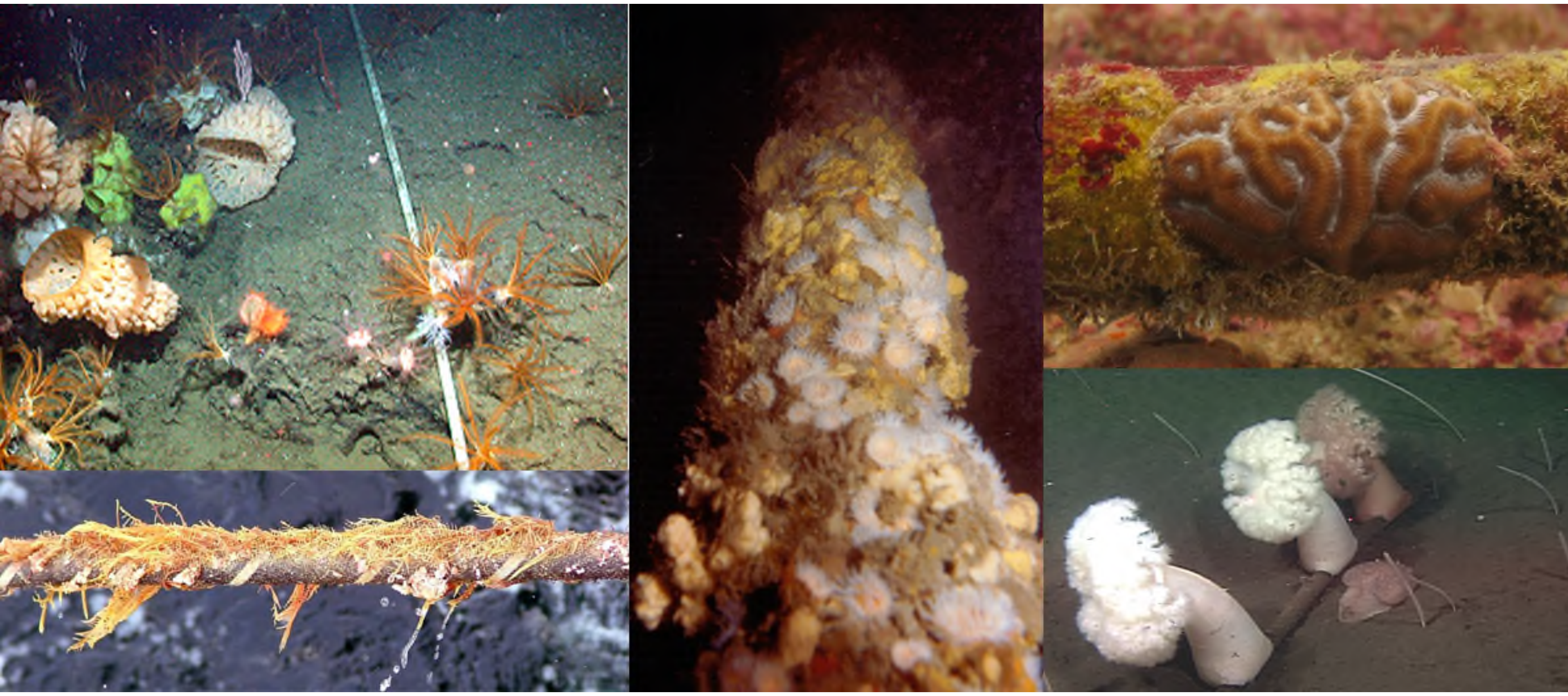
Submarine Cables and BBNJ

Preparatory Committee established by General Assembly resolution 69/292: Development of an internationally binding instrument under the United Nations Convention of the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction

The International Cable Protection Committee



The inert nature and small physical footprint of cables on the seabed is clearly shown these photographs, which are mainly from the continental margin within EEZs. They are (clockwise from top left) (i) a scientific cable on Pioneer Seamount, California; source Monterey Bay Aquarium and Research Institute, MBARI: (ii) encrusted power cable, now decommissioned, in Cook Strait, New Zealand; source K. Grange, NIWA: (iii) delicate corals and coralline algae colonised on a fibre-optic cable; source G. Rivera and S. Drew: (iv) anemones attached to an exposed section of a science cable, California; source MBARI: (v) epifauna growing on a fibre-optic cable; source N. Irvine.

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SUBMARINE CABLES AND BBNJ

This paper is respectfully submitted by the International Cable Protection Committee ("ICPC")[1] to provide the PrepCom with information on submarine cables, their contribution to sustainable development and their relationship to the marine environment in areas beyond national jurisdiction.[2] The views presented generally reflect the consensus of the international community of interest in submarine cables that includes cable owners, cable ship operators, marine route surveyors, scientific institutions and interested governments ("submarine cable community"). Every effort, however, is made to provide references to peer reviewed scientific, engineering, and legal references to assist the diplomats to carry out a dispassionate review while working on "development of an internationally binding instrument under the United Nations Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction." In this paper, "BBNJ" refers to the high seas proper and the Area beyond national jurisdiction as defined in the United Nations Law of the Sea Convention.

The paper is divided into three parts. The first part highlights the many uses of submarine cables and their value to sustainable social and economic development. The second part addresses BBNJ environmental aspects of cables in the context of marine protected areas ("MPA") and environmental impact assessments ("EIA"). The third part discusses the adequacy of existing ocean international law and governance for international submarine cables within BBNJ.

EXECUTIVE SUMMARY

Submarine cables are essential to the modern world's economic life and social fabric-they are the international paths that connect the internet. As summarized below, other uses of the ocean like shipping, fishing and mining cannot match their contribution to sustainability (pp. 4-6, 18-20). None of these uses can do so with such a neutral effect on the marine environment.

The physical footprint of a submarine cable in the BBNJ area is only 17-22 mm in diameter-i.e. it fits in the space between these parentheses (   ). In total, the percent of the BBNJ seabed surface covered by all in-service cables is about 0.00002% (pp. 11 and 21).

The cables are made up of inert materials (polyethylene, copper, glass, plastic) (pp. 11, 22). The amount of power in a submarine telecom cable is a slight constant DC current of about 0.6 to one amperes. By comparison, a laptop computer operates on about three amperes and most household circuit breakers are around 10-20 amperes[3] (p. 21).

Submarine cables underpin sustainable development:

- They are critical communications infrastructure carrying more than 98% of international internet, data, video and telephonic traffic (p. 4).
- By comparison, undersea cables dwarf satellites for international communications and are unmatched for their reliability, speed, volume of traffic, and low cost (p. 4).
- The Society for World Interbank Financial Telecommunications (SWIFT), The Continuous Linked Settlement (CLS) Bank, and the US Clearing House Interbank Payment System (CHIPS) all depend exclusively on submarine cables for daily transactions values at several trillions US$ (pp. 4-5).
- With the laying of submarine cables along the east coast of Africa in 2009-2010, only about 22 nations and territories remain isolated from fibre-optic cables (p. 5). These cables have empowered local people to improve their farming and fishing by applying new techniques and accessing regional markets: enhance universal education opportunities with on-line classrooms, resources and teacher access, and improve medical care provided through telemedicine (pp. 5-6).
- The "cloud" of legions of computer servers distributed in data centres worldwide is based on seamless connection via international submarine fibre-optic cables (pp. 5 and 23).
- The World Bank estimates that a 10% increase in Broadband Internet Access, contributes to an increase of 1.38% in Gross Domestic Product; submarine cables enable this sustainable growth, Submarine cable connections to a country lift economic prosperity for its people (p. 5).
- Submarine cables are important for marine and climate research and scores of cable enabled projects are now active in the oceans with many more planned for the future for ocean climate monitoring, tsunami warning, and fundamental ocean research (p. 6).

SUBMARINE CABLES ARE NEUTRAL TO THE MARINE ENVIRONMENT

Submarine cables in the BBNJ marine environment have a very small ecological footprint as demonstrated by a substantial peer reviewed literature plus reports and workshops:

- Recognition of that neutral effect is recorded in The Oceans and the Law of the Sea Report of the Secretary-General, the United Nations World Ocean Assessment for 2016, a joint study by the United Nations Environmental Program, the World Conservation

Monitoring Centre, and the ICPC, International Seabed Authority Technical Study No. 14, international multidisciplinary workshops involving multiple leading academic institutions devoted to ocean law and policy, and scores of peer reviewed scientific, engineering, and legal reports (pp. 21-22 and Endnotes section).

- Submarine cables used in the BBNJ area are of a light weight, non-armoured design with a diameter of about 17-22 mm -akin to that of a domestic garden hose. (pp. 11, 21).
- Cables are laid on the ocean floor surface (not buried) thus minimising any disturbance. In other words, cable operations are brief, rare activities in contrast to repetitive and prolonged activities such as fishing and shipping (pp. 14, 22).
- Cables rarely require any repair in BBNJ where an average of four repairs annually is recorded worldwide in their typical 20 to 30 year life (pp. 14, 17, 22, Annexes B-1 and C).
- When a cable is damaged, unlike a pipeline, there is no pollution or oil spill; just lost communication (p. 19).
- Cable routes are carefully chosen to avoid, where possible, marine natural hazards (landslides and turbidity currents, active and inactive volcanoes or seamounts, strong ocean currents) and modern cable routes reflect this historic "tried and true" experience. (pp. 11-16)
- Not only do submarine cables have a very small carbon footprint, but they also play a key role in reducing carbon dioxide emissions by underpinning teleconferencing as opposed to conference air travel. A two day teleconference from New York to Sweden yields 5.7 kg of CO_2 compared to an equivalent face-to-face meeting in Sweden involving travel that releases 1920 kg of CO_2 (pp. 16-17).
- Fibre-optic cables are made from chemically inert materials with nil environmental impact. (pp. 11, 21)
- Such is the positive and well documented environmental history of fibre- optic cables that the precautionary approach is not required for their use in BBNJ (pp. 22-23 and Endnotes section).
- In contrast to fibre-optic cables, submarine high-voltage power cables, because of physical transmission and depth limits, weight and other physical considerations, are not employed in the BBNJ area and none are forecast (p. 27, Annex A).

The world's undersea fibre-optic cable systems are the direct result of private investment, innovation, advanced ocean engineering, and international cooperation based on best practices anchored on the well regarded and proven provisions of UNCLOS. These must not be undermined:

- History and well established custom and practice confirm UNCLOS articles 87, 112-115, 297 carefully provide for the freedom to lay and repair international cables function in balanced harmony with environment articles 192 and 206 (pp. 18-20, 23-25).
- UNCLOS provisions for submarine cables allow for an efficient balance with due regard for other activities such as merchant and fishing vessel operations, pipeline crossings, and deep sea bed mining. Already in place best practices, Memorandums of Understanding, and tried and true custom and practice demonstrate historically that the existing governance works. There is no need to fix what is not broken (pp. 18-20).
- Because of the proven environmental record of fibre-optic cables in BBNJ, article 206 provides sufficient legal protection for the environment with respect to environmental impact assessments (pp. 23-25).

- **Submarine cables and marine protected areas are not mutually exclusive; fibre-optic cables already exist in such areas with a record of little or no harm (pp. 24-25 and Annex C).**
- **In contrast to other ocean uses (shipping, fishing, oil and gas exploitation, and deep sea bed mining) that do impact the marine environment, the record presented in this paper supports an exemption for submarine fibre-optic cables from any new legal regime that might be imposed in an implementing agreement for BBNJ (p. 25).**

As a result, the existing provisions in UNCLOS with respect to submarine cables should not be changed or encumbered with unnecessary regulations that could both create unintended consequences and negatively impact the undeniable socio-economic benefits that decentralized submarine cable systems bring to the world. In particular, any environmental impact assessment requirements beyond those existing in article 206 will not be helpful and would place a needless impediment on the operation, expansion and improved resilience of world's acknowledged critical cable infrastructure. (pp. 23-25)

With respect to marine protected areas, in whatever form that may emerge in the PrepCom process, a solid historical record underscores that fibre-optic cables and such protection zones are not mutually exclusive and in fact coexist well today. Applying marine spatial planning to BBNJ to include submarine cables is unnecessary and would undermine the successful and well proven current decentralized systems, with its critical route diversity, introduce cybersecurity risks, impede the connection of fibre-optic cables to remote island and coastal communities, and reduce needed cables required to provide for alternative paths for restoration in the event of a cable fault (pp. 23-25).

Based on the evidence presented in this technical paper, it is respectfully submitted that whatever instrument that may emerge from the BBNJ process, submarine cables should be exempted and the current successful legal system provided in UNCLOS for submarine cables should not be undermined.

I. SUBMARINE CABLES AND SUSTAINABLE DEVELOPMENT

The Oceans and the Law of the Sea Report of the Secretary-General[4] succinctly sums up the conventional wisdom about international submarine cables and sustainable development:

> **53**. Submarine cables are critical communications infrastructure, being used for more than 98 per cent of international internet, data, and telephone traffic, with only a few States being without fibre connectivity, and many of these having cable projects currently underway. [5] Submarine cables are recognized as vitally important to the global economy[6] and hence to economic growth. By underpinning international communications, their role in providing access to data and information for all peoples is evident.
>
> **55.** Functioning as the backbone of the international telecommunications system, submarine cables are directly part of global critical infrastructure and sustainable industrialization and indirectly they contribute to all other areas recognized as important for sustainable development.

Amazingly, when people think about international communications, they often mistakenly regard satellites as the primary medium of modern international communications. They express surprise to learn that over 98% of international communications are carried by a relatively small number of fibre-optic submarine cables with diameters akin to a domestic garden hose even though this has been the case for almost 30 years.

The confusion is understandable. The idea that a person's cell phone air link is sent to a nearby cell tower, but that the overseas messages themselves are then broken into bits of data, which then at the speed of light ply the ocean depths on unseen cables is hard to imagine. This is hard to comprehend. The tremendous volume of data carried at low cost by modern fibre-optic submarine cables dwarfs the limited capacity of higher cost satellites. For example, the capacity of a single transatlantic cable has increased by a factor of 100,000 in 25 years.[7] Additionally, the technical transmission delays, modest capacity and other quality limitations inherent in satellites make them comparatively marginal for continuous transmission of high speed voice, video, and data traffic.

The collective impact of the laypersons' mistaken beliefs and knowledge gap is negatively compounded by the fact that many in government share their misconceptions, even as they fashion ocean policies and regulations that overlook submarine cable history, marine engineering, seamanship, environmental aspects and international law. Not infrequently, these flawed regulatory efforts undercut the viability of the successful submarine cable network as the critical international infrastructure upon which the internet and global economy are based.

Even more popularly unknown or appreciated is the substantial body of scientific research and records that document the inter-relationship of submarine cables and the marine environment. Like cables, the time tested and very successful international legal regime that support international cables is often misunderstood or overlooked.

The purpose of this paper is that it provides useful background information to the diplomats engaged in the momentous BBNJ discussions in PrepCom.

A. SUBMARINE CABLES AND ECONOMIC AND SOCIAL DEVELOPMENT

Each day the Society for Worldwide Interbank Financial Telecommunications (SWIFT) transmits 15 million messages over cables to over 8,300 banking organizations, securities institutions and corporate customers in 208 countries. The Continuous Linked Settlement (CLS) Bank located in the United Kingdom is just one of the critical market infrastructures that rely on SWIFT as it provides global settlement of 17 currencies with an average daily US dollar equivalent of approximately USD3.9 trillion. The U.S. Clearing House Interbank Payment System (CHIPS) is another structure that processes over USD1 trillion a day to over 22 countries for investment companies, securities and commodities exchange organizations, banks and other financial institutions.[8]

If the approximately 40 or so garden hose diameter cables connecting the United States to the rest of the world were cut, even using every single satellite in the sky, it is estimated that only 7% of the total United States traffic volume could be carried by satellite.[9] Referring to the submarine cable networks, the Staff Director for Management of the Federal Reserve observed "when the communication networks go down, the financial sector does not grind to a halt, it snaps to a halt."[10] The same can be said for most industries enmeshed in the global economy through the internet including shipping companies, airlines, banks, supply chain, manufacturing businesses, and entertainment industries.

Other countries are no different in their reliance. Australia and Singapore, for example, each rely on several cables landing in each nation for over 99% of their international communications. Japan does the same with about 20 international cable systems. And the list goes on. With the laying of submarine cables along the east coast of Africa in 2009-2010, this last major group of nations now has access to the world's submarine cable network. As of mid-2012, only 22 nations and territories remained isolated from fibre-optic connectivity and many of these have connecting cable projects underway.[11] A major challenge now being met by the submarine cable community is providing connections to small island economies and isolated coastal communities of the high Arctic, together with provision of redundant cable connections to keep these economies connected in the event of a cable fault.

The world's dependence on reliable low cost and secure submarine cables continues to grow. "Every *second* they can carry 31 terabits across the Pacific and 55 terabits across the Atlantic."[12] A look at the websites of major companies like Google, Microsoft, Facebook and Amazon shows the diverse locations of the legions of computer servers in each company's data centres which are distributed worldwide and on every continent except Africa. These *cloud* data centres are seamlessly connected by international submarine fibre-optic cables. It is not an exaggeration to say the *cloud* would not exist but for cables under the sea.

By 2020, one expert estimates that there will be 4 billion people connected to the internet, $4 trillion of revenue opportunity from these connections, using over 25 million apps, with over 25 billion embedded intelligent systems, and 50 trillion gigabits of data.[13] These connections will exist almost exclusively on international submarine cables, the backbone of the internet. Applications known to many such as Skype, Facetime, Netflix, Twitter, Facebook, and You Tube remind us all in a personal way that our lives are directly impacted by submarine cables.

The unparalleled ability of submarine cables to increase GDP is recognized by the World Bank:

> "Subsea Fiber has recently gained renewed focus within the TMT Investment sector of IFC (the private investment arm of the World Bank); as it has a broad economic impact on developing economies. Subsea provides increased international capacity, which usually equates to a drop in wholesale pricing, and open access to service providers. As volume and completion increases, prices fall to the enterprise and the end consumer. This will stimulate development of new business models regarding health, education, and commerce. Additionally, increased subscriber rates due to access to low cost, high speed internet access is one of the key catalysts to economic development. **The World Bank estimates that a 10% increase in Broadband Internet Access, contributes to an increase of 1.38% in GDP**."[14]

Affordable telecommunications services are now a reality in places where internet connectivity was nearly unheard of just a few years before. The new systems in Africa and Asia-Pacific are prime examples showing the economic impact that just one fibre-optic cable can have. World Bank press releases herald these transformative cable impacts:

> "This cable is more than simply an important piece of technology. It is a key infrastructure project that can deliver extraordinary benefits across Samoa's education, health, business and tourism sectors for decades to come."[15]
>
> "Faster, cheaper, and more reliable connections can result in the development of:
>
> - New opportunities to share information: teachers, doctors, farmers, and fishermen use technology to communicate, share information, buy goods, find better prices, make payments, improve the reach of their services and increase their bargaining power.
> - E-services: Developed by Pacific governments to provide geographical information systems, new modes of distance learning, and online business applications.
> - Trans-national cooperation: On issues such as monitoring natural resources like fisheries, disaster mitigation, and collaboration on service deliver like health and education, including in remote areas.
> - There is huge potential to harness the power of technology to create economic growth and opportunities to reduce poverty."[16]

Africa is also a bellwether example of the transformative impact of modern fibre-optic submarine cables:

> "A key indicator for broadband development in Africa is the deployment of basic infrastructure, such as international submarine cables. Many African governments have co-sponsored new cables of this type along the continent's east and west coasts, with the aim of improving broadband connectivity."[17]

Other examples illustrate the wide use and importance of cables to modern life. The National Marine Fisheries Service of the United States tracks trade in fish products between the US and China valued at USD100M per annum and these transactions are carried out on submarine cables.[18] Through cables, unique environmental and cultural tourism in small developing island communities like Vanuatu and Fiji are promoted.[19] The impact is demonstrated by a single group in Fiji that employs over 600 persons in a diverse portfolio of tourist related services including transportation, retail travel, overseas wholesaling, and hotel ownership and development.[20]

International telemedicine at world-renowned facilities in Dubai and Minnesota is a reality through cables worldwide.[21] Cables allow instantaneous machine-to-machine and artificial intelligence solutions to improve healthcare on many levels.

The future contributions of submarine cables to sustainability are bright and varied. Technology advances in 3D printing will allow items to be locally manufactured, reducing the need for ocean or air transportation and other high carbon footprint industries. For example, an electric lightweight 80 km/h motorcycle entered print production this year.[22] All that will be required is an international fibre- optic cable connection to allow the software, blue prints, and payments to flow. Similarly, long distance learning will allow disbursed populations in archipelagic States to have common access to the best teachers and resources. Medical data and expertise will allow for improved health care and bring high-level care to more and more people. Mapping and location services enabled by cables will save energy, time, and funds in providing government and private industry services with the precision needed for their efficient management and provision.

B. SUBMARINE CABLES AND SCIENCE

Besides the critical economic and social sustainability roles played by the submarine cables as international arteries connecting the world, submarine cables are also vital for marine science and the quest to learn more about the oceans and climate. In a 2009 survey, the ICPC identified 193 ocean observation sites and areas worldwide, including at least 34 that planned or were using submarine cables for data transmission and power transfer in the world's oceans.[23] The 800 km cable-based Neptune system, with multiple scientific nodes (special seabed housings capable of supporting monitoring equipment and experiments) off Vancouver Island, British Columbia is a standout operational example. Another is the Ocean Observatory Initiative (OOI) array off Oregon, which like its Canadian counterpart is based on a 900 km cable that supports a suite of nodes.[24] Japan has pioneered the use of submarine cable systems to monitor seismic activity and detect tsunamis.[25]

II. SUBMARINE CABLES AND THE BBNJ MARINE ENVIRONMENT

While the BBNJ area is remote and deep, there is still sufficient knowledge to provide a general overview of the environment. Satellites continually observe the temperature, height, currents and plankton content of the ocean surface as well as the topography of the ocean floor (Fig. 1) [26,27]. On Earth, various observatories constantly monitor global seismic activity, tsunamis and ocean currents [e.g., 28,29]. Such information is complemented by a wealth of regional studies from ship-borne surveys. However, the biological world is less well covered. Global programmes such as the Census of Marine Life are advancing knowledge especially of the North Atlantic and Pacific oceans but are also exposing data-poor regions in the high Arctic and parts of the Southern Hemisphere[30].

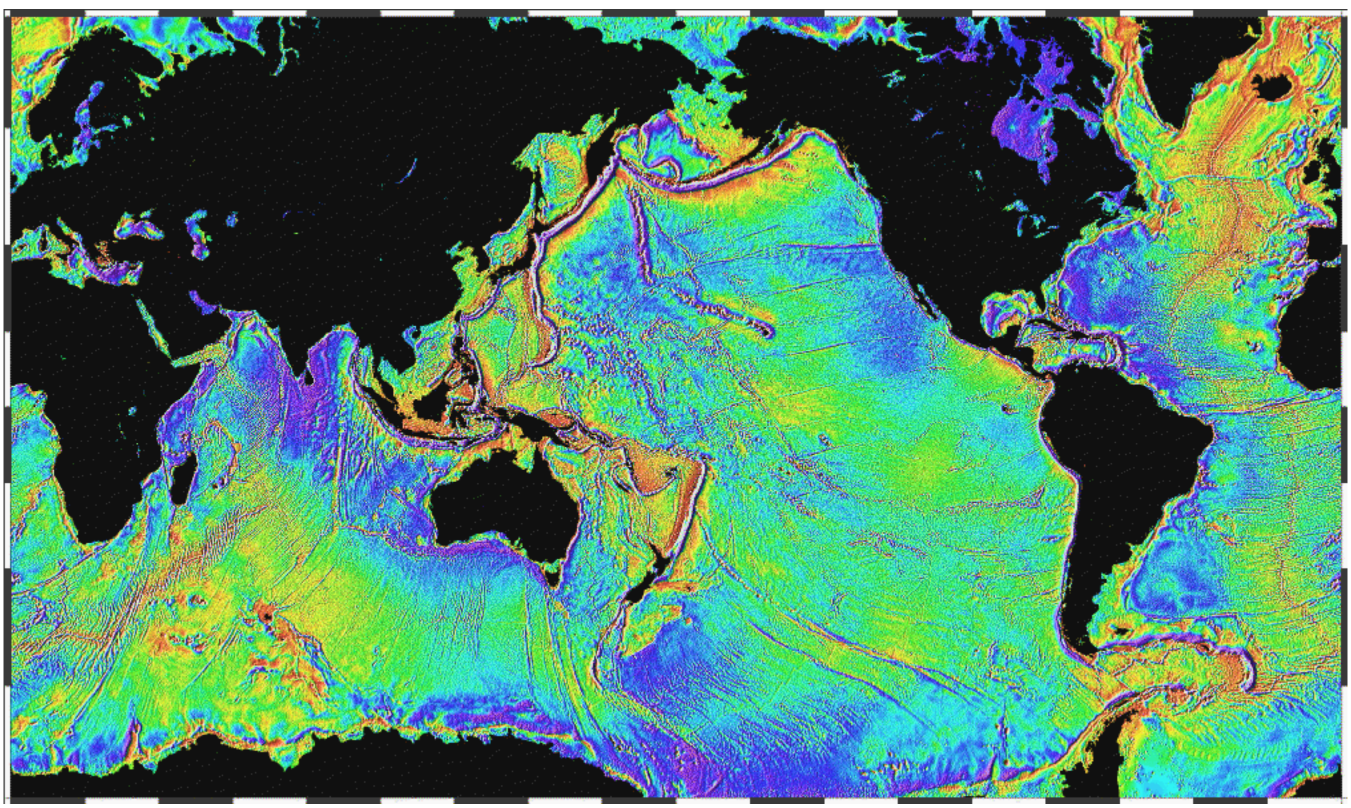

Figure 1. The ocean surface is shaped by the underlying seabed and gravity. Satellite measurement of surface deflections on scales of centimetres, together with computer modelling, provide an unprecedented view of the ocean floor from space. Source: **http://topex.ucsd.edu/marine_grav/mar_grav.html**

A. THE BBNJ ENVIRONMENTAL SETTING

1. Depth and shape of the deep ocean

The BBNJ surface area is substantial as shown by the following numbers.

Oceans area	= 362 million km^2 or 71% of Earth's surface[31]
Average ocean depth	= 3688 m
BBNJ	= ca. 230 million km^2 or ca. 39% of Earth's surface (this is an approximation that reflects uncertainties of some EEZ boundaries).
Average BBNJ depth	= > 3688 m as it usually excludes the 0 to 2000-3000 m-deep continental margin, which commonly resides within the EEZ (Fig. 2) [32].

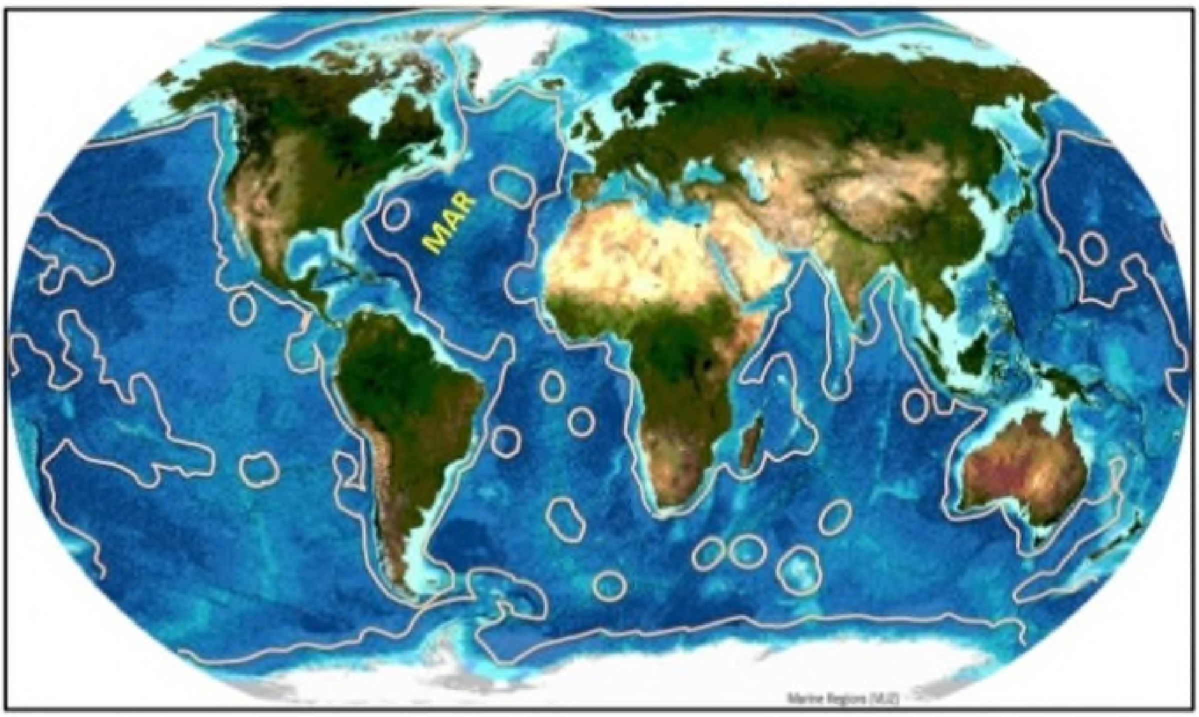

Fig. 2. A generalised chart of seaward boundaries of Exclusive Economic Zones (pink lines) includes a hypothetical 200 nautical mile limit around Antarctica[33]. The EEZ encompasses the shallow continental shelf (0- *ca.* 130 m depth), continental slope and rise (*ca.* 120 m to 1500-3000 m) and, in areas such as the circum-Pacific rim, even deeper waters. In contrast, the BBNJ is essentially the abyssal ocean plain that typically extends below *ca.* 3000 m depth. Even mid-ocean ridges such as the mid-Atlantic Ridge (MAR), that pass through the BBNJ, are mainly deeper that 3000 m but locally shallow to less than 1500 m. Chart compiled from Marine Regions [34].

A cable in BBNJ typically traverses a diverse ocean floor comprised of abyssal plains and hills, mountainous ridges larger than terrestrial counterparts, plateaux and innumerable submarine volcanoes or *seamounts* (Figs. 1,2)[e.g. 35]. There are also depressions. Trenches can extend to 6 km below the adjacent ocean floor. Channels can continue from submarine canyons, and wend across the ocean floor for hundreds to thousands of kilometres (Fig. 3).

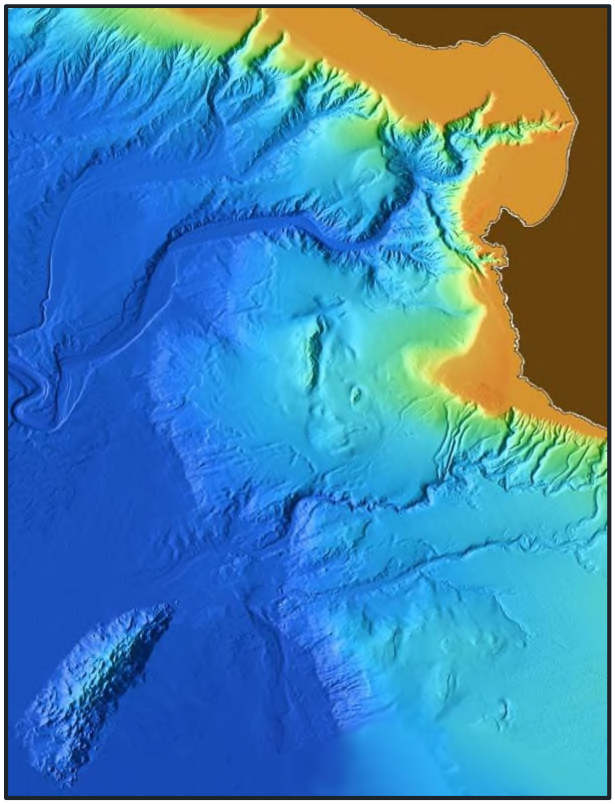

Figure 3. Although well within the US EEZ, the ocean floor off California, serves two purposes relevant to the BBNJ process. [1] The extinct 2,280 m-high, Davidson Seamount (lower left) is an example of the type of feature that cable routes in the EEZ and BBNJ avoid due to the presence of steep slopes, rough rocky topography, locally intensified currents and often rich and diverse biological communities, which can attract commercial fishing especially on the high seas. [2] The continental margin, comprised of a shelf (brown), slope (yellow green) and rise (pale blue), is part of an earthquake-prone zone where seismic shocks may trigger landslides and turbidity currents that pass down submarine canyons, clearly shown on the continental slope and rise, and less distinctive channels. From the evidence to hand, it is only infrequent major earthquakes that produce turbidity currents capable of extending into the BBNJ and even then, current speeds may be too slow to damage cables. Source: *Image copyright 2000 MBARI.*

2. Ocean currents

The ABNJ ocean floor is subject to major currents that connect the Northern and Southern Hemispheres. Super cold, dense water is formed around Antarctica and spreads northwards in water depths greater than 2000 m. At the same time, surface currents in the North Atlantic Ocean, in particular the Gulf Stream, cool as they flow north, providing heat for Europe and the eastern seaboard of North America (Fig. 4). As this water cools it too becomes dense and sinks to return south to Antarctica [e.g. 36,37]. Normally these deep currents are slow *ca.* 5-10 cm/s (0.1-0.2 knots) but they can intensify against the steep submarine topography especially that of continental margins, submarine ridges and flanks of seamounts[38]. Current can accelerate to erode the seabed in depths of 3000-4000 m and deeper [39]. This interaction with zones of strong relief can also form giant eddies, which in the case of the Gulf Stream disturb the seabed at around 5 km depth[40].

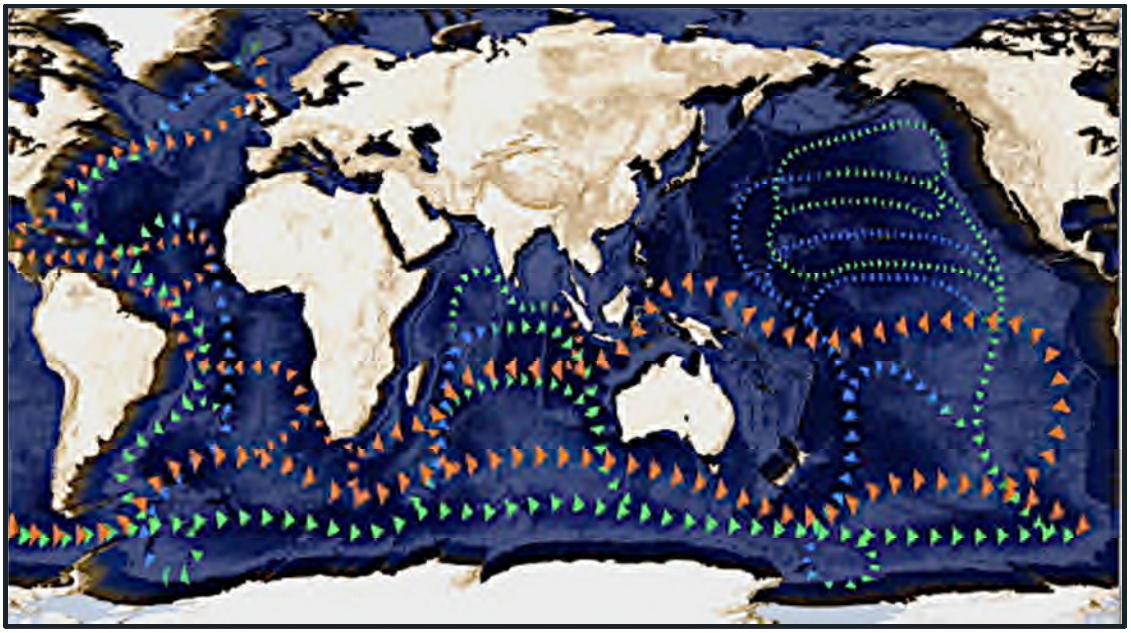

Figure 4 Currents of the global ocean circulation system, formerly known as the *Ocean Conveyor*. Of relevance are the deep currents (blue arrows *ca.* >2000 m water depth) that circulate through the BBNJ. These flows can intensify against steep slopes, such as those of undersea volcanoes or *seamounts*, to reach speeds capable of moving sediment, which in turn may fatigue or abrade cables. Source http://www.cmar.csiro.au/currents/animations.htm

3. Natural hazards

Natural hazard risk and experience are major factors in cable route selection. The distribution and frequency of natural hazards varies with the regional geology, climate and oceanography. The most hazardous regions are where tectonic plates collide; a phenomenon marked by extensive earthquake and volcanic activity, extreme erosion and disproportionally large discharges of river sediment into the ocean. Taiwan, for example, is smaller than Iceland but produces about 2% of the sediment reaching the world ocean [e.g. 41]. The most extensive region of tectonic plate collision is the rim of the Pacific Ocean, popularly known as the *Pacific Ring of Fire.* Lesser, but nonetheless important collisional zones also dominate the Caribbean, northeast Indian Ocean and the Mediterranean regions.

The continental margins of such earthquake-prone regions are subject to submarine landslides that can transform into *turbidity currents*[42]. These turbulent sediment-laden flows can reach speeds of 68 km/hour and travel hundreds of kilometres commonly guided by submarine canyons and channels. And if cables lie in a current's path there is the threat of breaks[e.g. 43].

If a seamount is active, potential threats include lava flows, hot-water vents, earthquake- or volcanic-triggered landslides and debris flows, and rugged rocky topography that may suspend cables. Furthermore, the strong relief of seamounts can intensify currents. Extinct seamounts are a lesser risk, but the hazards of intensified currents and rough topography remain (Fig. 3).

The impact of icebergs, sea ice, storm surges and tsunami are felt primarily at the coast and continental shelf and have minimal effect [44], unless the last two mechanisms generate turbidity currents capable of travelling to the BBNJ.

B. CABLES AND INTERACTIONS WITH THE BBNJ PHYSICAL ENVIRONMENT

1. Cable physical and chemical presence

Given that the average depth within the BBNJ exceeds 3688 m, cables are laid directly on the seabed. This reflects an absence of activities known to directly cause cable breaks namely ships' anchors and bottom trawl fishing[45]. Accordingly, there is no requirement for protective burial below the seabed thus minimising any disturbance to the benthic environment. Furthermore, for water depths exceeding 1500 - 2000 m, telecommunications cables are typically 17-22 mm diameter, hence their physical foot print is small[46,47]. As 80% of the ocean is deeper than 2000 m then a similar percentage of cables are of small-diameter "lightweight" design (Fig. 5).

Certainly, water depths in the BBNJ favour the deployment of lightweight cable, i.e. one comprised of a high-grade, marine polyethylene tube with a core of steel wire for strength, a copper conductor to power acoustical repeaters and glass fibres for communications [48,49]. There is no need for protective armour and anti-fouling agents are not used as a matter of course.[50]. In that context, lightweight cables are chemically inert [51,52].

Figure 5. A lightweight fibre-optic cable with (from outside to core) black and white polyethylene sheath, power conductor (copper), wire strength member, glass fibres and plastic support sheath (white).

Such is their chemical stability that decommissioned fibre-optic cables and their coaxial predecessors, are becoming targets of an expanding recycling industry even though these cables may have lain on the seabed for three decades and longer[53].

2. Cables and natural hazards

Taking a broader view, between 150 and 200 cable faults occur each year worldwide. Between 60-70% of those faults are caused by human activities, especially fishing and shipping [54,55]. Thus it is not surprising that most faults are concentrated on the continental shelf in depths less than 200 m [56] as well shown by the global distribution of 2,162 faults for 1959-2008 (Fig. 6) [57]. Faults due to failure of cable components are less than 5% whereas faults caused by natural hazards such as submarine landslides, are less than 10% of all faults, and tend to occur in water depths over 1200 m [58].

Figure 6. This distribution of 2,162 cable faults were recorded between 1959 and 2008 a period that covers the last of the telegraphic cables, coaxial cables and fibre-optic systems, the latter coming to prominence in the late 1980s. Most faults occurred in the shallow (<200 m deep) seas around Europe, SE Asia and eastern seaboard of North America and reflect the intense fishing and shipping activity of those regions. Faults across the North Atlantic Ocean result from the failure of old cables due to abrasion and component failure. For the rest of the BBNJ, cable faults are presently 4 per annum worldwide[59]. (Figure used with permission of TE Subcom.)

The most common natural causes of faults in the deep ocean are submarine landslides and associated turbidity currents[60,61,62]. Today, areas of concern are the island of Formosa[63] and Algeria[64] where earthquakes in 2006 and 2003 caused 22 and 29 cable breaks respectively. Damaging turbidity currents are also generated by cyclonic winds and rainfall through rivers discharging mud-laden flood waters that dive and move along the seabed. Likewise storm waves disturb seabed sediments that also evolve into a turbidity current[65,66].

While zones of tectonic plate collision produce cable damaging turbidity currents on an annual basis, their impact on cables in the BBNJ is likely to be modest because (a) the main areas of landslides and turbidity currents are the continental slopes that usually occur within EEZs (Figs. 2, 3) and (b) any turbidity current leaving an EEZ is likely to move on to a near-flat floor of the BBNJ where current speed reduces to a level where it is no longer a threat to a cable[67]. However, there are local departures from that generalisation. One example is the 1929 Grand Banks earthquake, which produced a major turbidity current that ran 800 km to break telegraph cables seaward of the Canadian EEZ[68].

Where possible, cable route planners avoid zones of active landslides and turbidity currents such as submarine canyons and channels but this is not always possible. The circum-Pacific Rim, for example, includes major cities such as Manila, Tokyo, San Francisco, Los Angeles, Santiago and others. And these metropolises rely on the services provided by submarine cables, which therefore must traverse the hazardous margins of the Pacific Rim. The plotting of a least hazardous route requires up-to-date knowledge of deep-ocean hazards as demonstrated for the Strait of Luzon. There, at least 17 fibre-optic cables cross a highly active submarine canyon and adjoining Manila Trench. These cables keep Southeast Asia connected to the rest of the world (Fig. 7). New research is suggesting that new cable routes cross deeper parts of the Manila Trench where turbidity currents slow down and are less damaging[69].

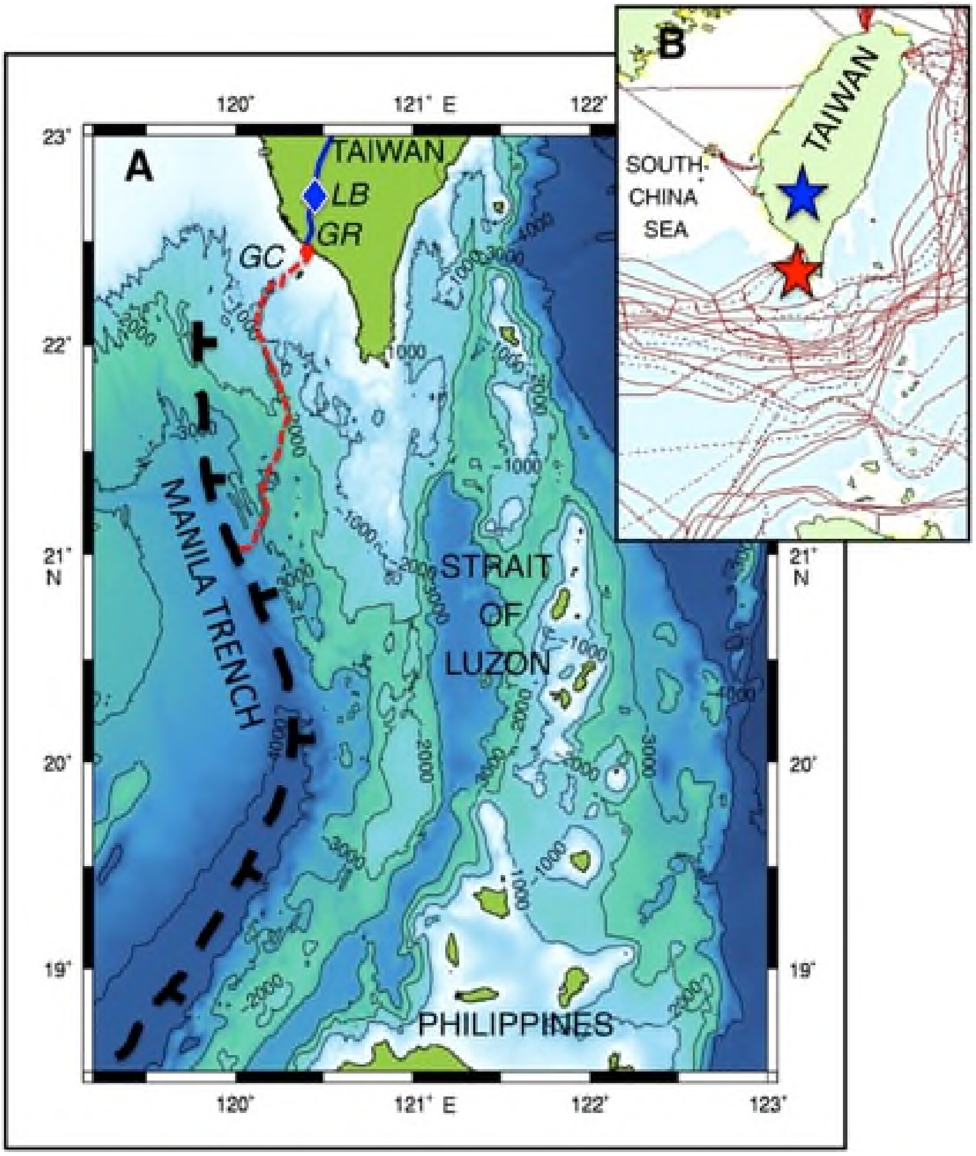

Figure 7. The Strait of Luzon (A) is where at least 17 cables (B) cross the active Gaoping Submarine Canyon (GC; course in red)) and Manila Trench. The combination of frequent earthquakes and typhoons cause landslides and turbidity currents. [70].

In the same vein, cable route planners avoid volcanically active seamounts and sectors of ocean ridges. This approach is successful as there are few cable faults directly attributed to lava flows, debris flows, hot-water vents and other facets of volcanic activity. The main threat comes from the rough volcanic terrain (e.g. Fig. 3) and local currents that intensify in gaps and against the steep sides of extinct and active seamounts. If a cable is suspended across a rough rocky terrain, strong currents may cause the cable to swing or vibrate resulting in fatigue and failure at the suspension points. Alternatively, a cable on a sandy substrate can be abraded as sand grains shift in the strong flow.

Risks from climate change appear to be low due to the depths of the BBNJ area. Deep water tends to dampen more obvious effects of change as manifested in the upper ocean, namely strengthening storms, rising sea level and changing ocean currents and waves [71]. However, there is the suggestion that stronger and wetter tropical cyclones will form large floods capable of transforming into turbidity currents with sufficient power to break cables as seen off Formosa [72]. However, any effect on cables in the BBNJ area will be minimal. The seaward limit of Taiwan's EEZ is over 1020 nautical miles (1890 km) east of the country and any turbidity current would be trapped by the intervening submarine topography. Furthermore, studies show turbidity currents are a spent force just ca. 120 nautical miles (220 km) from Taiwan[73]. With regard to climate change, there may be an effect on deep ocean currents but those changes will be modest, as evinced by reconstructions of current behaviour in past warming periods[74].

Overall, the number of cable faults from all causes, including natural hazards, is small in the BBNJ area. An analysis undertaken of cables in the Sargasso Sea revealed a total of three cable repairs for the period 2008-2015[75]. Those faults were related mainly to abrasion in the vicinity of a chain of extinct seamounts. Worldwide, the annual rate of cable faults in the BBNJ for 2008-2015 was four faults per annum[76]. (Annex B-1)

3. Cable operations

The laying of a submarine cable is guided by a desk-top study followed by a ship-borne survey to identify a safe, commercially-viable and environmentally neutral route [77,78]. There are substantial databases that provide a useful first cut at designing a new cable route. Nevertheless, a route survey is required to provide the detail necessary for successful cable deployment. In the BBNJ, these surveys are normally limited to a single pass of multibeam sonar. Where possible, cables avoid obvious natural hazards, zones of biological significance and cultural heritage sites[79,80]. Route surveys are an inseparable part of the freedom to lay cables.

As noted earlier, hazardous zones are not always possible to avoid. The first trans-oceanic cable, for example, took the most direct route between Ireland and Newfoundland. Thus, the route crossed the volcanic mid-Atlantic Ridge (MAR) that extends from the high Arctic to the Southern Ocean (Fig. 2). Telegraphic cables, which operated from 1866 to the 1950s and early coaxial systems (1950s - 1960s; Fig. 6) were subject to faults in the general region of the MAR. Those faults were largely attributed to abrasion and fatigue in areas of current swept rocky seabed and to component failure, bearing in mind components in the older cable systems were less reliable than their modern counterparts. Today, at least 21 fibre-optic cables traverse the MAR[81] with considerably more reliability due to (a) improved cable design, (b) the development of accurate seabed mapping systems and navigation and (c) improved scientific knowledge.

Cables typically have a design life of 20 to 25 years[82,83], but improvements of signal processing mean that existing cables can be upgraded to operate for up to 30 years. Whether the life is 20 or 30 years, the deployment of a cable is a brief, infrequent event of minimal extent. This contrasts with repetitive or long-duration activities such as commercial fishing, oil and gas exploitation and seabed mining.

Because of the lack of human activities like bottom trawling and anchoring in the BBNJ, repairs are rare (Annex B-1). Repairs involve the towing of a specialised grapnel that secures and cuts the cable[84,85]. The secured end is brought to the surface and tied to a surface buoy. The grapnel then recovers the other cable end, at which stage a new section of cable is inserted or *spliced* between the recovered cable ends. The repaired assembly is lowered to the ocean floor taking care it is laid under tension to ensure coils or loops are not formed. It is recognised that the ocean floor will be momentarily disturbed during recovery. A grapnel may disturb a swath of ocean floor up to 1 m wide and a few kilometres long [e.g. 86], although the actual nature of the disturbance will depend upon the geological nature of the seabed.

There is an argument that grapnel scars will be short-lived. The few fault repairs (four per annum-Annex B-1) in the BBNJ occur mainly in zones of mobile seabed where currents shift sediment that abrades and fatigues cables[87,88]. Such seabed mobility also has the potential to naturally smooth out any scars.

As repairs are designed to last a cable’s lifetime, repair operations per se are infrequent and briefly invasive over a limited area.

4. Cables and marine biota

Knowledge of the interaction of cables with the marine benthic biota is based mainly on studies undertaken on the continental margin where the abundance and diversity of marine species is higher than that currently known for the deep ocean. This situation reflects the nutrient- and plankton-rich surface waters that typically overly continental margins but may also extend into the BBNJ via major currents such as the Gulf Stream (Fig. 8).

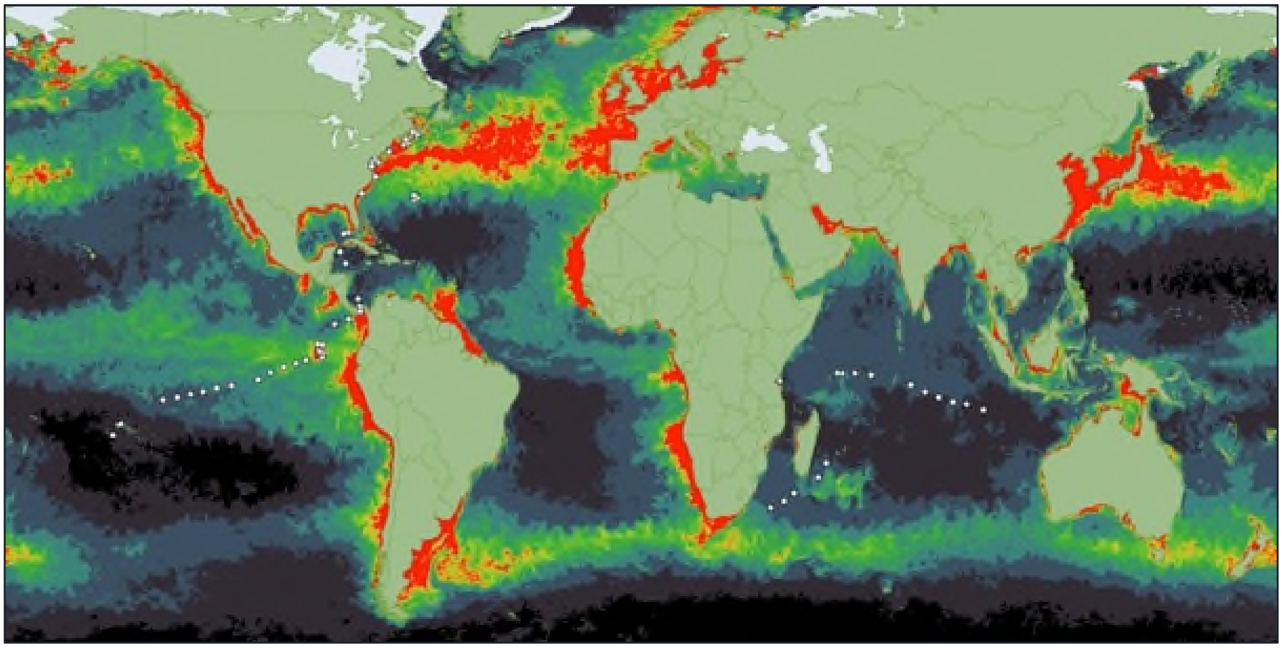

Figure 8. Satellite data showing regions of high chlorophyll in surface waters. Chlorophyll is a proxy for plant plankton, which underpin the marine food chain. Highest production of plankton are red and lowest are dark grey regions which covers much of the BBNJ area, but may also follow major ocean currents. http://www.mpi-bremen.de/en/Biodiversity_research_project_launched.html

Studies of organisms living on and in a seabed occupied by cables show no statistical difference in abundance and diversity compared to areas without cables[89]. A recent study,[90] for example, is based on repeated seabed surveys made before (2004) and after cable deployment (2007, 2010, 2015) of a combined fibre-optic/power cable in Monterey Bay. Since the cable became operational, the abundance and distribution of skates and sharks, as well as animals larger than one mm living in or on the seabed, showed few changes that could be attributed to the cable. In essence, any measurable effect of the cable was overshadowed by the natural variability of the biota.

In the pre-1950s, whales, especially sperm whales, were observed entangled with old submarine telegraphic cables at the edge of the continental shelf[91]. However, the improved cable designs of coaxial cables and fibre-optic systems, plus better laying and repair procedures, were followed by a complete cessation of whale entanglements - a situation that continues to the present day (Fig. 9)[92]. In addition, most water depths within the BBNJ exceed 2000 m, which is the known diving limit of sperm whales[93].Fish bites, including those of sharks, have damaged telecommunication cables from the telegraphic to fibre-optic cable eras[94]. Evidence of fish bites comes from the shape of the bite marks and the presence of teeth embedded in a cable's polyethylene sheath [95]. From 1901 to 1957 at least 28 telegraphic cables were damaged [96]. Between 1959 and 2006 - a span that encompasses coaxial and fibre-optic systems - approximately 11 cables needed repair due to fish bite[97]. The most recent data covering 2007 to 2015 reveals no cable faults attributable to fish[98]. This marked decline in fish-related faults results mainly from improved cable design.

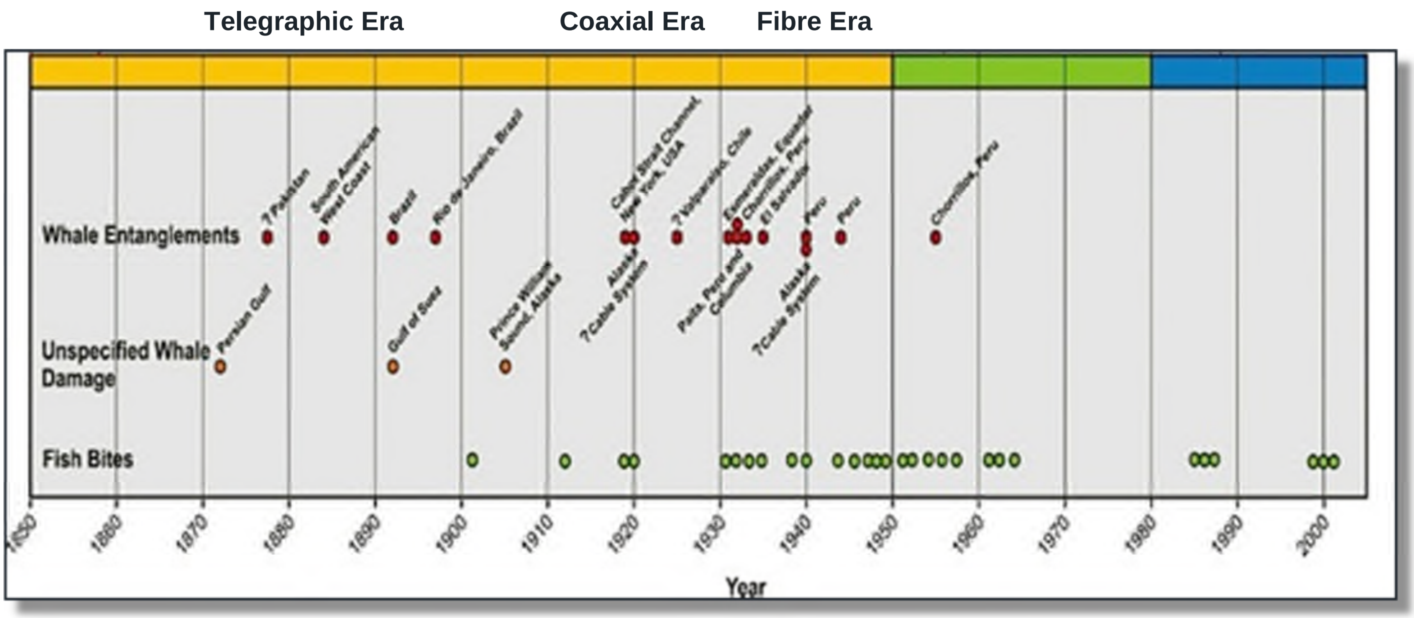

Figure 9. The record of whale entanglements ceased with the establishment of coaxial cables (1950s-1960s) and their fibre-optic successors (1980s to present day). Faults from fish bites have generally declined and have not been recorded since 2007[99].

5. Cables and their environmental value

Since deployment of the first fully operational trans-oceanic cable, exactly 150 years ago, cables have provided information and knowledge about the marine environment. Early telegraphic cables recovered from abyssal depths were sometimes encrusted with marine life or covered with sediment containing live organisms. These isolated discoveries came at a time of much debate in Victorian science circles as to whether life could exist in depths greater than 500 fathoms (914m). Cold temperatures, a lack of light, and high pressures were thought by some scientists to be too extreme to support life[100]. To resolve the issue the first worldwide survey of the ocean, namely the HMS *Challenger* expedition, was instigated with a prime aim to determine what life, if any, occupied the oceanic abyss[101]. The four-year venture between 1872-1876 revolutionised mid-19th Century views of the ocean with the discovery of many new organisms at all ocean depths.

Cables continue to be sentinels of the deep ocean by providing information on processes that shape the ocean floor such as tsunami, landslides and turbidity currents. Indeed, the first direct observation of such currents came from cable breaks caused by the 1929 Grand Banks earthquake[102].

Due to their speed, capacity and environmental neutrality, fibre-optic cables and fibre-optic/power cable hybrids form the communications and energy “backbones” of major science observatories of which there are many worldwide, with the North American Ocean Networks Canada and the US Ocean Observatories Initiative being particular examples[103,104].

There is also a role in reducing carbon dioxide emissions. A cradle-to-grave study estimated the carbon dioxide (CO_2) budget for a fibre-optic cable from its manufacture, operation, maintenance and recovery for recycling[105]. That information was used to assess CO_2 emissions from (i) a two-day teleconference between Stockholm and New York and (ii) a face-to-face meeting involving 16,000 km of air travel. Just 5.7 kg of CO_{2eq} were released by the teleconference compared to 1920 kg of CO_{2eq} from the face-to-face meeting.

6. Submarine power cables

Although legally holding the same status, there are important differences between power cables and telecommunication cables[106]. However, due to physical depth, weight and length limitations, no power cables have been laid or are planned to be laid in the High Seas. A power cable discussed between Iceland and the United Kingdom, if realized, will be laid along the continental shelf and EEZ of those States and the Faroe Islands- and not in the BBNJ- in order to keep the cable depth to less than 1000 metres.[107] For reference, a comparison chart of differences between submarine telecommunication and High Voltage Direct Current (HVDC) submarine power cables in the BBNJ is attached as Annex A.

The physical size of submarine power cables in the BBNJ is unknown as there are currently no examples that extend into that area. However, on the continental shelf and the EEZ, diameters range from typically 80 mm to 150 mm. Telecommunication cables in the BBNJ area are typically 17-22 mm because water depths minimise threats from bottom trawling and shipping, and hence the need for protective armour. Power cables are associated with electromagnetic fields (EMF) that are constrained closely to the cable.[108] Our present knowledge of any effect of power cable EMF on marine organisms, while incomplete concludes that power cable fields have no negative effect on the marine organisms studied, which includes animals sensitive to such fields.[109]

III. THE ADEQUACY OF EXISTING INTERNATIONAL LAW AND BBNJ OCEAN GOVERNANCE FOR SUBMARINE CABLES

A salient aspect of the United Nations General Assembly Resolution 69/292 mandate is that any proposed terms in a possible new implementing agreement must not undermine the United Nations Law of the Sea Convention (UNCLOS).[110] In the particular case of international submarine cables this aspect is vital based on their low impact to the marine environment and historically proven practicality that has provided the world with its amazing critical infrastructure communication system.

The success of the world's submarine cable systems would not have occurred but for the crucial support it has received from UNCLOS, which comprehensively addresses rights and obligations of submarine cables in all of the maritime zones established by UNCLOS. Under UNCLOS, the freedom to lay cables includes those operations associated with this freedom such as cable route surveys and repairs.[111]

Submarine cables in the BBNJ are seldom disturbed once laid with no burial below the seabed surface. Worldwide cable fault records for the period of 2008-2015 show that in the BBNJ there are on average little more than four faults annually spread out in all of the world's high seas areas. These few faults are generally associated with underwater landslides, seismic events, or other natural phenomena since there are few, if any, human generated events at those depths. This data and comparison to faults in territorial waters and EEZ waters is shown graphically in Annex B-1.

Also shown on the graphs are the causes for repair delays for these faults. (Annex B-2 and B-3) There is no requirement for repair permits on the high seas. While permits for emergency repairs to international cables in the EEZ are inconsistent with UNCLOS freedom to lay and maintain cables, several coastal States insist on permits and delays with the negative results for the resiliency of the world's undersea cable communications. The graphs also underscore the unpredictable patchwork of a minority group of coastal State permitting regimes in their EEZ and the corresponding alarming delay to emergency cable repairs. (Annex B-3) These coastal State regulations and actions are classified as excessive maritime claims.[112] Similar excessive permitting would not be helpful to introduce in BBNJ; it reinforces the wisdom in UNCLOS that allows for the freedom to lay and repair cables on the high seas proper.

A. THE FACTUAL CONTEXT FOR INTERNATIONAL LAW FOR CABLES IN THE BBNJ

These time tested and proven norms of international law codified in UNCLOS are fundamental to international submarine communications. To understand how well the current UNCLOS provisions work and the risks involved of unintended consequences in altering these balanced provisions, it is important to understand the practical reality about international telecommunication submarine cables.

First, the foremost priority for the submarine cable community is the integrity and resilience of the submarine cable systems, which are critical for a wide variety of essential services that we take for granted. From the submarine cable community perspective, additional regulations that undermine traditional freedom to lay and repair cables in areas beyond national jurisdiction would have a detrimental effect on the reliability of the cable network.

For context in submarine telecommunication cable reliability and resilience, ocean policy makers and diplomats should consider seven key points that apply universally:

1. As established in the prior section of this paper, cables have a neutral environmental footprint on the seabed. In the BBNJ, submarine cables are surface laid on the flat seabed, not buried; to avoid damage to potential biological “hot spots” they are not laid on the tops or flanks of seamounts and avoid areas of active volcanism.
2. There is no single global submarine cable network any more than there is a single world airline network. (There are about 236 active separate and decentralized international cable systems totalling 997,336 km.)
3. Cable systems are either owned by consortia of four-thirty private companies or in some cases by a single company. About 99% of international telecommunication cables are non-government owned. Cable systems are not “flagged” to any one State.
4. Cable repair arrangements are organized regionally by private contract-not by government mandate. Contracts require repair ships to sail within 24 hours of notice of a cable fault; GOAL = FAST RESPONSE AND REPAIR.
5. There are about 59 cable ships in the world; about half are on stand-by to carry out emergency repairs pursuant to cable ship pooling contracts with various cable owners and cable ship operators, and the other half is laying new cables or performing other tasks (training, vessel maintenance, out of service cable recovery).
6. Cable ships are expensive, custom built, conspicuous, require specialized crews, and fly diverse flags (UK, France, Marshall Islands, Singapore, Japan, China, Korea, UAE, Panama, Denmark, Norway, Spain, Italy, Philippines, Mauritius, Barbados, Belize, Indonesia) = COMPETITIVE RATES + EFFICIENCY.
7. Cable repairs are urgent not only to restore service, but because each cable acts as the backup for other cables that are damaged and awaiting repair= RESILIENCY.

In light of the above points, the most pressing concern for the cable community is the possibility that the existing UNCLOS provisions for submarine cables will be changed or overridden by a possible new environmental regulatory regime implemented under the BBNJ process. The submarine cable community believes, given the critical importance of telecommunication cables, that the submarine cable provisions in UNCLOS should not be modified or subjected to any new regulatory burden associated with any new BBNJ implementing agreement.

B. BALANCING SUBMARINE CABLES AND OTHER USES WITH BBNJ

1. Merchant and fishing vessels and pipeline crossings

The submarine cable community understands that the freedom to lay and maintain cables on the high seas is not unqualified and has never treated it as such. Always present are the obligations to avoid conduct that prejudices the repair of other cables or pipelines,[113] to indemnify damage to any first laid cable or pipeline that is crossed ("the first laid rule"),[114] to indemnify mariners or vessel owners who, through no fault of their own foul a cable, but sacrifice their gear to avoid injury to the cable,[115] and to show "due regard" for the interests of other States in the exercise of the freedom of the high seas and with respect to activities in the Area.[116]

Unlike the high seas, in national waters, the most significant largest cause of faults-about 72-86 %-comes from bottom trawl and similar aggressive fishing activities and contact with ship anchors.[117] Based on the structure provided in UNCLOS, the submarine cable community has developed over the past 166 years sound practices with the fishing and shipping industries including charting, education and liaison, and other time tested techniques that allow these risks to be managed and reduced.[118] In those cases where appropriate, domestic legislation and legal remedies in national admiralty courts[119] are adequate to provide a deterrent to culpably negligent or wilful conduct (excluding terrorism)[120] that threatens or damages the critical international submarine cable infrastructure.

It is emphasized that injury to a telecommunications cable results in zero marine pollution, only a disruption in communications.[121] With respect to crossing other cables or pipelines anywhere, the custom and practice of the industries involved allows for these events to take place routinely, safely, and in almost all cases without conflict. The engineers for the crossing systems meet and work out a crossing arrangement or in some case a formal agreement that complies with the due regard obligations in UNCLOS.[122] As with fishing and shipping, the current practices and protections for cable and pipeline crossings provided in UNCLOS are adequate and need no additional supplemental treaty provisions or super regulator. Nor is there a need with respect to cables for marine spatial planning since conflicts are historically well managed by those involved.

Instead of a new submarine cable treaty provisions or centralized marine spatial planning by a new or existing entity, greater compliance by States with their existing, but largely unfulfilled, obligations under article 113 would strengthen and enhance the reliability of the world's critical ocean infrastructure. The United Nations Omnibus Resolution on Oceans and the Law of the Sea[123] underscores this point:

> *Recognizing* that fibre optic submarine cables transmit most of the world's data and communications and, hence, are vitally important to the global economy and the national security of all States, conscious that these cables are susceptible to intentional and accidental damage from shipping and other activities, and that the maintenance, including the repair, of these cables is important, noting that these matters have been brought to the attention of States at various workshops and seminars, and conscious of the need for States to adopt national laws and regulations to protect submarine cables and render their wilful damage or damage by culpable negligence punishable offences,
>
> **158.** *Calls upon* States to take measures to protect fibre optic submarine cables and to fully address issues relating to these cables, in accordance with international law, as reflected in the Convention;
>
> **159.** *Encourages* greater dialogue and cooperation through workshops and seminars among States and the relevant regional and global organizations on the protection and maintenance of fibre optic submarine cables to promote the security of such critical communications infrastructure;
>
> **160.** *Also Encourages* the adoption by States of laws and regulations addressing the breaking or injury of submarine cables or pipelines beneath the high seas done wilfully or through culpable negligence by a ship flying its flag or by a person subject to its jurisdiction, in

accordance with international law, as reflected in the Convention;

161. *Affirms* the importance of the maintenance, including the repair, of submarine cables, undertaken in conformity with international law, as reflected in the Convention;

The resolution does not encourage or call upon States to change the provisions in UNCLOS that are involved with submarine cables, but simply to comply with the existing ones.

2. Deep seabed mining

The freedom to lay and maintain cables is further qualified by the obligation of the submarine cable community to exercise this freedom "with due regard for this Convention with respect to activities in the Area."[124] In this regard, the International Seabed Authority ("ISA") has issued a technical study that directly confirms the common obligation of cable owners, the mining contractors, and the ISA to provide notice and meaningful consultation among themselves before initiating their activities.[125] Since 2010, the ISA and the ICPC have productively worked together under a Memorandum of Understanding (MOU) to address a practical "due regard" process.

While no mining exploitation licenses have been issued by the ISA, two concession areas have been identified with active submarine cable systems present.[126] Based on the joint workshop approach developed by the ISA and the ICPC, there is a high degree of confidence that any conflicts with these systems or future mining operations and other cable systems will be professionally resolved by the participants using the existing applicable provisions of UNCLOS and the custom and practice of the submarine cable community in similar crossing situations found in national waters. Accordingly, there is no need for any new implementing treaty to address issues or spatial planning about deep seabed mining and submarine cables in ABNJ. The current provisions in UNCLOS are adequate and well understood by those involved.

C. LEGAL ENVIRONMENTAL ASPECTS OF SUBMARINE CABLES WITH BBNJ

The current UNCLOS balance between submarine cables and the environment and sustainability is easily jeopardized by a potential new regulatory regime characterized by some as an enhanced "conditional freedom of the seas." But enhancing the freedom to lay cables with new conditions impedes the nimble, efficient, and innovative character of the submarine cable community in a spiralling tangle of what appears to be an unnecessary, ever changing, unpredictable and excessive BBNJ regulations imposed by well-intentioned new or existing regulatory entities.

The high risk of unintended consequences of such actions needs to be carefully considered based on the unique known situation of submarine cables in the marine environment. For example, even the indirect centralization and well-intentioned control of the world's submarine cable systems by a BBNJ EIA process and similar permission requirements by a new or existing governance entity raises troubling and unpredictable consequences that may well diminish the ability to counter cybersecurity threats to the world's decentralized undersea communication systems, making them more vulnerable to such threats. If a new or existing international entity is tasked with coordinating marine spatial planning for everything including cables, it will likely obtain all of the data on the existing submarine cable positons and centralize them in a single data base. Terrorists or anarchists could then hack into a single target data base, dramatically increasing the risk that current cable systems will be compromised in some form.

A new BBNJ implementing regulatory approach for governance of submarine cables is not necessary for several reasons. Submarine cables are already well regulated by coastal States through national legislation whenever an international submarine cable land in the territory of a State or transits its territorial sea. The world's small fleet of cable ships is regulated by their Flag States and subject to port and coastal State jurisdiction as well. However, while non-flag State regulatory regimes do not apply on the high seas proper, it is the historical and scientific environmental record for modern submarine cables that speaks for itself. There is no justification in grafting either a new regulatory and governance regime on a proven ongoing process under UNCLOS or the creation of a super-international regulator for submarine cables when no significant harm exists.

The physical footprint of a submarine cable in the BBNJ area is only 17-22 mm in diameter-i.e. fits in the space between these parentheses (   ). Using a fibre optic cable diameter of 22 mm, assuming total fibre optic cable in service in the BBNJ area totals approximately 314,350 KM[127], the total ocean coverage by cables is estimated to be about 6.9 KM^2. Using a BBNJ area estimate of about 230,000,000 KM^2,[128] the percent of BBNJ area covered by in-service cables is about 0.00002%.

The amount of power in a submarine telecom cable is a constant DC current of about 0.6 to 1.0 amperes. By comparison, a laptop computer operates on about three amperes and most household circuit breakers are around 10-20 amperes.[129]

In terms of numbers of international cables, the cumulative impact is also minimal. The numbers of these dispersed garden hose-like structures in the vastness of the oceans are regionally small, stable, or experiencing only small increases in numbers to respond to increased capacity demand. One reason for the number stability, besides the considerable cost of a new cable system, is the new low cost upgrades that became available around 2006. These upgrades based on further division of the light spectrum, allow the capacity of an existing operational cable to be upgraded by large multiples by simply changing equipment at the cable landing stations, leaving the physical cable on the seabed undisturbed.[130]

Submarine cables are a lawful use of the sea and have now been in the world's oceans for 166 years, from the telegraph era 1850-1950, to the telephone era (1950-1986) to the optical era (1987 to the present).[131] In this span of history, submarine cables have never been associated with the irreversible loss of any species.[132] In fact, out-of-service cables are used as artificial reefs and reused for monitoring of the ocean environment.[133]

The Oceans and the Law of the Sea Report of the Secretary-General[134] succinctly sums up the conventional wisdom about international submarine cables and the marine environment:

> **54.** The environmental dimension of submarine cables is, however, less apparent. Submarine cables themselves are considered to have a low-carbon footprint and a small relative impact on the environment, with the maintenance of submarine cables causing the highest impacts as a result of the operation of the cable ships themselves.[135] Submarine cables have the potential to be an active contributor towards disaster warning and addressing climate change with work underway to examine the potential for monitoring purposes.[136]

The small impact of submarine cables in the environment is documented in a long record of collaborative study in well established, peer review international scientific journals, workshops, and studies with top scientists and legal scholars.

In 2009 UNEP, the World Conservation Monitoring Centre (WCMC) and the ICPC collaborated and published a cross-disciplinary review and study of the impact of submarine cables in the marine environment).[137] The 64 page UNEP-WCMC Report, based on a review of 191 cited peer reviewed scientific, academic, industry and government studies, and vetted by 18 external reviewers, concluded: "as outlined in this report, the weight of evidence shows the environmental impact of fibre-optic cables is neutral to minor." Since the UNEP-WCMC milestone report, approximately 25 other peer review university and research institution studies have been completed on various aspects of submarine cables in the marine environment including, leaching studies, seabed recovery studies, marine mammal and shark studies, and EMF. Many are listed in the Endnotes section (i)-(viii). The cumulative result of these studies echoes the UNEP-WCMC Report that modern submarine cables have a benign or neutral impact in the marine environment.

The low environmental foot print of submarine cable was reconfirmed in the standard treatise on submarine cables *Submarine Cables The Handbook of Law and Policy* in 2014 where it is observed that in practice cables are laid to avert environmental harm by identifying during the cable route survey process fragile ecosystems that are bypassed.[138] A subsequent 2015 ISA publication *Submarine Cables and Deep Seabed Mining* notes that "submarine cables have a reduced carbon footprint" and "that their environmental impact is minor if not negligible."[139]

In 2015 an interdisciplinary workshop "Submarine Cables in the Sargasso Sea: Legal and Environmental Issues in Areas beyond National Jurisdiction"[140] made by consensus several relevant BBNJ findings:

a. For water depths over 2000 m, cables are laid directly on the seabed and hence seabed disturbance is minimal.

b. The laying of a cable is intended to be a one-off operation in the 25 year design life of a cable, although faults may occur mainly via natural and human-related hazards. When repairs are needed, grapnels used for cable recovery may disturb the seabed along meter-wide paths. The recovered cable is repaired and lowered to the seabed to minimize further disturbance. Again, a repair is planned to be a one-off operation in a cables' remaining design life.

c. Cable operations also have a low carbon footprint, and are done with concern for safety, fuel economy and the environment.

d. Once the cable is laid, the physical impact on the seabed is minimal. The size of communications cables is small, ranging from 17 mm to 21 mm. Cables are protected by a substantial sheath of marine grade polyethylene which is inert in the ocean.

e. Research into cables and benthic organisms living on and in the seabed show that there is no statistical difference in the abundance and diversity for organisms living near and away from a cable.

f. Studies have also been done on the direct environmental impact of cables on marine life[141] (including whales[142] and sharks[143]). Whale entanglements with cables ceased with the transition from telegraph to coaxial cables by the early 1960s which reflected improved cable design, laying techniques and seabed mapping.

While the Sargasso Sea workshop focused on the Atlantic Ocean ABNJ, the above findings are consistent with the industry custom and practice in other ABNJ areas in other oceans. These findings as well as the neutral nature of submarine cable impact to the marine environment were again confirmed in 2016 at an international workshop in Ankara, Turkey.[144]

The recent United Nations World Ocean Assessment reviewed submarine telecommunications cables and concluded that they "*have very limited environment impacts.*"[145] It also acknowledges the socio-economic importance of cables and the role played by the ICPC in ensuring the safety of cables and reducing even further their minor impact on the environment.

Notwithstanding the thorough and consistent record of scientific and academic review of modern cables discussed above, a remark about the precautionary approach is appropriate. While the submarine cable service respects the precautionary approach when warranted, the unique status and cumulative studies of submarine cables make its application as a basis for new regulation of submarine cables in the BBNJ process inappropriate.

The noted scientist Professor Sir Peter Gluckman, ONZ KNZM FRSNZ FMedSci FRS, chief Science Advisor to the New Zealand government, observed:

> The Precautionary Principle was initially intended as a framework FOR ACTION in the face of scientific uncertainty-that, not using an absence of evidence as

> reason not to act-for example on climate change. But Callon pointed out that, when applied to the innovations space, the Precautionary Principle was being wrongly framed as a reason for abstention and inaction. The default position has insidiously shifted to an interpretation that allows nothing in the face of uncertainty, which by definition must exist. And so the misuse of the principle has become a guiding tool for advocates trying to stop any particular innovation.[146]

PrepCom is asked to carefully consider that innovation allowed by the existing UNCLOS provisions on the freedom to lay and maintain international cables is the core lifeblood of the modern internet. The *cloud* is in fact thriving because of the submarine cables that link data centre servers and peoples in all nations. It is respectfully submitted that the existing environmental requirements in UNCLOS are sufficient to safeguard the marine environment from the demonstrably nil to very small environmental risks posed by the small, chemically inert submarine cables.

The precautionary approach should not be mechanically applied to justify regulation of well-established routine international cable operations and routes. As documented in the many peer review references in this paper, cable operations are a known activities with a long historical record of safe interaction with the marine environment. These routine operations have no significant impact on the marine environment and certainly not one that would justify application of the precautionary approach to them. A new and untried regulatory regime may stifle and suffocate the innovation that has given the world its critical international cable infrastructure. This could lead to unintended consequences such as limiting or prolonging the efforts to bring fibre-optic cables to small islands and developing States or providing alternate cable routes and restoration options to minimize risks from natural disasters. Such consequences, delays in repairs, delays in connecting small island nations as well as African nations, and providing alternate cable redundancy for security have already been the reported focus of international leaders at high levels of the Organization for Economic Co-operation and Development (OECD)[147] and the International Telecommunications Union (ITU).[148]

1. Environmental impact assessments for submarine cables

Under UNCLOS, submarine cables in the BBNJ area are already subject to article 206 [Assessment of potential effects of activities]. Under article 206, a State that has reasonable grounds for believing an planned activity under their jurisdiction or control may cause substantial pollution or significant harmful changes to the marine environment may as far as practicable assess the potential harm of such activities on the marine environment.[149] Thus the flag State of the cable ship or a State whose nationals own or operate an international submarine cable already have authority need to carry out an environmental impact assessment (EIA) if justified.

By definition submarine cables are not “pollution of the marine environment,” nor can cables realistically cause such pollution. A modern fibre-optic cable is not a substance or energy likely to result in deleterious effects as harm to living resources and marine life.[150] As demonstrated previously, submarine cables also do not cause “significant harmful changes”[151] to the marine environment. In view of the substantial scientific record, article 206 has not been applied on the high seas. The point is, however, it remains a legal obligation that is in force, respected by the submarine cable community, and always available to States to protect the marine environment.

In view of article 206, there is no need to create a new overlapping EIA obligation in a BBNJ implementing agreement for submarine cable laying and repair. As the UNEP-WCMC report highlights:

> “EIAs for cable operations are rare and are generally limited to a coastal State’s territorial sea. The European Union EIA Directive currently does not explicitly impose and EIA requirement on cable-laying projects”[152]

The Sargasso Sea workshop in particular extensively looked at all aspects of cables on the High Seas and their relationship to the marine environment and the consensus reached was "that the impact of submarine cables and cable operations in the deep water of the Sargasso Sea would also be minimal" because cables were not buried or laid on seamounts, hazards posed by turbidity currents were slight and hence repairs were infrequent.[153] Furthermore the workshop reached consensus that there was no baseline in the deep ocean by which to compare any change in the marine environment and no cost benefit analysis to justify the delays and costs associated with an EIA in ABNJ where there was no "clear benefit of EIA's in such areas".[154]

"It was also agreed that an EIA (or equivalent) should not be required before cable repairs take place in the Sargasso Sea given the importance of ensuring that repairs are done as expeditiously as possible."[155] This is common sense. Where coastal States have required an EIA for submarine cables, the normal time frame varies from weeks to years to carry out the EIA and submit it to the government authority making the request.[156] In the case of an emergency cable repair, this would be like having the fire department carry out an EIA on a burning building before attempting to bring the fire under control and extinguish it. For laying a new cable system, new delays for a High Seas or BBNJ EIA would threaten the viability of a project that depends on being innovative and nimble to increasing broadband demand and at the same time compliant with a budget, financing, and project timeline. In view of the demonstrated lack of any significant harm from these activities, there is no need for such new regulatory and untested BBNJ burden on submarine cables.

It is respectfully submitted that article 206 is sufficient to safeguard the marine environment in the case of submarine cables in BBNJ. As such there is no reasonable justification to add to submarine cable operations, especially to emergency repairs, a new obligation to carry out an EIA under any new undefined BBNJ regulatory regime.

2. Marine protected areas in the BBNJ

The submarine cable community's use of the term marine protected area (MPA) in the BBNJ context includes proposals based on formal MPA's, Vulnerable Marine Ecosystems (VME), Particularly Sensitive Sea Areas (PSSA), or similar formulations that may be considered in the PrepCom process.

The submarine cable community's position on MPAs in the BBNJ is neutral so long as there is due regard for the freedom to lay and maintain submarine cables. Historically, submarine cables have co-existed in MPA's with no significant harm to the environment.[157] In fact, scientists have concluded that cable protection zones with the appropriate environmental attributes such as rocky reefs to encourage fish aggregation, can make ideal *de facto* marine protected areas.[158]

The majority of submarine cable routes follow the same "tried and true" historic paths of earlier telegraph cables.[159] This reflects the proven low environmental impact and natural hazard risks historically experienced with submarine cable laying along these routes. As a result new MPAs may well be considered over existing cable routes. The cable community does not see this as a problem as submarine cables and MPAs are not mutually exclusive by any means.

The following table underscores that submarine cables are mutually consistent with MPAs and have been so for years.

Analysis of International Submarine Cables in BBNJ MPAs

(Based on comparison of MPA data base[160] http://www.mpatlas.org/explore/ and commercial data base of Global Marine Systems Ltd (GMSL))[161]

Data Description	ABNJ
Total number of cable systems in data base in ABNJ	150
Total cable systems in MPAs	22
Percent of cables that cross MPAs	15%
Total km of cables in ABNJ in data base	314,350 km
Total fibre-optic km in ABNJ MPAs	5,362 km
Percent of total km in MPAs	1.7%

Annex C is a chart that illustrates current active fibre-optic cables in the Atlantic in the ABNJ area and the location of declared MPA's. The cable lines width on the chart is obviously not to scale since the diameter of one of these cables fits in these parenthesis ( ). The chart shows the cables avoid seamounts and follow the "tried and true" traditional cable routes in this ocean.

For example, the chart shows new High Seas MPA's declared by the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). Concerns have been raised by the submarine cable community when OSPAR unilaterally and without any consultation with ocean submarine cable stakeholders declared High Seas MPAs over five existing transatlantic cable systems.[162] However to date the declaration appears inactive for submarine cables with no impact or restrictions on the laying and repair of these systems.[163]

If a High Seas MPA were to become a "no go" or restricted area for international submarine cables or if repairs to existing cables are delayed or prejudiced, then of course the cable owners and/or cable ship operators would request their respective States to take up the issue diplomatically to prevent endangering this global critical infrastructure. These remedies already work in UNCLOS and should not be undermined by a new super-international regulator with remit over international cables.

CONCLUSION

The UNCLOS obligation of due regard is sufficient to ensure a harmonious relationship between submarine cables and any High Seas MPA that may appear in the future.[164] The careful existing balance in ABNJ between the environment (articles 192 and 206) and the freedom to lay and maintain international submarine cables (articles 87, 112-115 and 297) has worked successfully since UNCLOS came into force. For these reasons, whatever the outcome of the BBNJ process for MPAs and EIAs, the existing structure of UNCLOS for submarine cables should not be undermined by changes to existing time tested practices that have served humankind so well or by subjecting cables to a new regulatory BBNJ regime that is not required to protect the marine environment from cables. Put another way, there is no need to fix something that is not broken.

The submarine cable service respectfully urges the diplomats involved in the BBNJ process not to change or condition the existing provisions in UNCLOS that deal with submarine cables and not to impose any new and additional EIA and MPA requirements for cables in a new implementing agreement. There is precedent for this approach. The drafters of the 2001 Convention on the Protection of the Underwater Cultural Heritage,[165] after considering the historical record that submarine cables had never been a threat or damaged underwater cultural heritage, exempted submarine cables from this treaty.[166] Similarly, the compelling scientific evidence, the long positive track record of submarine cables in the marine environment, and the vital role of cables as critical international infrastructure merits a similar result in the BBNJ process.

Submarine cables, with their small footprint, positive contribution to reducing greenhouse gases, and well-studied neutral environmental impact, stand uniquely apart from other high impact uses of concern to the BBNJ area such other as shipping, deep seabed mining, fishing, pipelines and energy. Submarine cables should be expressly excluded from any new implementing agreement.

ANNEX A

Comparison of Representative Telecommunication Cable and HVDC Cable on the High Seas/ABNJ

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Comparison of Representative Telecommunication Cable and HVDC Cable on the High Seas/ABNJ/BBNJ

FEATURE	COMMENT	FIBER-OPTIC TELECOM CABLE	HVDC CABLE
Diameter		17mm (.0.67 inches) (domestic garden hose size)	Between 12cm (4.28 inches) and 20 cm (7.86 inches), depending upon rating
Insulation	No liquid oil insulation in power cables	Polyethylene	XPLE or mass impregnated paper
Longest cable laid (km)	To date, HVDC cables only laid in EEZ while fiber-optic laid in EEZ, on the continental shelf and the high seas	9400km Single Segment TransPacific 11,036km Multi Segment TransPacific 25,000km Multi landing (Europe-Asia)	590km (NorNed HVDC cable)
Deepest water depth of cable lay (m)		9200m	1600 m
Weight (1 m section) kg		0.59kg (1.3 pounds)	50kg (110 pounds) to 60kg (132 pounds)
Number of cable ships	Cable ships laying each type of cable are different and not interchangeable	About 50	About 4 to 5
Length of segment between splices (km)	For fiber-optic, segment is where the optical amplifier is inserted into the cable at the factory For HVDC, segment varies by the weight the cable ship can hold and cable loaded in a segment per voyage (100km)	10km-60km	Cable usually manufactured in 30km lengths then factory jointed
Capacity cable ship (km)		About 7000km to 9000km of deep-sea cable	About 100 km
Universal joint kit (UJK) available	For fiber-optic cable, UJK allows any cable ship to joint cables. At sea about 14 hours required for telecom spice. For power cable, jointing is carried out only by factory technicians. At sea about 6 days required for HVDC splice	Yes	no
Burial	Fiber-optic cables laid in high seas/ABNJ/BBNJ are not buried. No HVDC cables currently exist on the high seas/ABNJ/BBNJ	no	NA
UNCLOS	Both types of cables enjoy the same rights and obligations	yes	yes

ANNEX B

Submarine Cable Repairs Worldwide 2008-2015

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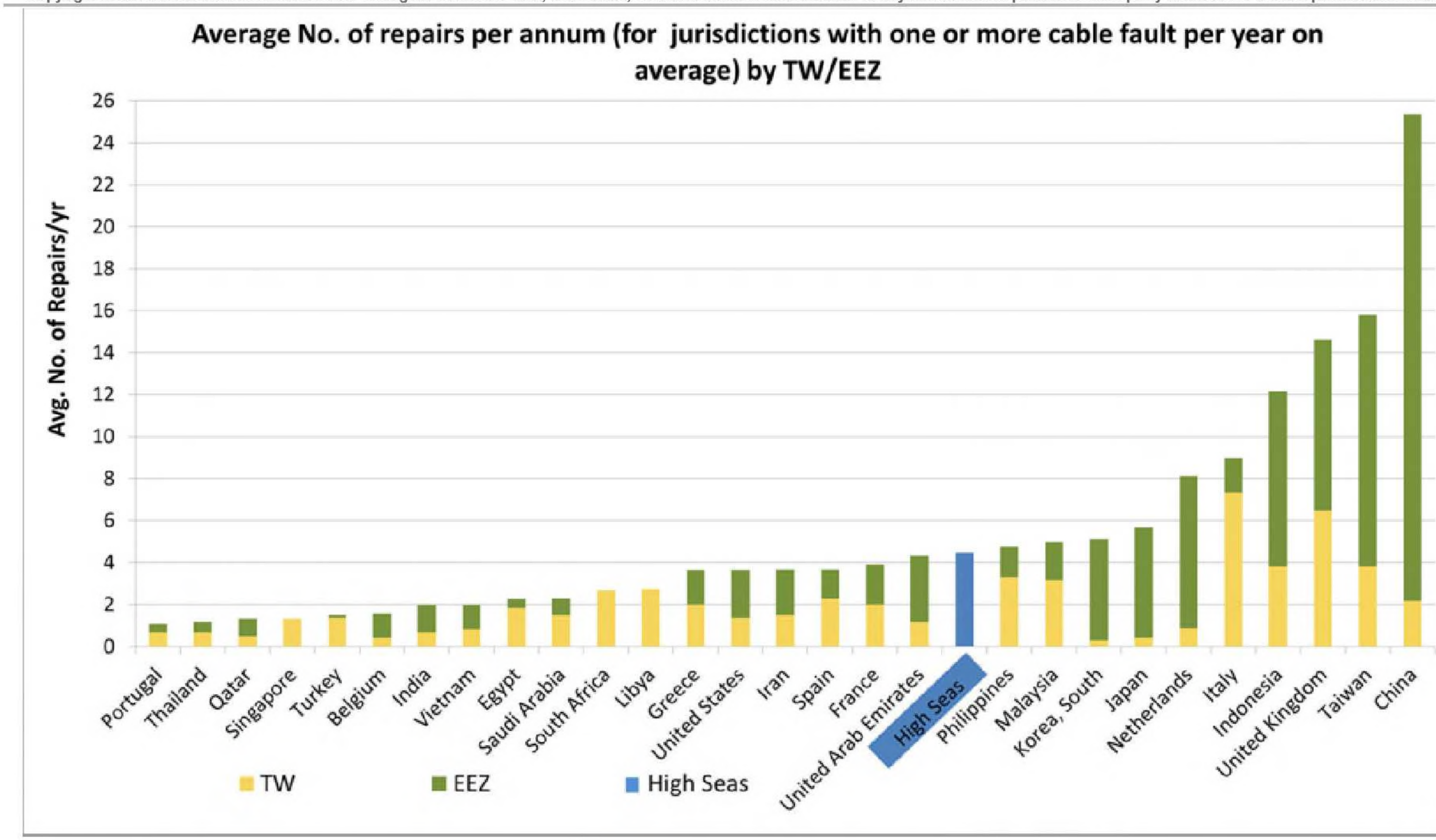
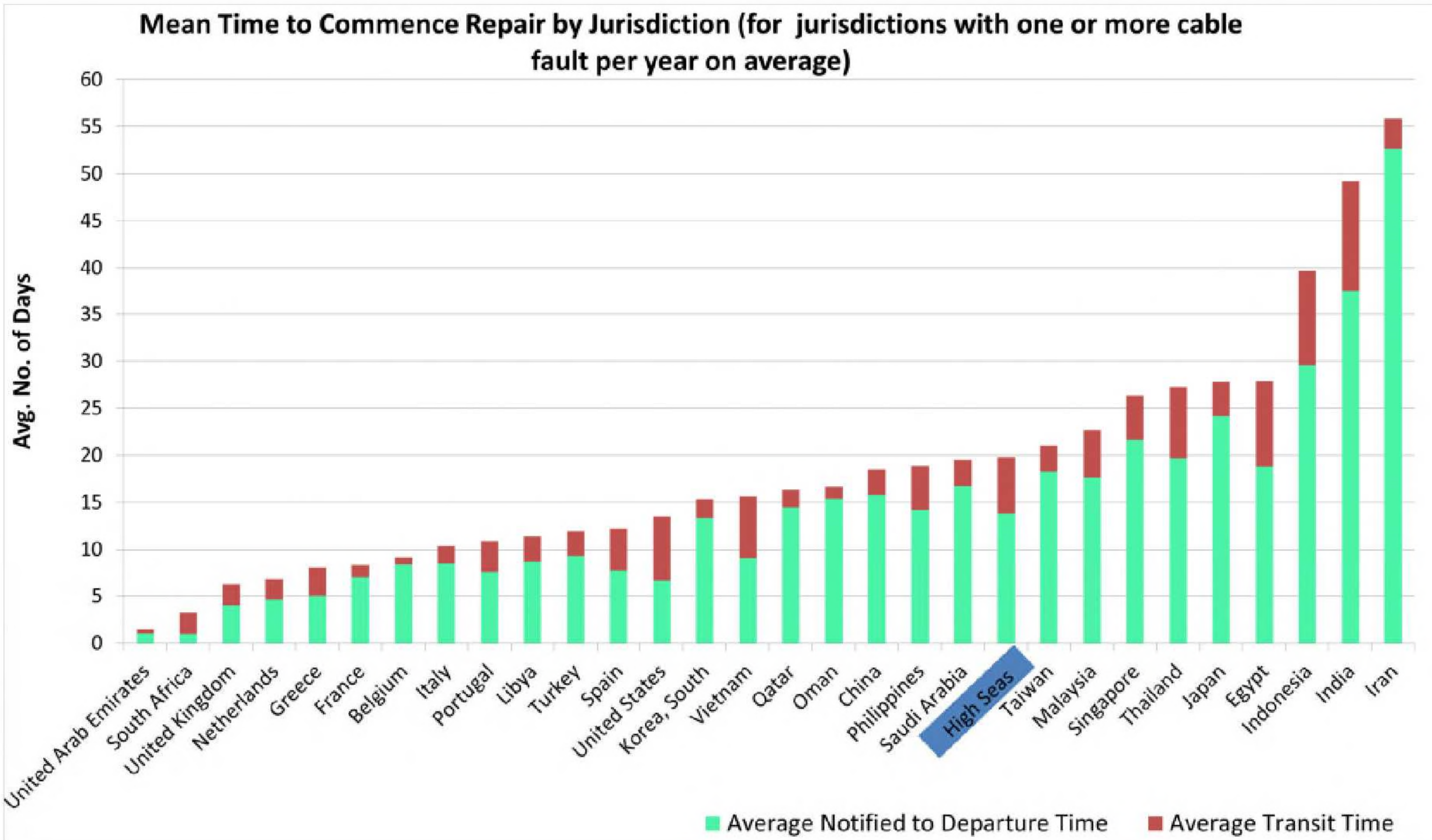
Submarine Cable Repair –2008-2015 Worldwide-Average Repairs/year



(Note that data for the United States includes repairs not only in the TW and EEZ of mainland USA but in its 'Unincorporated Territories' of the Territory of Guam and the Commonwealth of the Northern Mariana Islands (CNMI))

Submarine Cable Repair- 2008-2015
Average Time to Begin Repair



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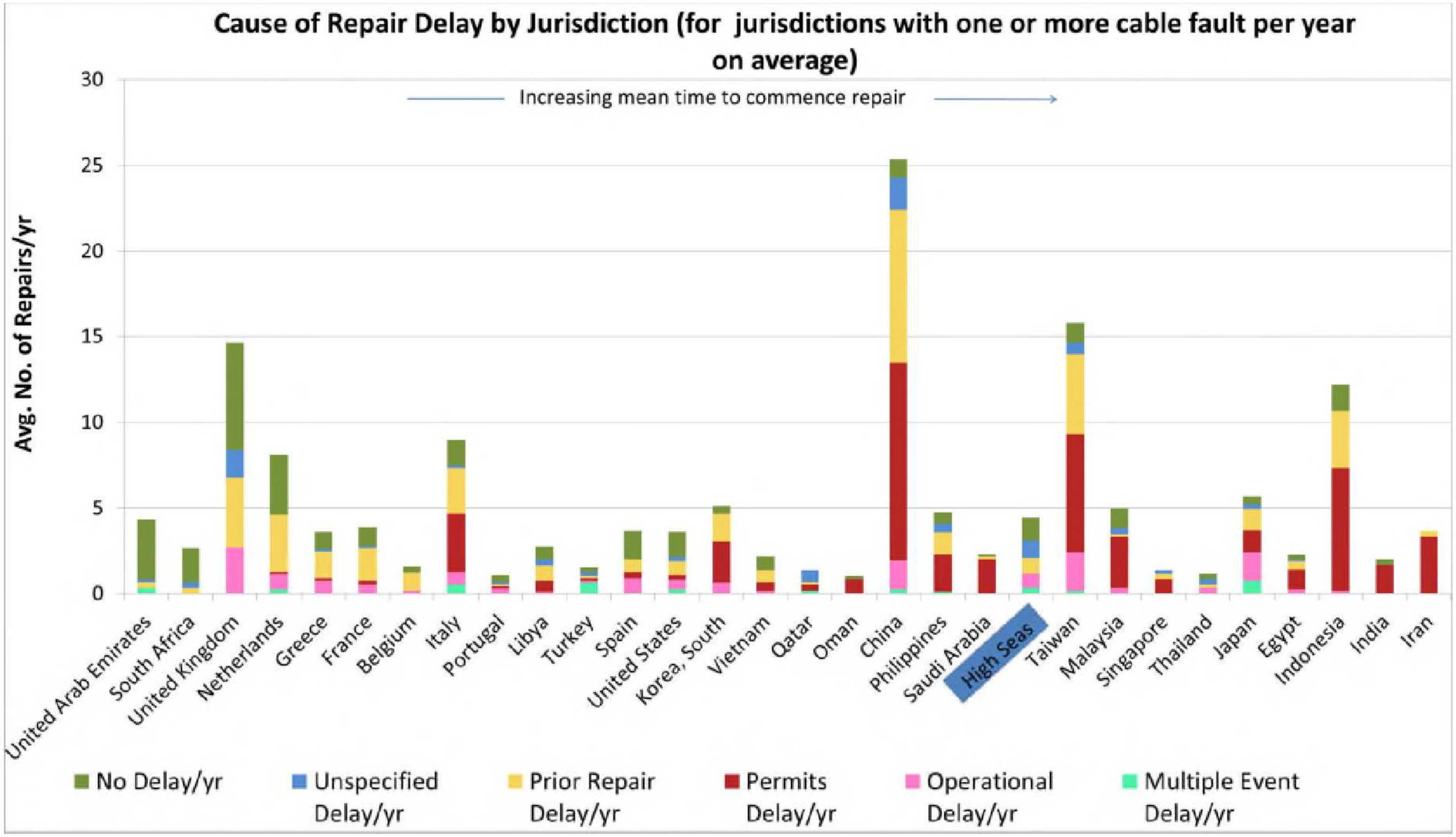
Submarine Cable Repairs-2008-2015
Causes for Repair Delay



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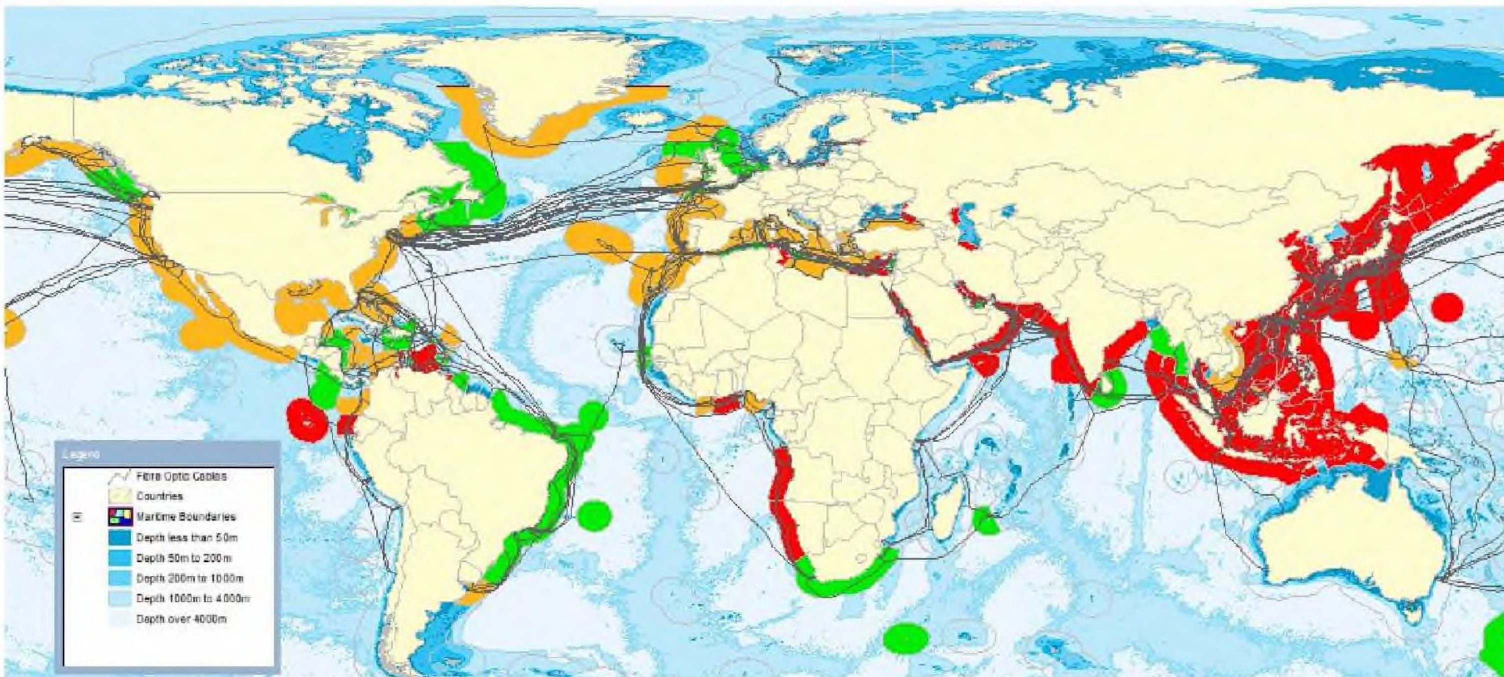
Submarine Cable Repair 2008-2015 Results and Areas of Concern

International Cable Protection Committee



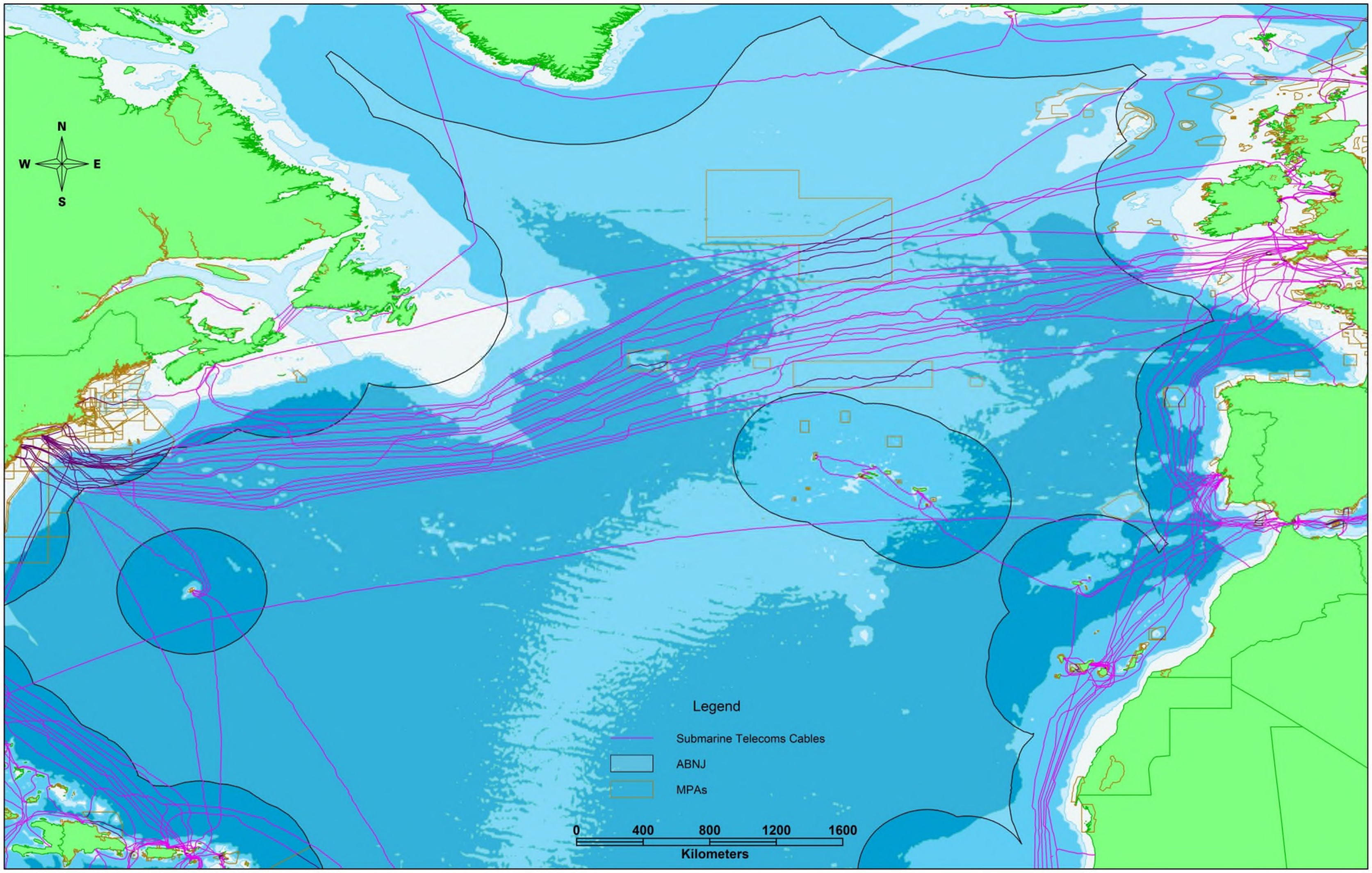
(Note that data for the United States includes repairs not only in the TW and EEZ of mainland USA but in its 'Unincorporated Territories' of the Territory of Guam and the Commonwealth of the Northern Mariana Islands (CNMI))

Notified to Departure times are categorised as follows:

Green = less than 5 days, Orange = 5 to 10 days, Red = more than 10 days

ANNEX C

Illustrative chart of transatlantic submarine cables and MPAs in BBNJ


N
W
E
S
Legend
Submarine Telecoms Cables
ABNJ
MPAs
0
400
800
1200
1600
Kilometers

ENDNOTES

1 The ICPC, founded in 1958, is a non-governmental organization with about 160 members from over 63 nations that includes virtually all of the owners of the world's international fibre optic telecommunication cables, many of the international scientific and power submarine cables and virtually all of the cable ships that maintain these cable systems. The ICPC welcomes government members and presently has five: Australia, Malta, New Zealand, Singapore, and the United Kingdom. www.iscpc.org

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4 A/70/50 (March 2015)

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