola lalandi*) as a Surrogate Host for the Production of Southern Bluefin Tuna (*Thunnus maccoyii*) Seed via Spermatogonial Germ Cell Transplantation' (2015) 28 *Reproduction, Fertility and Development* 2051, 2051.

28 For example the limited number of eggs and restricted handling tolerance: ibid 2052.

29 Ibid.

30 Ryosuke Yazawa et al, 'GnRHa-Induced Spawning of the Eastern Little Tuna (*Euthynnus affinis*) in a 70-m^3 Land-Based Tank' (2015) 442 *Aquaculture* 58, 58.

31 Steelhead trout (*Oncorhynchus mykiss*) and masu salmon (*Oncorhynchus masou*): see ibid.

32 Goro Yoshizaki et al, 'Germ Cell Marker Using Fish Vasa Gene' (United States Patent No 8,222,385B2, published on 17 July 2012, assigned to National University Corporation Tokyo University of Marine Science Technology, Nippon Suisan Kaisha, Ltd).

The Food and Agriculture Organization of the United Nations ('FAO') has acknowledged that when offshore aquaculture extends to the deep sea, there will be a regulatory vacuum.[33] Aquaculture is a relatively new industry[34] but it is clear that production would need to expand significantly to meet global demands for fish protein.[35] For example, FAO estimates that aquaculture production would need to expand over 1000 times to feed the expected global population at current levels in 2050.[36] Scarcity of resources and conflict between users means that it is unlikely that freshwater and coastal aquaculture can meet this demand.[37] 'Experts agree that the future of aquaculture is the seas and oceans'.[38] Now aquaculture is rapidly advancing off the coast almost all over the world and gradually moving further offshore.[39] Access to offshore areas is already concentrated in the hands of a few states[40] and companies[41] who can afford the technologies for deep sea research and aquaculture operations.[42] Questions of sustainability and state responsibility for the protection and preservation of the marine environment that arise from aquaculture's movement into the deep sea are crucial considerations but are beyond the scope of this article, which focuses on the sharing of genetic resources. The use of deep sea waters for breeding with genetic resources raises questions of equity for coastal and landlocked states where well resourced countries are more likely to benefit from the breeding and technological advances in this 'rent free' space.

Under *UNCLOS*, states have the freedoms of navigation[43] and fishing on the High Seas[44] as well as the freedom to construct artificial islands and other installations permitted under international law.[45] The latter freedom is sufficient

33 Food and Agriculture Organization Committee on Fisheries, Sub-Committee on Aquaculture, 'Moving Aquaculture Further Offshore: Governance Issues and Challenges' (FAO Technical Paper COFI/AQ/V/2010/7, 5th sess, May 2010) 9 [55] ('Moving Aquaculture').

34 Industrial aquaculture was virtually unknown 40 years ago but it is now emerging as the fastest growing global food production sector: David Greer and Brian Harvey, *Blue Genes: Sharing and Conserving the World's Aquatic Biodiversity* (Earthscan, 2004) ix. It 'now provides half of all fish for human consumption': Food and Agriculture Organization of the United Nations, 'The State of World Fisheries and Aquaculture 2016' (Food and Agriculture Organization of the United Nations, 2016) ii <http://www.fao.org/3/a-i5555e.pdf>.

35 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [4].

36 Ibid.

37 Alessandro Lovatelli, José Aguilar-Manjarrez and Doris Soto (eds), 'Expanding Mariculture Farther Offshore: Technical, Environmental, Spatial and Governance Challenges' (FAO Technical Workshop, Fisheries and Aquaculture Proceedings No 24, Food and Agriculture Organization of the United Nations, 2013) 3.

38 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, 2 [6].

39 Ibid.

40 Out of the 145 sovereign nations with an Exclusive Economic Zone, only 17 of them account for 98 per cent of mariculture production: Lovatelli, Aguilar-Manjarrez and Soto, above n 37, 1.

41 See the successful trial of growing out yellowtail in the world's deepest moored aquaculture installation: Kampachi Farms LLC, *Offshore Technology* (2014) <http://www.kampachifarm.com/offshore-technology>.

42 Expensive technologies like Remote Operated Vehicles are the future of deep sea research and aquaculture: Oldham et al, above n 13, 14.

43 *UNCLOS* art 87(1)(a).

44 *UNCLOS* art 87(1)(e).

45 *UNCLOS* art 87(1)(d).

to permit aquaculture operations on the High Seas.[46] However, a state has no authority to grant any type of tenure or authority for the use of a particular site in areas beyond national jurisdiction.[47] In respect of navigation and fisheries freedoms, ships are required to fly the flag of one state and the responsibility of offences is assigned to that state.[48] In the case of aquaculture, however, there is arguably no obligation for installations such as sea cages to register in a given state to which responsibility could be assigned.[49] A state may get around this by extending its domestic aquaculture and patent laws to its nationals who carry out deep sea farming, however non-nationals carrying out the aquaculture operations would not be covered.[50] Barring this approach and until the New Instrument clarifies the regulation of deep sea aquaculture, only tangential aspects of aquaculture can be dealt with, such as interference with navigation.[51] While the freedom to carry out deep sea aquaculture comes with a clear obligation to ensure that aquaculture activities do not conflict with the rights of other states, such as the duty to preserve and protect the marine environment,[52] it is less specific than freedoms applicable to navigation and fisheries. This uncertainty makes it difficult to determine where the responsibilities lie for violation of an obligation,[53] including obligations for technology and knowledge transfer resulting from deep sea aquaculture.

III BALANCING LEGITIMATE INTERESTS AND USES OF TECHNOLOGY UNDER *UNCLOS*

With due regard for the sovereignty of all states, *UNCLOS* establishes a legal order for the seas and oceans and promotes 'the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment'.[54] Having concluded in 1982, the agreement preceded state sovereignty access and benefit sharing agreements concerning genetic resources including the United Nations' *Convention on Biological Diversity*

46 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [47].
47 Lovatelli, Aguilar-Manjarrez and Soto, above n 37, 15.
48 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [49].
49 Ibid.
50 Lovatelli, Aguilar-Manjarrez and Soto, above n 37, 15. See *UNCLOS* arts 235(1)–(2); Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [57], for a discussion about why enforcement of this arrangement would be problematic.
51 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [55]. The FAO's Technical Guidelines on Genetic Resource Management in Aquaculture in support of its Code of Conduct for Responsible Fisheries has limited application because it does not cover legal aspects of access and benefit sharing or intellectual property: Food and Agriculture Organization, 'Aquaculture Development 3: Genetic Resource Management' (Technical Guidelines for Responsible Fisheries No 5 Supp 3, Food and Agriculture Organization, 2008) 53.
52 See *UNCLOS* arts 192, 194(1), 196–7, 204, 206.
53 Food and Agriculture Organization, 'Moving Aquaculture', above n 33, [49].
54 *UNCLOS* Preamble para 4.

('*Biodiversity Convention*')[55] and its supplementary agreement, the *Nagoya Protocol* ('*Protocol*').[56] It also preceded recent state agreements on minimum standards for intellectual property concerning genetic resource inventions such as the *TRIPS* agreement.[57] As such, *UNCLOS* includes neither a specific regime for access and benefit sharing of aquatic genetic resources nor a mechanism for balancing proprietary and public interests in the resources. It is relevant to note that the *Biodiversity Convention* applies to genetic resources in waters where states might exercise sovereignty (internal waters,[58] territorial waters,[59] archipelagic waters,[60] the contiguous zone,[61] the Exclusive Economic Zone[62] and the continental shelf[63]) but not to the physical genetic resources of areas beyond national jurisdiction – the deep sea (the High Seas[64] and The Area[65]). The *Biodiversity Convention* does however apply to processes and activities carried out by a party's nationals within its control beyond the limits of their national jurisdiction.[66] Under *UNCLOS*, paying due regard to the interests of other states,[67] all states irrespective of their geographical location have the right to conduct marine scientific research in The Area[68] and enjoy certain freedoms in the High Seas, including the freedom of fishing[69] and the freedom of scientific research[70] that must be exercised for peaceful purposes.[71] These rights are subject to obligations outlined below relating to the development and transfer of marine technology[72] and the sharing of marine scientific research and knowledge.[73] It is unclear at this stage how the New Instrument concerning access and benefit sharing will relate to these obligations and the type of implementation systems that may be adopted after the negotiations.

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55 *Convention on Biological Diversity,* opened for signature 5 June 1992, 1760 UNTS 79 (entered into force 29 December 1993) ('*Biodiversity Convention*'). The *Biodiversity Convention* is a multilateral treaty providing a framework for national strategies and laws for the conservation and sustainable use of biological diversity.

56 *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*, opened for signature 29 October 2010, [2012] ATNIF 3 (entered into force 12 October 2014) ('*Protocol*'). The *Protocol* has not yet entered into force for Australia. The *Protocol* is a supplementary agreement to the *Biodiversity Convention* providing a transparent legal framework for the effective implementation of the fair and equitable sharing of benefits arising out of the 'utilization of genetic resources': at art 1.

57 The *TRIPS* agreement came into force in 1995.

58 *UNCLOS* art 8.

59 *UNCLOS* arts 2–15.

60 *UNCLOS* arts 46–50.

61 *UNCLOS* art 33.

62 *UNCLOS* arts 55–74.

63 *UNCLOS* arts 76–85.

64 *UNCLOS* arts 86–120.

65 *UNCLOS* arts 133–91.

66 *Biodiversity Convention* art 4(b).

67 *UNCLOS* art 87(2).

68 *UNCLOS* art 256.

69 *UNCLOS* art 87(1)(e).

70 *UNCLOS* arts 87(1)(f), 238.

71 *UNCLOS* art 88.

72 *UNCLOS* pts XIV, XI.

73 *UNCLOS* pt XIII.

Large commercial profits from marine genetic resources are still rare and the New Instrument is likely to emphasise non-monetary (rather than monetary) benefits such as technology transfer and cooperation,[74] including access to samples and data.[75] '[S]cientific research on the genetic diversity of the oceans [is] mostly state funded and carried out predominantly by developed countries'.[76] It is difficult to identify not only the point at which private interests become involved to trigger longer term investment in developing technologies[77] but also which sector – private or public – is predominantly involved in patent applications.[78] Further, 'collaboration between developed and developing countries [is] mostly carried out on a small scale, and often [consists] of ad hoc activities on a bilateral basis'.[79] The IWG has observed that direct participation in joint research is a more effective approach to sustainable capacity building than information sharing.[80] It also stresses that capacity building should not be considered as a single activity but as a complex series of interrelated activities such as partnerships, mentoring and cooperation between regional institutions.[81] It is clear that obligations for technology transfer and capacity building will perform a key role in addressing the inequities between developed and developing countries in both physical access to the deep sea to carry out aquaculture activities, as well as access to deep sea biological samples, knowledge and data.[82] In other words, these will be the key benefits from the access and use of deep sea genetic resources that are likely to be shared in practice.

A *UNCLOS* Part XIV Technology Transfer Obligations

While there are specific technology transfer obligations that apply only to non-living resources in The Area,[83] the obligations under *UNCLOS* Part XIV outlined below are not restricted to a particular jurisdiction. In this regard, the obligations arguably apply to all marine technologies including those arising out of activities in deep sea areas. 'Marine science' and 'marine technology' are not defined under *UNCLOS*. The *2003 Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology* ('*Technology Transfer Guidelines*')[84] which were developed in accordance with article 271 of *UNCLOS*, have offered the following guideline:

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74 Ad Hoc Open-Ended Informal Working Group, 'Intersessional Workshops', above n 17, [38].
75 Ibid [53].
76 Ibid [12].
77 Ibid.
78 Ibid [16].
79 Ibid [13].
80 Ibid [129].
81 Ibid.
82 Ibid [53].
83 *UNCLOS* arts 144, 273–4. These provisions apply to 'activities in the Area' which is confined under art 1 to activities concerning 'resources of the Area' which is in turn defined under art 133 to only relate to non-living resources.
84 Intergovernmental Oceanographic Commission Advisory Body of Experts on the Law of the Sea, 'Criteria and Guidelines on the Transfer of Marine Technology' (IOC Information Document No 1203,

> marine technology refers to instruments, equipment, vessels, processes and methodologies required to produce and use knowledge to improve the study and understanding of the nature and resources of the ocean and coastal areas.[85]

The *Technology Transfer Guidelines* list examples of marine technology including information and data, sampling and methodology equipment, equipment for in situ experimentation and 'expertise, knowledge, skills, technical/scientific/legal know-how and analytical methods related to marine scientific research and observation'.[86] The list is not exhaustive and arguably includes knowledge relating to genetic resource technologies. It is less certain whether it includes sharing the actual genetic samples that are the subject of the technological know-how. States, however, are required to establish programs 'for the effective transfer of all kinds of marine technology'[87] and arguably there is nothing to preclude the inclusion of genetic resource technologies. The New Instrument is likely to clarify whether genetic resource technologies fall within technology transfer obligations.[88]

States have current technology transfer obligations under Part XIV to:

- cooperate 'to promote actively the development and transfer of marine science and marine technology on fair and reasonable terms and conditions';[89]
- 'promote the development of the marine scientific and technological capacity of States … particularly developing States, including land-locked and geographically disadvantaged States, with regard to the exploration, exploitation, conservation and management of marine resources, the protection and preservation of the marine environment, marine scientific research and other activities in the marine environment';[90] and
- 'endeavour to foster favourable economic and legal conditions for the transfer of marine technology for the benefit of all parties concerned on an equitable basis'.[91]

The basic objectives of the technology transfer provisions are to promote the facilitated access to marine technological knowledge and data,[92] to develop 'appropriate marine technology'[93] and the infrastructure necessary to facilitate its transfer[94] as well as to build human resource capabilities through training

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UNESCO, 2005) ('*Technology Transfer Guidelines*'). The final draft of the *Technology Transfer Guidelines* was approved in 2003 at the 22nd Session of the Assembly of the Intergovernmental Oceanographic Commission through Resolution XXII-12: at 4.

85 *Technology Transfer Guidelines*, above n 84, 9.

86 Ibid.

87 *UNCLOS* art 269(a).

88 *New Instrument Resolution*, above n 6, para 2.

89 *UNCLOS* art 266(1).

90 *UNCLOS* art 266(2).

91 *UNCLOS* art 266(3).

92 *UNCLOS* art 268(a).

93 *UNCLOS* art 268(b).

94 *UNCLOS* art 268(c).

and education.[95] To achieve these objectives, states are obliged to endeavour to establish programmes of technical cooperation for the effective transfer of all kinds of marine technology to states requesting this assistance, particularly disadvantaged states, and to promote exchange of expertise and joint ventures[96] and international cooperation at all levels.[97]

Significantly, in promoting cooperation pursuant to these obligations, states must have 'due regard for all legitimate interests, including, inter alia, the rights and duties of holders, suppliers and recipients of marine technology'.[98] In balancing the interests of the holders of technology and the needs of developing states, some IWG delegates have drawn attention to the guiding principle in the *Technology Transfer Guidelines*[99] 'that transfer of marine technology must be conducted on fair and reasonable terms and conditions and enable all parties to benefit, on an equitable basis, from developments in marine science-related activities'.[100] A question remains, however, about the type of benchmark that would be required under *UNCLOS* for an interest to be sufficiently 'legitimate' to prevent the transfer of marine technology.

B *UNCLOS* Part XIII: Knowledge Sharing and Capacity Building Obligations

The objective of the marine scientific research provisions under *UNCLOS* is to increase scientific knowledge of the marine environment for the benefit of humankind as a whole.[101] Part XIII applies to the deep sea including the water column beyond the Exclusive Economic Zone[102] and The Area.[103] In The Area, marine scientific research must also be carried out in conformity with Part XI and these provisions are not restricted to non-living resources like the other Area provisions.[104] 'Marine scientific research' is not defined under *UNCLOS* and arguably includes research concerning deep sea genetic resources.

Under Part XIII, states have general knowledge sharing obligations to promote international cooperation in marine scientific research[105] and:

- 'make available by publication and dissemination … knowledge resulting from marine scientific research';[106] and
- actively promote the flow of data and information and the transfer of knowledge resulting from marine scientific research, in particular to

95 *UNCLOS* art 268(d).
96 *UNCLOS* art 269(d)–(e).
97 *UNCLOS* art 268(e).
98 *UNCLOS* art 267.
99 *Technology Transfer Guidelines*, above n 84.
100 Ad Hoc Open-Ended Informal Working Group, *Letter Dated 25 July 2014*, above n 9, [75].
101 *UNCLOS* Preamble, arts 143, 243, 246(3).
102 *UNCLOS* art 257.
103 *UNCLOS* art 256.
104 *UNCLOS* art 143 refers to 'scientific research in the Area' and is not limited to 'resources' as defined under art 133 which only includes non-living resources.
105 *UNCLOS* art 242. See also art 143(3).
106 *UNCLOS* art 244(1). See also art 143(2).

developing states, as well as building developing states' capacities to develop their own research and technologies.[107]

Significantly, marine scientific research must not 'unjustifiably interfere with other legitimate uses of the sea compatible' with *UNCLOS* and must be 'duly respected in the course of such uses'.[108] Just as the terms 'legitimate interests' are undefined for the effective realisation of the technology transfer obligations under Part XIV, the benchmark of 'legitimate uses' for marine scientific research is also ambiguous. In other words, a question remains about the benchmark required under *UNCLOS* for a *use* to be sufficiently 'legitimate' to 'justifiably interfere' with obligations for transferring knowledge and building developing states' capacities to develop their own technologies.

IV BALANCING LEGITIMATE INTERESTS AND USES OF TECHNOLOGY UNDER HUMAN RIGHTS

Human rights, affirmed in the *Charter of the United Nations*, are codified in the *International Bill of Human Rights*, comprised of the *Universal Declaration of Human Rights*,[109] the *International Covenant on Civil and Political Rights*[110] and the *Covenant*.[111] There are nine core international human rights instruments and several optional protocols dealing with specific concerns.[112] These instruments are based on the premise that all human rights are universal, indivisible, interdependent and interrelated.[113] 'Universal' means that the rights are valid and applicable in all parts of the world, regardless of country or culture, and should be enjoyed by every human being without discrimination.[114] 'Indivisible' means that: (a) the whole set of rights must be implemented, even if individuals within a state are concerned only with limited and separate parts of the rights; and (b) the different legitimate concerns of all members of society should be constructively considered and balanced.[115]

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107 *UNCLOS* art 244(2). See also art 143(3).

108 *UNCLOS* art 240(c).

109 *Universal Declaration of Human Rights*, GA Res 217A (III), UN GAOR, 3rd sess, 183rd plen mtg, UN Doc A/810 (10 December 1948) ('*UDHR*').

110 *International Covenant on Civil and Political Rights*, opened for signature 16 December 1966, 999 UNTS 171 (entered into force 23 March 1976) ('*ICCPR*').

111 *International Covenant on Economic, Social and Cultural Rights*, opened for signature 16 December 1966, 993 UNTS 3 (entered into force 3 January 1976).

112 See the list at: Office of the Human Rights Commissioner, *The Core International Human Rights Instruments and their Monitoring Bodies* <http://ohchr.org/EN/ProfessionalInterest/Pages/CoreInstruments.aspx>.

113 *Vienna Declaration and Programme of Action*, adopted by the United Nations World Conference on Human Rights, UN Doc A/CONF.157/24 (12 July 1993) pt I para 5; reprinted in 32 ILM 1661 (1993), adopted by the General Assembly, GA Res 48/121, UN GAOR, Agenda Item 114(b), 48th sess, 85th plen mtg, UN Doc A/48/49 (14 February 1994).

114 Asbjørn Eide, 'Interdependence and Indivisibility of Human Rights' in Yvonne Donders and Vladimir Volodin (eds), *Human Rights in Education, Science and Culture: Legal Developments and Challenges* (Ashgate, 2007) 11, 12.

115 Ibid 13.

'Interdependent' relates to: (a) the balance between the protection of two different rights; and (b) considerations where rights may or must be limited to respect other rights and for legitimate concerns in society.[116] 'Interrelated' concerns 'situations where some rights are, at least in part, specific applications of more general rights'.[117] The analysis below highlights how the universal, indivisible, interdependent and interrelated nature of human rights is the key to how it balances 'legitimate interests' in scientific knowledge for the benefit of mankind with the rights of creators of the knowledge, the right to take part in cultural life and the right to food under the *Covenant*.

Article 15 of the *Covenant* provides that:

> 1. The States Parties to the present Covenant recognize the right of everyone:
>
> (a) To take part in cultural life;
>
> (b) To enjoy the benefits of scientific progress and its applications;
>
> (c) To benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

Article 15 links the right to the benefits of scientific progress and its applications with the right to participate in cultural life and the recognition of the intellectual property claims of authors, creators and scientists. Several other major human rights instruments, including the *UDHR*[118] enumerate these rights as components of a single article.[119] This linkage means that one right cannot be exercised to the detriment of the realisation of another.[120] Further, the realisation of these rights is dependent on the enjoyment of human rights guaranteed in other human rights instruments such as the freedom of expression including the freedom to seek, receive and impart information and ideas of all kinds.[121]

Everyone has the right to take part in cultural life.[122] This right applies not only to aspects of creativity, but to a much wider set of human rights concerns, ranging from food procurement to intellectual property protections.[123] The Committee on Economic, Social and Cultural Rights ('Committee') that monitors the implementation of the *Covenant* considers that culture 'encompasses, inter alia, ways of life … methods of production or technology, natural and man-made environments, food … through which individuals, groups … and communities

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116 Ibid 13–14.

117 Ibid 14.

118 *UDHR* art 27.

119 Committee on Economic, Social and Cultural Rights, *General Comment No 17 (2005): The Right of Everyone to Benefit from the Protection of the Moral and Material Interests Resulting from any Scientific, Literary or Artistic Production of which he or she is the Author (Article 15, Paragraph 1 (c), of the Covenant)*, 35th sess, UN Doc E/C.12/GC/17 (12 January 2006) [3] ('*General Comment No 17*').

120 Ibid [4].

121 See, eg, *UDHR* art 19 and *ICCPR* art 19(2).

122 Committee on Economic, Social and Cultural Rights, *General Comment No 21 (2009): Right of Everyone to Take Part in Cultural Life (Art 15, para 1 (a), of the International Covenant on Economic, Social and Cultural Rights)* 43rd sess, UN Doc E/C.12/GC/21 (21 December 2009) ('*General Comment No 21*') [9].

123 Stephen A Hansen, 'The Right to Take Part in Cultural Life: Toward Defining Minimum Core Obligations Related to Article 15(1)(a) of the International Covenant on Economic, Social and Cultural Rights' in Audrey R Chapman and Sage Russell (eds), *Core Obligations: Building a Framework for Economic, Social and Cultural Rights* (Intersentia, 2002) 279, 303.

express their humanity and the meaning they give to their existence'.[124] The Committee has recognised one of the necessary preconditions for the full realisation of cultural rights as being 'the presence of cultural goods and services that are open for everyone to enjoy and benefit from, including … nature's gifts, such as seas, lakes, rivers … including the flora and fauna found there'.[125]

In relation to the right to enjoy the benefits of scientific progress and its applications, the 'processes, products and applications of science should be used for the benefit of *all humanity* without discrimination, particularly with regard to disadvantaged and marginalized persons and communities'.[126] Enjoyment of the applications of the benefits of scientific progress implies inter alia non-discriminatory access, including technology transfer and capacity building.[127] Enjoyment can be in the form of participating in scientific progress and in the form of equitable sharing of the benefits of scientific progress and its applications, but sharing is not dependent upon participation.[128] In other words, these are benefits that every person must be able to enjoy in everyday life, regardless of whether individuals had contributed to scientific progress.[129]

The 'right to benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author' (creator's rights) is a category of cultural human rights,[130] but has an economic dimension as a material safeguard for the freedom of scientific research and creative activity.[131] The Committee considers that intellectual property regimes primarily protect business and corporate interests and investments.[132] In contrast, the human right to benefit from the protection of the moral and material interests resulting from any scientific production (such as scientific innovations)[133] derives from the inherent dignity of all persons.[134] The moral interests protected include the right of authors to be recognised as the creators of their scientific productions and to object to any derogatory action which would be prejudicial to their honour and reputation.[135] Material interests are not directly linked to the personality of the creator but contribute to their

124 *General Comment No 21,* above n 122, [13].
125 Ibid [16].
126 United Nations Educational, Scientific and Cultural Organization, 'Venice Statement on the Right to Enjoy Scientific Progress and Its Applications', in *The Right to Enjoy the Benefits of Scientific Progress and its Application* (Experts' Meeting Summary and Outcome, 16–17 July 2009) para 6 ('*Venice Statement*') (emphasis added). The *Venice Statement* aims to clarify the normative content of *Covenant* art 15(1)(b).
127 *Venice Statement*, above n 126, para 13(b).
128 Ibid para 11.
129 Hans Morten Haugen, 'Human Rights and Technology – a Conflictual Relationship? Assessing Private Research and the Right to Adequate Food' (2008) 7 *Journal of Human Rights* 224, 232.
130 Hans Morten Haugen, *The Right to Food and the TRIPS Agreement: With a Particular Emphasis on Developing Countries' Measures for Food Production and Distribution* (Brill, 2007) 202.
131 *General Comment No 17*, above n 119, [4].
132 Ibid [2].
133 Ibid [9].
134 Ibid [1]. These rights can only be held by natural persons, not legal entities such as corporations: see at [7]–[8].
135 See ibid [13].

enjoyment of the right to an adequate standard of living.[136] Significantly, the Committee said that bearing in mind

> the different levels of development of States parties, it is essential that any system for the protection of the moral and material interests resulting from one's scientific … productions *facilitates and promotes* development cooperation, technology transfer and scientific and cultural cooperation, while at the same time taking due account of the need to preserve biological diversity.[137]

At a practical level, the Committee has stated that states have 'a duty to prevent unreasonably high costs for access to … plant seeds or other means of food production … from undermining the rights of large segments of the population to … food'.[138]

In relation to the scientific, creator and cultural rights above, states have technology sharing obligations to:

- take steps necessary to achieve the full realisation of the rights under article 15[139] including 'those necessary for the conservation, the development and the diffusion of science and culture' at article 15(2). This includes obligations to refrain from erecting barriers to scientific communication and collaboration across borders[140] and to 'take measures to extend the benefits of science and technology to all strata of the population';[141]
- 'respect the freedom indispensable for scientific research and creative activity' as outlined in article 15(3). This includes the freedom to seek, receive, and impart information and ideas of all kinds;[142] and
- 'recognize the benefits to be derived from the encouragement and development of international contacts and co-operation in the scientific and cultural fields' in article 15(4). This includes the obligation 'to cooperate internationally in order to realize the legal obligations under the Covenant, including in the context of international intellectual property regimes'.[143]

The right to an adequate standard of living including adequate food under article 11 of the *Covenant* is also indivisible, interdependent and interrelated with the above rights under article 15. The right to food is realised when everyone

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136 *Covenant* art 11(1); moreover, these material interests may be vested in the author for a limited time: see ibid [15]–[16].

137 *General Comment No 17*, above n 119, [38] (emphasis added).

138 Ibid [35].

139 *Covenant* art 2(1).

140 See *Venice Statement*, above n 126, para 14(c); Audrey R Chapman, 'Towards an Understanding of the Right to Enjoy the Benefits of Scientific Progress and its Applications' (2009) 8 *Journal of Human Rights* 1, 28.

141 *Declaration on the Use of Scientific and Technological Progress in the Interests of Peace and for the Benefit of Mankind,* GA Res 3384(XXX), 30th sess, Agenda Item 69, UN Doc A/RES/30/3384 (10 November 1975) art 6.

142 *Venice Statement*, above n 126, para 14(a).

143 *Intellectual Property Rights and Human Rights*, UN Human Rights Office of the High Commissioner, Sub-Commission on the Promotion and Protection of Human Rights Res 2001/21, 53rd sess, UN Doc E/CN.4/SUB.2/RES/2001/2 (16 August 2001) para 7.

individually or in community with others has physical and economic access at all times to adequate food or means of its procurement.[144] In other words, the right and obligations apply to accessing both the food itself and the means of producing it such as using genetic resources in aquaculture 'by making *full use* of technical and scientific knowledge'.[145] To this end, states have an obligation to 'pro-actively engage in activities intended to strengthen people's access to and utilization of resources and means to ensure their livelihood, including food security'.[146] As part of their obligations to protect peoples' resource base for food, states have an obligation to take appropriate steps to ensure that activities of the private business sector and civil society are in conformity with the right to food.[147]

There are some key points from the human rights approach to balancing legitimate interests and uses of genetic resource inventions that are expanded in the discussion section of this article.[148] First, rights may be limited to respect other rights and for legitimate concerns in society.[149] In the case of creator's rights, 'private interests should not be unduly advantaged and the public interest in enjoying broad access to new knowledge should be given due consideration'.[150] Secondly, when determining the threshold of 'legitimate interests' creators can only benefit from the protection of such moral and material interests that are *resulting from* their scientific productions.[151] Thirdly, when determining the threshold of 'legitimacy', the *Covenant*'s obligations do not distinguish between commercial and non-commercial uses of a creator's productions, as long as the ultimate goal is to promote 'human well-being'[152] such as through technical or scientific progress that benefits humankind. Finally, when assigning responsibility for fulfilling obligations, human rights are universal and applicable in all parts of the world, regardless of country or border and so can arguably apply to any human activities in the deep sea where there is no state responsibility.

V BALANCING LEGITIMATE INTERESTS AND USES OF TECHNOLOGY UNDER *TRIPS*

UNCLOS provides that 'marine scientific research activities shall not constitute the legal basis for any claim to any part of the marine environment or

144 Committee on Economic, Social and Cultural Rights, *General Comment No 12: The Right to Adequate Food (Art 11)*, 20th sess, UN Doc E/C.12/1999/5 (12 May 1999) ('*General Comment No 12*') [6].
145 *Covenant* art 11(2)(a) (emphasis added).
146 *General Comment No 12*, above n 144, [15].
147 Ibid [27].
148 See below n 171 and following body text.
149 Eide, above n 114, 13.
150 Committee on Economic, Social and Cultural Rights, *Human Rights and Intellectual Property*, 27th sess, 79th mtg, Agenda Item 3, UN Doc E/C.12/2001/15 (14 December 2001, adopted on 26 November 2001) [17].
151 *General Comment No 17*, above n 119, [17].
152 *Human Rights and Intellectual Property*, above n 150, [4].

its resources'.[153] No state practice, however, supports an interpretation of this provision as excluding the patenting of inventions resulting from marine scientific research of deep sea aquatic genetic resources.[154] Deep sea genetic resource technologies of relevance to aquaculture product development, such as luciferase constructs[155] and the vasa gene vectors[156] are increasingly becoming the subject of patents as a means of recouping or protecting the high cost of investment in deep sea research and prospecting. Consistent with the human rights approach above, *TRIPS* provides that the protection of intellectual property should contribute to the 'transfer and dissemination of technology' to benefit both producers and users of technical knowledge 'in a manner conducive to social and economic welfare'.[157] The *TRIPS* agreement establishes an international legal framework for national patent laws of WTO Members. WTO Members may, 'in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of [*TRIPS*]'.[158] In other words, *TRIPS* provides for a minimum level of patent protection[159] but allows flexibility about the '*means* by which this minimum level of protection is secured in each Member's legal system'.[160] One flexible mechanism is provided under article 30 for making patent law exceptions.[161] Exceptions guide the circumstances, for example, in which patented genetic resources and their derivatives can be shared without the authorisation of the patent holder. A key to defining the circumstances for technology transfer is determining the 'legitimate interests' of the patent holders and third parties under article 30's 'three step test'.

The three step test was interpreted by the WTO Panel in *Canada – Pharmaceutical Products Case* which affirmed that Members may provide exceptions to the exclusive rights conferred by a patent, provided such exceptions are: (1) limited in their impact on rights;[162] (2) do not unreasonably conflict with a normal exploitation[163] of the patent; and (3) do not unreasonably prejudice the

153 *UNCLOS* art 241.

154 Jørem and Tvedt, above n 11, 337. See also Eve Heafey, 'Access and Benefit Sharing of Marine Genetic Resources from Areas beyond National Jurisdiction: Intellectual Property-Friend, not Foe' (2014) 14 *Chicago Journal of International Law* 493, 510.

155 See above n 24 and accompanying text.

156 See above n 32 and accompanying text.

157 *TRIPS* art 7.

158 *TRIPS* art 8(1).

159 *TRIPS* art 27.

160 *Report of the Panel on Canada – Patent Protection of Pharmaceutical Products*, WTO Doc WT/DS114/R (17 March 2000) [4.30] ('*Canada – Pharmaceutical Products Case*'), citing *TRIPS* art 1(1) (emphasis in original).

161 For an overview of *TRIPS*-compliant patent law defences that apply to aquaculture see Fran Humphries, 'Shellfish Patents Krill Experimentation: Defences for Sharing Patented Aquatic Genetic Materials in Aquaculture' (2015) 37 *European Intellectual Property Review* 210 ('Patent Law Defences').

162 Where it must only make a 'small diminution of the rights in question': *Canada – Pharmaceutical Products Case*, above n 160, [7.30].

163 Involving the extraction of 'economic value from their patent': ibid [7.54].

legitimate interests of the patent owner, taking account of the legitimate interests of third parties.[164] The WTO Panel found that 'legitimate interests' means '"justifiable" in the sense that they are supported by relevant public policies or other social norms'.[165] It used as an illustration the exception where the use of a patented product for scientific experimentation without the consent of the holder is not infringement (experimental use exception). The Panel stated:

> It is often argued that this exception is based on the notion that a key public policy purpose underlying patent laws is to facilitate the dissemination and advancement of technical knowledge and that allowing the patent owner to prevent experimental use during the term of the patent would frustrate part of the purpose of the requirement that the nature of the invention be disclosed to the public. To the contrary, the argument concludes, under the policy of the patent laws, both society and the scientist have a 'legitimate interest' in using the patent disclosure to support the advance of science and technology. While the Panel draws no conclusion about the correctness of any such national exceptions in terms of Article 30 of the TRIPS Agreement, it does adopt the general meaning of the term 'legitimate interests' contained in legal analysis of this type.[166]

This benchmark of 'legitimate interests' arguably applies to other exceptions that may guide the sharing (transfer) of patented genetic resources for use in aquaculture. Examples include breeding exceptions (where the effect of a patent does not extend to using biological material for breeding, discovery and development of a new plant variety type),[167] regulatory approval exceptions (allowing the performing of tests and experiments on a patented invention for the purpose of preparing regulatory approval),[168] and innocent bystander exceptions (where the effects of the patent do not extend to biological material that is obtained in the field of agriculture by chance or because it is technically unavoidable).[169] Significantly for the discussion below, the Panel found that as the *TRIPS* system was designed to extend across borders, 'there was no reason why the legitimate interests of the third parties in other countries could not be taken into account when applying a limited exception under Article 30'.[170]

VI A CONSISTENT APPROACH TO LEGITIMATE INTERESTS AND USES OF TECHNOLOGY ACROSS INSTRUMENTS

As proprietary interest in deep sea genetic resources grows, it will become increasingly important to formulate a benchmark for determining when a proprietary interest such as a patent may constitute a 'legitimate interest'

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164 *TRIPS* art 30.

165 *Canada – Pharmaceutical Products Case*, above n 160, [7.69].

166 Ibid.

167 See, eg, *Patentgesetz* [Patent Law] (Germany) 16 December 1980, BGBI, 1981, 1, § 11(2a); *Code de la Propriété Intellectuelle* [Intellectual Property Code] (France) art L613-5-3; *Bundesgesetz über die Erfindungspatente* [Federal Act on Patents for Inventions] (Switzerland) 25 June 1954, SR 232.14, art 9(1)(e).

168 See, eg, Australia's *Patents Act 1990* (Cth) s 119A.

169 *Bundesgesetz über die Erfindungspatente* [Federal Act on Patents for Inventions] (Switzerland) 25 June 1954, SR 232.14, art 9(1)(f).

170 *Canada – Pharmaceutical Products Case*, above n 160, [4.38(d)].

sufficient to override technology transfer obligations under *UNCLOS* Parts XIII and XIV. Such a benchmark will be integral to the balancing of interests for the fair and equitable sharing of deep sea resources under the New Instrument. As *TRIPS* and *UNCLOS* deal with the same genetic resources, a consistent approach would bring certainty for the aquaculture sector. To effectively balance the private and public interests for the purpose of access and benefit sharing this section argues that it is first necessary to clarify the nature and type of resources that are subject to the obligations. The second issue is to clarify the requisite link between the access and benefit sharing obligations, the relevant interest and the origin of the genetic resource. This requires examination of whether access, benefit sharing and control over the genetic resource technology depend on the biological origin, geographical origin or functional origin of the relevant genetic resource. These three types of origins are benchmarks for determining the 'legitimacy' or otherwise of an interest in, or use of, a genetic resource. The third issue to determine is how to balance competing commercial and non-commercial 'legitimate uses' of genetic resources in deep sea waters, including offshore breeding and farming of biological resources.

A Nature and Type of Resources under Obligations

UNCLOS does not define the nature of living resources that may be subject to its technology and knowledge transfer obligations. The access and benefit sharing regime under the *Biodiversity Convention* relates to the use of a biological resource for its genetic material,[171] rather than for its other attributes such as the biological product (fillet) for consumption. The use of the deep sea shrimp for its luciferase potential or tuna for its vasa genes in biotechnology applications are clear examples of using a biological resource for its genetic material. The capture and fattening (ranching) of wild tuna is arguably an example of using the resource for its product because the biological resources are treated as part of the quota for capture fisheries.[172] A key issue for aquaculture is that it is sometimes difficult to distinguish when a particular resource is used either for its genetic material (potentially attracting access and benefit sharing) or for its biological product (not attracting access and benefit sharing).[173] There is some segregation of the aquaculture industry into seed production (breeding using genetic material) and grow-out facilities (farming for fattening the biological product).[174] Breeding, however, can occur during grow-out unless steps are taken to prevent it.[175] Technology and knowledge sharing obligations under

171 Under *Biodiversity Convention* art 2, genetic resource means 'genetic material of actual or potential value'. Genetic material means 'any material of plant, animal, microbial or other origin containing functional units of heredity'.

172 See Bar et al, above n 27, 2051.

173 See Humphries, 'ABS in Aquaculture', above n 5, 67.

174 Bartley et al, above n 18, 2.

175 For example through biological (production of sterile female only populations) or geographical forms of containment: see Jay Sanderson and Fran Humphries, 'Unnaturally Natural: Inventing and Eating Genetically Engineered AquAdvantage® Salmon and the Paradox of Nature' in Charles Lawson and Berris Charnley (eds), *Intellectual Property and Genetically Modified Organisms: A Convergence in Laws* (Ashgate, 2015) 185, 191 n 29.

UNCLOS Parts XIII and XIV are silent about whether they apply to the biological product as well as the genetic material. There is an opportunity, however, to clarify in the New Instrument the nature of interests in, and uses of, deep sea genetic resources and derivatives that would fall within access and benefit sharing obligations.

UNCLOS is also silent about the types of marine technologies that fall within its technology transfer obligations.[176] There is no definition of marine technology but states are required to establish programs for the effective transfer of 'all kinds of marine technology'.[177] This indicates that the obligations apply to 'natural resources'[178] which according to Lawson probably extends broadly to include 'anything that is living and might be taxonomically classified'.[179] IWG delegates have suggested that the scope of the New Instrument 'should encompass all marine resources in areas beyond national jurisdiction currently known or discovered at any time in the future'.[180] If the New Instrument is to be consistent with the *Biodiversity Convention*, it is likely to also apply to derivatives,[181] including the results of an organism's metabolism (for example physical natural compounds), but it may also extend to derivatives understood as any result of human activity using a genetic resource (for example non-living synthetic compounds) and derivatives understood as information about genetic resources (for example intangible digitalised information).[182] All of these categories are relevant to patenting in aquaculture; from the manipulation of deep sea genetic resources such as tuna for use in selective breeding programs, to the patenting of DNA vaccines[183] and transgenic animals.[184] Tvedt and Schei have argued that the decisive criterion for whether a derivative falls within the scope of similar obligations under the *Protocol* seems to be the biological origin rather than the biological form.[185] For example, transfer of genetic information into digital form

176 See above n 84 and accompanying text.

177 *UNCLOS* art 269(a).

178 *UNCLOS* arts 56(1)(a), 77, 79(2), 145(b), 193, 194(3)(c), 246(5)(a), 249(2).

179 Charles Lawson, *Regulating Genetic Resources* (Edward Elgar, 2012) 93.

180 Ad Hoc Open-Ended Informal Working Group, *Letter Dated 13 February 2015 from the Co-Chairs of the Ad Hoc Open-Ended Informal Working Group to the President of the General Assembly*, 69th sess, Agenda Item 74(a), UN Doc A/69/780 (13 February 2015) [19].

181 A derivative means 'a naturally occurring chemical compound resulting from the genetic expression or metabolism of biological or genetic resources, even if it does not contain functional units of heredity': *Protocol* art 2(e).

182 Ad Hoc Open-Ended Working Group on Access and Benefit-Sharing, *Report of the Meeting of the Group of Legal and Technical Experts on Concepts, Terms, Working Definitions and Sectoral Approaches*, 7th mtg, Provisional Agenda Item 3, UN Doc UNEP/CBD/WG-ABS/7/2 (12 December 2008) annex [19]–[22].

183 See, eg, Saravanane Poobalane, Kim Thompson and Alexandra Adams, 'Vaccine' (United States Patent No 8,257,713, published on 4 September 2012, assigned to the University of Stirling).

184 Fran Humphries, 'Technology Transfer of Aquatic Genetic Resources under the *Convention on Biological Diversity* and the *Nagoya Protocol*: "Sponging" off Patent Law Defences' (2016) 39 *University of New South Wales Law Journal* 234, 250 ('CBD and Aquaculture').

185 Morten Walløe Tvedt and Peter Johan Schei, 'The Term "Genetic Resources": Flexible and Dynamic while Providing Legal Certainty?' in Sebastian Oberthür and G Kristin Rosendal (eds), *Global Governance of Genetic Resources: Access and Benefit Sharing after the Nagoya Protocol* (Routledge, 2013) 18, 21.

does not change its genetic character and is likely to fall within the obligations.[186] Purely synthetic compounds may fall within this benchmark depending on their biological link to the original genetic resource.[187] Using this reasoning, *UNCLOS* technology transfer obligations could apply to 'all kinds of marine technology' that have a biological origin.[188]

B Benchmarking 'Legitimate Interests' and 'Legitimate Uses'

Arguably the implied trigger for technology transfer obligations under *UNCLOS* Part XIV is the geographical origin of the relevant genetic resource. This is because the access and benefit sharing regime within national jurisdiction under the *Biodiversity Convention* depends on ascertaining the country of origin of a genetic resource for the purpose of access and benefit sharing.[189] The *Biodiversity Convention* does not apply to the physical aquatic resources that fall outside national jurisdictions[190] so geographical origin is the default benchmark for whether a given resource falls within a particular regime. Global discussions on the New Instrument are focusing on the need to address the current lack of an international law obligation to disclose the geographical origin of organisms.[191] The IWG, however, has acknowledged that it is often impossible to establish which patents relate to inventions based on marine genetic resources of areas beyond national jurisdiction as opposed to areas within national jurisdiction.[192] A large scale analysis of patents relating to marine genetic resources in the context of their known geographical distribution found that the deep sea resources that appear in patents also occur within national jurisdictions.[193] It concluded that '[in] the majority of cases it [was] likely that applicants referencing deep sea locations obtained the genetic material or data from commercial sources, public collections or databases, rather than field collections'.[194] To further complicate efforts to link compounds to a specific organism within a particular geographical location, marine compounds of interest may arise from trans-jurisdictional organisms being hosted by, or existing in a symbiotic relationship with, other local organisms[195] such as in the case of sea sponges which have been farmed for their pharmaceutical potential.[196] It is possible that the New Instrument under *UNCLOS* will clarify which access and benefit sharing regimes have priority in regulating genetic resources that are located in both jurisdictional areas.

A stewardship approach to balancing legitimate interests in deep sea genetic resources between creators of inventions and the rest of humanity may provide an

186 Ibid.
187 Humphries, 'CBD and Aquaculture', above n 184, 251.
188 *UNCLOS* art 269(a).
189 *Biodiversity Convention* arts 2, 15(3).
190 States have obligations in relation to the physical resources within their national jurisdiction and certain activities of their nationals outside national jurisdiction: *Biodiversity Convention* art 4.
191 Ad Hoc Open-Ended Informal Working Group, 'Intersessional Workshops', above n 17, [47].
192 Ibid [15].
193 Oldham et al, above n 13, 17.
194 Ibid.
195 Ibid 167.
196 See Humphries, 'CBD and Aquaculture', above n 184, 247–8.

alternative (or supplementary) benchmark to geographical origin. Under this approach, while the physical deep sea aquatic genetic resources may become the property of the legal person or entity that obtained them, the cumulative information and knowledge about the use of these resources are held in trust for current and future generations of users and producers and for Earth as a system. In other words, states are obliged to ensure that science is developed and diffused for the benefit of all of humankind. The distribution and use of the aquatic genetic material under a stewardship approach arguably transcends the boundaries of the provider/user transactional relationship of the proprietary approach and includes a kind of trust obligation toward the genetic resource knowledge itself.

Under the *Covenant*, the enjoyment by all humanity of the benefits of scientific progress and its applications is based on non-discriminatory access to such benefits, regardless of a person's country of origin.[197] When access to food and the means for producing it is involved, people (but not legal entities, for example corporations) should be able to make 'full use of technical and scientific knowledge'.[198] This more onerous obligation for sharing indicates that, consistent with international benefit sharing instruments,[199] this is a unique category for technology transfer where states have an obligation to consider the importance of genetic resources for food, agriculture and aquaculture and their special role for food security. On the other hand, a creator's protected interests are more limited in that they must be 'resulting' from the production.[200] The Committee has clarified that this means creators can only benefit from the protection of those moral or material interests that are 'directly generated' by their production.[201] This means that the mere fact that a genetic resource that is the subject of a creator's production has the same geographical origin, biological origin or biological form as those in the deep sea is unlikely to be sufficient to give that creator a legitimate interest in deep sea genetic resources that is capable of limiting the right of everyone to benefit from scientific progress and its applications. This standard of legitimacy would not mean that another person could profit from a creator's invention such as a novel expression of a genetic trait in tuna by replicating the invention (breeding) in a manner prejudicial to his/her honour or reputation[202] or adequate standard of living.[203] By the same token, the personal direct links between creators and their productions would arguably not be violated by someone further developing the production to contribute to scientific progress and food security of society as a whole by breeding a new strain that is *indirectly* generated from the genetic material used in the production. 'Directly generated' implies an active role for the original

197 *Venice Statement*, above n 126, para 6.
198 *Covenant* art 11(2).
199 *Protocol* art 8.
200 *Covenant* art 15(1)(c).
201 *General Comment No 17*, above n 119, [17].
202 Ibid [31].
203 Ibid [30].

production (for example a new species expressing the patented invention) rather than the invention merely being passively present in the new production.

Emerging norms in patent law defence frameworks are developing a similar stewardship approach to balancing patentees' legitimate interests in their inventions with patent law's technology transfer objectives.[204] In the aquaculture context, protection for a patentee's exclusive rights[205] over a genetic resource invention generally extends to every plant and animal containing the inventive element or resulting from a patented process.[206] A broadly worded patent claim over a plant or animal's gene or gene carrier (vector) may have the same outcome as patenting the whole plant or animal.[207] The holder of a patented invention may then be able to prevent others from using it for breeding purposes because the act of breeding is 'making' the invention again by replicating the patented gene, vector or trait in the new product (or offspring).[208] Claims are often broader than the immediate target genetic resources, which can extend the reach of patents even further. For example, the claim over the vasa gene vector as part of the tuna surrogate breeding technology extends to a variety of tuna species as the host[209] and a variety of other species as the surrogate,[210] even though the technology has not yet been successful in these species.[211] The European Court of Justice has opined, however, that under European law a patented trait may be present in material derived from the invention, but protection may only be attracted when the patented trait is *performing* its function[212] *at the time* of the alleged infringement.[213] The law in this area is not settled but using this approach, protection would not be attracted if the patented trait is merely *present* in a subsequent strain.[214] Rather, the trait must be expressed or performing its function in the genetic resource at the time of its use.[215] In other words, the benchmark for a patentee's legitimate interest sufficient to control the use of the genetic resource

204 See *TRIPS* art 7.

205 Patent holders have exclusive rights over the making, use, sale, offering for sale and importing of the products of an invention: *TRIPS* art 28(1)(a). For patented processes, rights extend to preventing a person from unauthorised use of the process and from using, offering for sale, selling and importing at least the product directly obtained from the process: *TRIPS* art 28(1)(b).

206 Viola Prifti, 'The Breeding Exemption in Patent Law: Analysis of Compliance with Article 30 of the *TRIPS* Agreement' (2013) 16 *Journal of World Intellectual Property* 218, 218.

207 Nuffield Council on Bioethics, 'The Use of Genetically Modified Crops in Developing Countries: A Follow-Up Discussion Paper' (Discussion Paper, December 2003) 87.

208 *Bowman v Monsanto* (Sup Ct, No 11–796, 13 May 2013) slip op 8 (The Court).

209 Families of Perciformes, Scombroidei, Scombridae and Thunnus: Goro Yoshizaki et al, 'Vasa Gene Patent', above n 32, 6–7.

210 Families of Perciformes, Scombroidei, Scombridae and Euthynnus: ibid 7.

211 See above n 27 and following body text.

212 *Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions* [1998] OJ L 213/13, art 9 ('*European Biotechnological Directive*').

213 *Monsanto Technology LLC v Cefetra BV* (C-428/08) [2010] ECR I-6765, I-6806–7 [50] (The Court), citing *European Biotechnological Directive* [1998] OJ L 213/13, art 9.

214 Humphries, 'Patent Law Defences', above n 161, 216.

215 Ibid.

by others is not the geographical origin[216] or the biological form or even the biological origin. The benchmark for a legitimate interest where patents are concerned would be the *functional origin* at the time of using the deep sea genetic resource.

This raises the question of how the functional origin benchmark may strike an appropriate balance between a patent holder's legitimate interest and patent law's exceptions as a tool for technology transfer. Current exceptions under national patent laws rarely clarify what has been referred to as the 'functionality question' in circumstances where subsequent strains are produced from a self-replicating patent.[217] For example, emerging breeding exceptions provide that protection of a patent does not extend to biological material used for breeding and developing a new strain.[218] While these exceptions would not generally extend to the commercialisation of a new strain,[219] it is unclear what benchmark is used to determine a patent holder's 'legitimate interest' in the new strain. In other words, how different must the final strain be from the patented original for the breeding exception to apply under patent law?[220] Using the functional origin approach, breeders might use a genetic resource with a patented trait (for example disease resistance) to breed a new strain where the patented characteristic is *present* but not expressed or performing its function at the time of the alleged infringing use (further breeding). The key for self-replicating inventions with dormant traits that spontaneously appear in subsequent generations is the timing of the use. This means that an exception may only apply if the patented trait is not functional *at the time* of the alleged infringement so that breeders can experiment with subsequent generations until such time as a new strain expresses the original patented trait.[221] The functional origin approach under patent law is consistent with the human rights approach where only those interests that are directly generated from (rather than simply present in) their production can legitimately limit the exercise of technology transfer obligations.[222] In other words, the cumulative information and knowledge about the use of these resources are held in trust (under stewardship) to create new technologies for the benefit of humankind and can only be limited by protection of legitimate interests in accordance with the functional origin approach.

These breeding exceptions may not apply, however, to genetic resource research tools such as luciferase constructs[223] that could be used as a reporter

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216 Note however the international discussion about using patent law to require disclosure of the country of origin of the genetic resources used in an invention. See the proposed *TRIPS* art 29*bis* and Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore, *Disclosure of Origin or Source of Genetic Resources and Associated Traditional Knowledge in Patent Applications*, 8th sess, WIPO/GRTKF/IC/8/11 (17 May 2005).

217 Humphries, 'Patent Law Defences', above n 161, 213.

218 *Patentgesetz* [Patent Law] (Germany) 16 December 1980, BGBI, 1981, 1, § 11(2a) provides that the effect of a patent shall not extend to the 'use of biological material for breeding, discovery and development of a new plant variety type'.

219 Humphries, 'Patent Law Defences', above n 161, 215.

220 Ibid 216.

221 Ibid.

222 See above n 201 and accompanying text.

223 See above n 23 and accompanying text.

gene for developing transgenic tuna. Exclusive rights may be infringed by research tools that are incorporated physically into a new product as well as those that are not physically incorporated but are used to make other products.[224] Several experimental use exceptions under national laws, however, only allow the investigation of a patented product, including a research tool, for the purpose of improving the invention and assessing new applications, but not using a research tool to investigate other genes and their expression.[225] This is because the latter uses the invention in the way intended by the inventor rather than for experimental use.[226] This would mean that using a patented luciferase construct invention to investigate a tuna gene without authorisation from the patent holder would not be excused under this narrower exception. Broader exceptions may allow experimentation with a research tool to investigate other genes, as well as creating new strains through the introduction of a genetic invention into a plant or animal genome but these exceptions are rare.[227] Again, a functional origin approach could help to determine the extent to which a new strain may contain the patented element in these broader exceptions, similar to the breeding exceptions above.

In summary, using geographical origin as the benchmark or trigger for technology transfer obligations is not practical for technologies based on cross-jurisdictional deep sea genetic resources or derivatives and ex situ resources for which no geographical origin can be traced. Instead, a more appropriate (or at least a supplementary) benchmark to determine the forms of marine technology that are subject to *UNCLOS* technology transfer obligations would be the 'biological origin'. This broader benchmark would include deep sea genetic resources characteristics or technologies (for example a certain trait or enzyme) that are either present or performing the genetic resource's original function in a derivative as long as those characteristics can be traced back to the original biological resource. In striking an effective balance, however, between creator's rights and the public interest in the benefits of deep sea technologies, particularly where access is necessary for food production and security, a supplementary benchmark may be required for private proprietary interests. This benchmark would prescribe that the technology transfer obligations (and/or access and benefit sharing obligations under the New Instrument) may only be limited by legitimate interests in patented deep sea genetic resources that are based on the

224 Janice M Mueller, 'No "Dilettante Affair": Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools' (2001) 76 *Washington Law Review* 1, 14–15.

225 Richard Gold and Yann Joly, *Experts' Study on Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights*, World Intellectual Property Organization Standing Committee on the Law of Patents, 15th sess, WIPO Doc SCP/15/3 (2 September 2010) annex 6 ('*The Patent System and Research Freedom: A Comparative Study*') 41. See, eg, Australia's *Patents Act 1990* (Cth) s 119C and Australian Law Reform Commission, *Genes and Ingenuity: Gene Patenting and Human Health*, Report No 99 (2004) 339 [13.86].

226 Chris Dent, 'The *TRIPS* Agreement and an Experimental Use Exception for "Research Tools"' (2011) 44 *Australian Economic Review* 73, 76.

227 See Prifti, above n 206, 219. For an example of a broader exception, see *Code de Droit Economique* [Code of Economic Law] (Belgium) 28 February 2013, book XI art 34(1)(b).

narrower *functional* origin and not the broader biological origin of the relevant genetic resource invention.

C Balancing Competing Legitimate Interests and Uses: Commercial v Non-Commercial

The final issue to clarify is how to balance competing interests in and uses of the sea and its resources. Under the *Covenant*, states have an obligation 'to strike an adequate balance' between the effective protection of creator's interests on the one hand and states' obligations in relation to the other rights above on the other hand.[228] In striking this balance, the private interests of creators 'should not be unduly favoured and the public interest in enjoying broad access to their productions should be given due consideration'.[229] States are therefore required to ensure that their legal or other regimes for the protection of a creator's moral and material interests constitute no impediment to their ability to comply with their core obligations in relation to other rights including enjoying the benefits of scientific progress and its applications.[230] The *Covenant* provides in article 4 that a state may subject human rights to 'such limitations as are determined by law only in so far as this may be compatible with the nature of these rights and solely for the purpose of promoting the general welfare in a democratic society'.[231] In other words, article 4 limits both the purposes for which limitations (for example patent law) may be imposed and the manner in which it may legitimately be done.[232] The Committee has clarified that any limitations must be proportionate, must pursue a legitimate aim and must be strictly necessary for the promotion of the general welfare of a democratic society.[233] This indicates that the sole benchmark for legitimacy when balancing rights and interests is the general welfare of society. Significantly, the technology transfer obligations under the *Covenant*[234] do not distinguish between commercial and non-commercial uses of a creator's productions, as long as the ultimate goal is to promote technical or scientific progress for humanity as a whole.[235] Arguably this highlights the *Covenant*'s stewardship approach to technology transfer where states are obliged to hold on trust the cumulative knowledge necessary to create new technologies from deep sea genetic resources by ensuring that science is developed and diffused for the benefit of all humankind.

While many exceptions under national patent laws make a distinction between commercial and non-commercial uses of a patented invention,[236] some jurisdictions are now seeking to strike a balance between the non-commercial

228 *General Comment No 17*, above n 119, [39(e)].
229 Ibid [35].
230 Ibid.
231 *Covenant* art 4.
232 Philip Alston and Gerard Quinn, 'The Nature and Scope of States Parties' Obligations under the International Covenant on Economic, Social and Cultural Rights' (1987) 9 *Human Rights Quarterly* 156, 193.
233 *General Comment No 17*, above n 119, [22]–[23].
234 See above n 139 and following body text.
235 *Human Rights and Intellectual Property*, above n 150, [4].
236 See Gold and Joly, above n 225, 41.

and commercial phases of research.[237] For example, the German Federal Supreme Court has emphasised that the German experimental use exception does not distinguish between commercial and non-commercial uses, as long as the ultimate goal is to promote technical or scientific progress.[238] This is consistent with the WTO Panel's opinion that 'both society and the scientist have a "legitimate" interest in using the patent disclosure to support the advance of science and technology'.[239] In other words, the balancing of 'legitimate uses' under the German approach is not so much a question of whether commercial uses outweigh other uses. Rather, it concerns the question of whether the experimental use exception will excuse uses of a patented invention with the ultimate goal of promoting technical or scientific progress.

While technology transfer obligations under *UNCLOS* Part XIV arguably apply to both pure and applied purposes, some observers argue that marine scientific research and its knowledge sharing obligations under Part XIII do not apply to commercial uses of the deep sea and its resources.[240] In practice, the distinction between the two forms of research is often blurred, particularly in the area of biotechnology,[241] and particularly where time lags between extraction and experimentation can make researchers' intent difficult to ascertain.[242] The United Nations Secretary General has observed that in most cases, genetic resources are collected and analysed as part of public-private scientific research project partnerships and it is only at a later stage that knowledge and useful materials extracted from the resources enter a commercial stage.[243] It concluded that 'the difference between scientific research and bioprospecting therefore seems to lie in the use of knowledge and results of such activities, rather than in the practical nature of the activities'.[244] The IWG has stated that all activities of research in the marine environment qualify as marine scientific research under *UNCLOS* and any new instruments would need to take into account developing trends where companies are buying licences and lead compounds from groups undertaking

237 Advisory Council on Intellectual Property, 'Patents and Experimental Use' (Report, 13 October 2005) 3. See also Matthew Rimmer, *Intellectual Property and Biotechnology: Biological Inventions* (Edward Elgar, 2008) 182.

238 *Clinical Trials II*, Bundesgerichtshof [German Federal Court of Justice], X ZR 68/94, 17 April 1997 reported in (1997) 135 BGHZ 217, quoted in Annette Kur and Thomas Dreier, *European Intellectual Property Law: Text, Cases and Materials* (Edward Elgar, 2013) 120.

239 *Canada – Pharmaceutical Products Case*, above n 160, [7.69].

240 Caroline von Kries and Gerd Winter, 'Harmonising ABS Conditions for Research and Development under UNCLOS and CBD/NP' in Evanson Chege Kamau, Gerd Winter and Peter-Tobias Stoll (eds), *Research and Development on Genetic Resources: Public Domain Approaches in Implementing the Nagoya Protocol* (Routledge, 2015) 75, 77–8.

241 Advisory Council on Intellectual Property, 'Patents and Expiremental Use', above n 237, 19.

242 Peter Johan Schei and Morten Walløe Tvedt, Fridtjof Nansen Institute, *The Concept of 'Genetic Resources' in the Convention on Biological Diversity and How It Relates to a Functional International Regime on Access and Benefit-Sharing*, Ad Hoc Open-Ended Working Group on Access and Benefit-Sharing, 9th mtg, UN Doc UNEP/CBD/WG-ABS/9/INF/1 (19 March 2010) ('*The Concept of 'Genetic Resources*') 26.

243 *Oceans and the Law of the Sea: Report of the Secretary-General*, 60th sess, Agenda Item 75(a), UN Doc A/60/63/Add.1 (15 July 2005) [202].

244 Ibid.

pure research.[245] This indicates that the architects of the New Instrument might consider the human rights and the German patent law approach where access and benefit sharing obligations would not distinguish between commercial and non-commercial uses of a creator's productions, as long as the ultimate goal is to promote technical or scientific progress. What this approach means for current *UNCLOS* technology and knowledge sharing obligations is that a commercial use of a deep sea resource or deep sea waters will not automatically constitute a 'legitimate interest' or 'legitimate use' sufficient to postpone technology and knowledge sharing obligations that aim to promote technical or scientific progress. In other words, consistent with a stewardship approach to technology transfer, cumulative information and knowledge for developing new deep sea genetic resource technologies that are held on trust for the benefit of humankind would not be limited by whether the knowledge is used for a commercial purpose. However, the legitimate interests of a patent holder in the relevant patented technology can be protected in accordance with the functionality question analysed above.

VII CONCLUSION

There will always be competing interests when it comes to the sharing of knowledge and genetic resources for various uses including aquaculture. In recognition of this, *UNCLOS*, *TRIPS* and the *Covenant* each use a concept of 'legitimacy' that in theory assists with the balancing and prioritising of one interest over another. The problem for a developing sector like aquaculture which relies on increasing exchange of genetic resources for breeding and research is that there is no benchmark for determining 'legitimate interests' and 'legitimate uses' that may preclude *UNCLOS* obligations to share knowledge and genetic resource technologies. To use the examples in this article, the lack of benchmarking causes confusion about when uses of luciferase technologies derived from the deep sea shrimp or vasa gene technologies derived from tuna would be subject to current *UNCLOS* obligations and proposed access and benefit sharing obligations under the New Instrument. This article has shown that lawmakers could look to other areas of law such as patent law and broader principles like human rights and equity to achieve an appropriate balance for access and benefit sharing of deep sea genetic resources for use in aquaculture.

While none of the instruments define the term 'legitimate' for the purposes of interests or uses, the WTO's Panel and the *Covenant*'s Committee have to some extent clarified the term when it comes to the sharing of knowledge and technologies. Under *TRIPS*, both the broader society and the scientist have a 'legitimate interest' in using the patent disclosure to support the advance of science and technology[246] and are justifiable where supported by social norms.[247]

245 Ad Hoc Open-Ended Informal Working Group, 'Intersessional Workshops', above n 17, [39].
246 *Canada – Pharmaceutical Products Case*, above n 160, [7.69].
247 Ibid.

The *Covenant*'s Committee has found that any limitation (such as patent law) on interests must be proportionate, must pursue a legitimate aim and must be strictly necessary for the promotion of the general welfare of a democratic society.[248] These stewardship approaches are consistent with *UNCLOS*'s aim to realise a 'just and equitable international economic order which takes into account the interests and needs of mankind as a whole'.[249]

The *TRIPS* and *Covenant* approaches to balancing public and private interests can guide *UNCLOS*'s many unanswered questions about: the nature and extent of genetic resources that fall within technology and knowledge sharing obligations; how to benchmark or classify 'legitimate interests' that are capable of overriding these obligations; and how to balance competing legitimate interests and uses of deep sea resources. This article has shown the first step is to clarify how to distinguish between biological resources used for their genetic material (for example breeding) and those used for their biological product (for example farming) for the purposes of access and benefit sharing, which is not easy when it comes to uses of resources in aquaculture. Arguably current technology transfer obligations apply to the broader biological resources. If the New Instrument follows the *Biodiversity Convention* and only applies to genetic material, it will need greater clarity over the kinds of marine technologies that fall within *UNCLOS* obligations, including in situ and ex situ resource technologies, synthetic compounds and digital derivatives as well as genetically improved offspring of wild resources.

The next step for benchmarking 'legitimacy' involves clarifying the requisite link between the access and benefit sharing obligations, the relevant interest and the origin of the genetic resource. While the implied benchmark for *UNCLOS* obligations is the geographical origin of a relevant genetic resource, the migratory nature of aquatic biological resources suggests that biological origin may be a more appropriate or supplementary benchmark. This broader benchmark would include derivatives of a deep sea genetic resource whose characteristics or technologies are either present or performing the genetic resource's original function, as long as those characteristics can be traced back to the original biological resource. Human rights and patent law, however, treat 'legitimacy' in narrower terms when striking an effective balance between creator's rights (or proprietary interests) and the public interest in the benefits of deep sea technologies, particularly where access is necessary for food production and global food security. Under the stewardship approach, technology transfer obligations (and/or access and benefit sharing obligations under the New Instrument) would only be limited by legitimate proprietary interests in patented deep sea genetic resources that are based on the narrower *functional* origin and not the broader biological origin of the relevant genetic resource invention.

The final step is to clarify how competing commercial and non-commercial 'legitimate uses' of genetic resources in deep sea waters can be balanced under *UNCLOS*. The key may be to follow the stewardship approach under human

248 *General Comment No 17*, above n 119, [22]–[23].
249 *UNCLOS* Preamble.

rights and German patent law which facilitates the sharing of technology, commercial or non-commercial, as long as the ultimate goal is to promote technological or scientific progress. The safeguard for creators (or patent holders) would be the balancing of their 'legitimate interests' when their inventions are subsequently used in accordance with the functionality question.

As a proactive step towards effectively regulating deep sea genetic resources, policy makers need to consider a consistent benchmark under regulatory frameworks for determining 'legitimacy' before tensions escalate between private and public interest in deep sea genetic resources. Such conflict and uncertainty about whether a deep sea resource is protected or freely available is likely to adversely impact innovations in downstream industries such as aquaculture. The patent law defence framework under *TRIPS* has normative content for technology transfer that can currently be applied to patented deep sea genetic resource technologies for use in aquaculture. Its consistency with the stewardship approach under *UNCLOS* and the *Covenant* means that the way it approaches the balancing of 'legitimate interests' and 'legitimate' uses can also serve as a model for current and proposed technology transfer obligations concerning genetic resources of areas beyond national jurisdiction. As patent law and the law of the sea both have an impact on deep sea genetic resource transactions, consistency between the laws on this issue can offer certainty for users and promote development of new technologies for the benefit of all humankind and Earth as a system.