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CONFERENCE PAPERS

**The Louisiana Civil Code Translation Project:
Enhancing Visibility and Promoting the Civil Law in English**
*Le projet de traduction du Code civil louisianais :
Améliorer la visibilité et la promotion du droit civil en anglais*
Louisiana State University, Paul M. Hébert Law Center, April 10–11, 2014

Part. 2 Worldwide Perspectives

- *Les termes comme miroir et loupe d'une société ?
L'exemple du Code civil italien* Enrica Bracchi
- *Pourquoi et comment former des juristes trilingues ?*..... Dominique Garreau
- *Translating the Charitable Affectation in Private Law* Anne-Sophie Hulin
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Editorial offices:

Paul M. Hebert Law Center
Center of Civil Law Studies
W326 Law Center
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jcls@law.lsu.edu
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**FRAGMENTED RIGHTS AND TRAGEDY OF
ANTICOMMONS: EVIDENCE FROM CHINA’S COASTAL
WATERS**

Bing Shui*

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* PhD in Law, Associate Professor at Faculty of Law, University of Macau. Email: bingshui@umac.mo. Prior drafts of this article circulated at the 2015 Chicago Law School Summer Institute in Law and Economics colloquium. For helpful comments, warm thanks to Professor Richard Epstein, Lior Strahilevitz, and Lee Anne Fennell.

ABSTRACT

The ownership of, and rights to, coastal waters are exhibited on a cumulative scale ranging from commons-like to private use. As an example of a natural resource with complex and interlinked ecosystems, coastal waters give rise to many kinds of legal norms and policy instruments. As shown by my investigation of China's coastal waters, people are willing to pay for legal rights which guarantee exclusive access, regardless of the relatively high cost. The statistical data further reveals that, when coastal waters are divided, there is a negative correlation between fragmentation of the seas and sea-based production. Therefore, based on the empirical evidence, I am reasonably confident that the tragedy of the anticommons is not occurring in China's coastal waters.

Keywords: natural resources, coastal waters, property law, Chinese law, comparative law

I. INTRODUCTION

Two metaphors are often used to describe the polar opposites of the allocation of natural resources: “the tragedy of the commons” and “the tragedy of the anticommons.” The tragedy of the commons describes the destruction that occurs when natural resources are accessible to all members in a given community.¹ Depleted fisheries and overgrazed fields are typical examples of this tragedy.² However, according to Michael Heller’s oft-cited article, a resource is prone to underuse when too many owners hold exclusive rights.³

1. In Hardin’s words, “Freedom in a commons brings ruin to all.” Garrett Hardin, *The Tragedy of the Commons*, 162 AM. ASSOC. ADV. SCIENCE PUB. 1243–44 (1968). Study on the broad range of commons includes adaptive systems, efficiency, environmental policy, equity, experimental economics, free riding, game theory, gender, institutional design principles, new institutional economics, participatory management systems, property rights regimes, resilience, regulation, sustainability, etc. See the Digital Library of the Commons (DLC), <https://perma.cc/2WTL-QQYV>.

2. Colin W. Clark, *Profit Maximization and the Extinction of Animal Species*, 81 J. POLIT. ECON. 950, 950–61 (1973).

3. Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 621–25 (1998); By

The more we divide common resources into small, fenced-off lots, Heller argues, the more difficult we make it for people to do business and build something.⁴ It is for this reason that too much ownership “wrecks markets, stops innovation, costs lives” and finally leads to “the tragedy of the anticommons” or a gridlocked economy.⁵

In some ways, the anticommons are a mirror image of the commons. Property theorists attest to extreme cases of the inefficient use of natural resources, claiming that the commons leads to overuse and destruction whereas the anticommons leads to underuse and waste. Nowadays, the term “anticommons” has become so widely used that it flows “easily from the lips and pens of nearly every property teacher and scholar.”⁶ The broad range of anticommons encompasses empty Moscow storefronts,⁷ suboptimal land use,⁸ undesirable cyberspace,⁹ weakening biotechnology innovation,¹⁰ and underdeveloped oyster farming.¹¹ However, aside from the controversial usage of this new term in the literature, there is insufficient empirical evidence to either confirm or refute the metaphor.¹² So, if a commons-like resource is divided into small fragments in accordance

mathematical means, Nobel Laureate James Buchanan proved the first economic model of the anticommons in 2000. James M. Buchanan & Yong J. Yoon, *Symmetric Tragedies: Commons and Anticommons*, 43 J. L. & ECON. 1, 1–13 (2000).

4. James Surowiecki, *The Permission Problem*, THE NEW YORKER, Aug. 11, 2008.

5. MICHAEL A. HELLER, *THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES* 2 (Basic Books 2008).

6. Lee Anne Fennell, *Common Interest Tragedies*, 98 NW. U. L. REV. 907, 908 (2004).

7. Heller, *supra* note 3.

8. Francesco Parisi, Norbert Schulz & Ben Depoorter, *Duality in Property: Commons and Anticommons*, 25 INT’L REV. L. & ECON. 578, 578–91 (2005).

9. Dan Hunter, *Cyberspace as Place and the Tragedy of the Digital Anticommons*, 91 CAL. L. REV. 439, 439–519 (2003).

10. Michael S. Mireles Jr., *An Examination of Patents, Licensing, Research Tools, and the Tragedy of the Anticommons in Biotechnology Innovation*, 38 U. MICH. J. L. REFORM 141, 144 (2004).

11. Michael A. Heller, *The Rose Theorem?*, 18 YALE J. L. & HUMAN. 29, 43 (2006).

12. For example, the influence of the anticommons is highly disputed with respect to intellectual property, while Epstein and Kuhlik pointed out that claims

with Heller's assumption, will it lead to coordination breakdown? If yes, it may prove that Heller's hypothesis is true in practice; if not, one can question whether this assertion is valid in all situations.

This article aims to explore the empirical realities of Chinese coastal waters and to determine whether fragmented property rights will lead to a tragedy of the anticommons. This examination is based on two separate but related grounds. First, the property regime of the coastal waters exhibits a cumulative scale ranging from commons-like to private use. As an example of a natural resource with complex and interlinked ecosystems,¹³ coastal waters accommodate many kinds of legal norms and policy instruments. Indeed, it would be no exaggeration to say that coastal waters are among the most challenging forms of natural resource from the perspective of property law.

Second, the evolution of coastal waters in China sheds light on the common-to-private spectrum. In the view of neoclassical economics, the transition of the Chinese economy since 1978 has been interpreted as a development of a "resources allocation mechanism."¹⁴ To put a new spin on this long-lasting issue, the legal mechanisms behind Chinese coastal waters can offer some instructive illustrations of the evolution of property rights. At first glance, coastal waters should be regarded as a common resource in the context of Chinese law. According to Article 9 of the Constitution of the People's Republic of China, coastal waters and other natural resources

of biomedical anticommons were unsupported by empirical data. See Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 *SCIENCE* 698, 698–701 (1998); Richard A. Epstein & Bruce N. Kuhlik, *Is There a Biomedical Anticommons?*, 27 *REGULATION* 54, 54–58 (2004).

13. DON HINRICHSEN, *COASTAL WATERS OF THE WORLD: TRENDS, THREATS AND STRATEGIES 2* (Island Press 1998).

14. Shigeru Ishicawa, *Underdevelopment of the Market Economy and the Limit of the Economic Liberation*, in *JAPANESE VIEWS ON ECONOMIC DEVELOPMENT: DIVERSE PATHS TO THE MARKET* 87 (Kenichi Ohno & Izumi Ohno eds., Routledge 1998).

belong to “the whole people.”¹⁵ However, with the development of fisheries, the invisible hand of the marketplace pushes coastal waters into the realms of private use. As a case in point, many fishermen fenced off small sections of the waters to produce seafood and as a consequence were able to benefit from the de facto occupation of the area. To resolve this situation without having to confer legal title, the Property Law of 2007 granted the fishermen in question the exclusive rights to use the coastal waters while the state retains monopoly ownership.¹⁶ Consequently, the legal status of coastal areas has been transformed from a commons-like resource into a mixture of state and private property. Within the legal context of the coastal waters in China, the main actors include the state owner, individual users, and local regulators. There are striking similarities in this form of legal structure between Moscow storefronts and Chinese seawaters. The question then arises as to whether this type of regime will lead to underuse.

In order to arrive at an answer that can be supported by evidence, I have spent many years investigating how the coastal water property regime has evolved in China. Initially, I distinguished between two methods of fishery production, namely aquaculture and capture, with the difference between them being essentially the degree of exclusive use. A central requirement of aquaculture is the persistent occupation of specific waters. To undertake aquaculture, a “well-

15. China’s reformers, unlike those in some Eastern Bloc countries, have been able to develop more varied and inventive mechanisms. Chinese civil law drafters: “seemed to be moving away from the Soviet concept of ‘state ownership,’ i.e. that ‘the state is the sole owner of state property,’ towards the more flexible notion of ‘state property’ which ‘belongs to the whole people.’” Edward J. Epstein, *The Theoretical System of Property Rights in China’s General Principles of Civil Law: Theoretical Controversy in the Drafting Process and Beyond*, 52 *LAW & CONTEMP. PROBS.* 177, 186 (1989).

16. According to Art. 122 of *Wu quan fa* [Property Law] (promulgated by the Standing Comm. Nat’l People’s Cong., Mar. 16, 2007, effective Oct. 1, 2007) 2007 Standing Comm. Nat’l People’s Cong. Gaz. (P.R.C.), “the right to the use of sea area that is obtained in accordance with law shall be protected by law.” Since China’s General Principles of Civil Law in 1986, five kinds of property rights have been granted to individuals, but the right to use coastal waters was not listed as a property right until the Property Law of 2007.

defined, enforceable, transferable, and durable” property right is necessary,¹⁷ and thus a rights-based regime needs to be created to facilitate the continuity of occupation and use of given waters. At the same time, capture is normally regulated by simple administrative tools such as permits and licensing. My fieldwork findings confirm this. As shown in the interview and questionnaire data, people are willing to pay for a legal title, which clearly indicates their expectation of exclusive access. Furthermore, by collecting data in all eleven coastal provinces, I found that aquaculture productivity in China is far higher than that of capture, a completely different situation compared to other parts of the world. Law and economics literature offers an explanatory account of the imbalance in growth between aquaculture and capture production. The property regime of aquaculture is an efficiency-increasing institution because it internalizes potential externalities in commons-like fields. This is consistent with Harold Demsetz’s classic doctrine—the emergence of property rights is said to overcome the tragedy of the commons.¹⁸

Demsetz’s doctrine did not indicate whether a property regime would, or the extent to which it would, bring about the opposite effect: where too many rights-holders could block the efficient use of a single resource. Fortunately, the empirical reality, established from the data collected in China’s coastal waters, has provided a striking base from which to explore this potential problem. On closer examination, I found that the fragmentation of coastal-water holdings has not led to underuse. In order to illustrate this point accurately, I delved deeper into the data on coastal waters which were occupied by rights-holders within China’s eleven coastal provinces. The statistical data revealed a correlation between the fragmentation index and the production index. It highlighted that the smaller the

17. Donald Leal, *Prologue* to *EVOLVING PROPERTY RIGHTS IN MARINE FISHERIES* ix (Donald Leal ed., Rowman & Littlefield 2005) [hereinafter *PROPERTY RIGHTS IN MARINE FISHERIES*].

18. Harold Demsetz, *Toward a Theory of Property Rights*, 57 *AM. ECON. REV.* 347, 349 (1967).

area designated for farming, the greater the level of production output. In other words, the fragmentation of coastal waters does not lead to underuse or a breakdown in fish production. To summarize, based on the empirical evidence, I am reasonably confident that the tragedy of the anticommons is not occurring in China's coastal waters.

The article proceeds as follows. Part II provides an overview of the common-to-private spectrum in natural resources. From a theoretical standpoint, I argue that Heller's dynamic analytics puts forward an incomplete explanation of the evolution of property rights. Part III introduces the historical background to the transition from commons-like resources into private property. China's wait-and-see process indicates that the change of utility would lead to a demand for exclusive-use rights. Part IV empirically explores two sequential questions. First, will the fragmented waters lead to a tragedy of the anticommons in accordance with Heller's hypothesis? And second, if not, why will this not occur? The answer lies in the fact that state owners and individual rights-holders can interact and coordinate with each other, and the market-driven system can prevent any gridlock. Part V will close with a brief conclusion.

II. THE EVOLUTION OF PROPERTY RIGHTS: SPECTRUM OR RUBIK'S CUBE?

From the perspective of property law, debates on natural resources "can move beyond polarizing oppositions that have made jurisprudential debates unsolvable and rendered concrete problems invisible" by dynamic analytics.¹⁹ To date, much has been written about the evolution of property rights over natural resources, even

19. Michael A. Heller, *The Dynamic Analytics of Property Law*, 2 THEORETICAL INQ. L. 79, 79 (2001). Actually, contrary to the Blackstonian tradition in common law, which regards natural resources law as a subset of property law, issues relating to the use and control of natural resources are often treated as administrative law problems rather than as property law problems in many jurisdictions. See Robert L. Fishman, *What is Natural Resources Law?*, 78 U. COLO. L. REV. 717 (2007).

though it is often unclear what is expected to evolve.²⁰ Following Harold Demsetz's classic hypothesis, which is still widely cited, the emergence of property rights is said to internalize potential externalities and thus the "tragedy of the commons" under the open-access regime could be eliminated.²¹ Therefore, the term the "tragedy of the commons" has gradually become one of the starting points for questioning the emergence of property rights over natural resources. Conversely, in what Heller has termed the "tragedy of the anticommons," the inefficient use of a specified piece of property will arise when "multiple owners are each endowed with the right to exclude others from a scarce source, and no one has an effective privilege of use. When too many owners hold such rights of exclusion, the resources are prone to underuse . . ."²²

The symmetrical tragedies of the commons and anticommons have set a framework for a wide range of social, economic, and legal issues. Along these lines, the current broad classification of categories of property in natural resources needs to be modified. The standard property trilogy of private, commons, and state seems outdated. In light of Heller's dynamic analytics, the evolution of property could be delineated as a common-to-private spectrum²³:

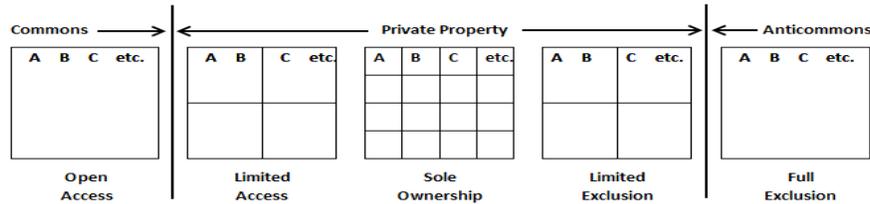
20. Henry E. Smith, *Exclusion Versus Governance: Two Strategies for Delineating Property Rights*, 31 J. LEGAL STUD. 453 (2002). There are, however, few theoretical works on the evolution of rights to natural resources by legal academics, while economists are much more interested in this area.

21. Demsetz, *supra* note 18.

22. Heller, *supra* note 3, at 622.

23. Michael A. Heller, *Boundaries of Private Property*, 108 YALE L. J. 1163, 1167 (1999); *see generally* Heller, *supra* note 19.

Figure 1. The Spectrum of Property Regime in Heller’s Dynamic Analytics



As Benjamin Cardozo wrote, “[m]etaphors in law are to be narrowly watched, for starting as devices to liberate thought, they end often by enslaving it.”²⁴ No matter how popular the use of the anti-commons metaphor may appear to be, it is evident that it is poorly suited to the task of explaining the property regime in the real world. Indeed, the evolution of the resource system cannot be portrayed as a one-dimensional spectrum moving from one extreme to the other.

First, there is insufficient empirical evidence to confirm Heller’s dynamic analytics in the field of natural resources. Across a broad range of contemporary scholarship on the subject of property, two approaches dominate the discussions: utilitarian theory and liberal contractarian theory.²⁵ Building on the work of Ronald Coase, Demsetz argues that the legal rule of resources follows the path that produces net benefits for the relevant community.²⁶ Yet some utilitarian theorists, such as Heller, are so concentrated on the “cost–benefit equation” that they usually, or often, ignore other factors that will generate the evolution of property rights over natural resources. More broadly, we might observe that custom and culture have played an under-analyzed but vital role in the allocation of natural resources. For instance, historical examples in areas such as mining

24. *Berkey v. Third Ave. Ry. Co.*, 24 N.Y. 84, 94, 155 N.E. 58, 61 (1926).

25. *PROPERTY AND COMMUNITY* xviii (Gregory S. Alexander & Eduardo M. Peñalver eds., Oxford University Press 2010).

26. Harold Demsetz, *Toward a Theory of Property RightsII: The Competition Between Private and Collective Ownership*, 31 J. LEGAL STUD. 653 (2002).

and whaling rules serve to illustrate that property law sometimes relies on community custom.²⁷ Similarly, traditional custom still holds the de facto influence when allocating natural resources in China's remote countryside.²⁸ Increasingly, empirical experience shows that historical tradition, cultural differences, distributional preference, and other factors combine to have an effect on the evolution of property rights over natural resources.²⁹ By regarding such a challenging subject as being "commons without tragedy"³⁰ or the "comedy of the commons,"³¹ we must recognize that the theory underlying commons and anticommons often fails to square with reality.

Second, Heller's dynamic analytics puts forward an incomplete explanation for the evolution of property rights. According to Heller's argument, there is the existence of a theoretical precondition that high transaction costs or potential hold-out problems will lead to "market failure" due to the lack of outsider authority. Conversely, Richard Epstein holds that government ownership and regulation often create far more gridlock than private property, and therefore he believes that there is not too much private property but, rather, too little.³² Personally, I take both of these two opposing views with a

27. Henry E. Smith, *Community and Custom in Property*, 10 THEORETICAL INQUIRIES L. 5, 24–34 (2002).

28. For instance, Mongolians still rely on some ancient rules to allocate and use natural resources such as the habit of "rotation grazing." See Bing Mei et al., *Gu Dai Meng Gu Zu Zi Ran Zi Yuan Bao Hu Fa Lv Ji Qi Shi* [The Enlightenment of Natural Resources Protection Law of the Ancient Mongols to Protect the Environment Nowadays], 36 LAN ZHOU DA XUE XUE BAO (J. LANZHOU U.) 100, 100–04 (2008) (Ch.).

29. As Gregory Alexander writes, "culture is all but missing from de Soto's explanation for the rise of capitalism in the developed world." Gregory S. Alexander, *Culture and Capitalism: A Comment on de Soto*, in HERNANDO DE SOTO AND PROPERTY IN A MARKET ECONOMY 41 (D. Benjamin Barros ed., Ashgate 2010).

30. Lee Anne Fennell, *Commons, Anticommons, Semicommons*, in RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 35 (Kenneth Ayotte & Henry E. Smith eds., Edward Elgar 2011).

31. Carol Rose proposed the term "comedy of the commons" to illustrate that enforcing private-property rights was costly. See Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 711–81 (1986).

32. Richard A. Epstein, *Heller's Gridlock Economy in Perspective: Why There is Too Little, Not Too Much Private Property*, 53 ARIZ. L. REV. 82 (2011).

grain of salt. In a world without the friction caused by transaction costs,³³ either private use or common use leads to efficiency. However, in a less than ideal world where a particular resource is used by multiple actors, the optimum regime established under the restriction of transactional barriers will vary from location to location. Therefore, the efficiency of property rights arrangements is situation-specific and Heller's hypothesis does not explain the whole story of resource regimes. To give one example, in Papua New Guinea, many land areas have been returned to communal ownership because the concept of private land ownership has not been well integrated into the local culture.³⁴ In contrast to the dogmatic dichotomy of commons and private property, these two seemingly contradictory models are always integrated and coordinated as a solution to high transaction costs in the real world.³⁵ Therefore, neither common nor private property provides a one-size-fits-all solution to the allocation of natural resources.

Third, given the conceptual gap between the common-law and civil-law systems, I am skeptical about whether Heller's hypothesis leaves enough room to interpret the property law of other jurisdictions. The implication of property rights in common law is different to that held within civil law. As any first-year law student knows, the common law has savaged the idea of "absolute" ownership and

33. It is worth pointing out that Fennell broadened the meaning of transaction costs. She proposed the term "resource access costs" to designate the full range of costs. See Lee Anne Fennell, *The Problem of Resource Access*, 126 HARV. L. REV. 1472, 1477 (2013).

34. THOMAS STERNER & JESSICA CORIA, POLICY INSTRUMENTS FOR ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT 47 (2d ed., RFF Press 2011).

35. Using a recent example, the failure of many traditional regulation structures has led economists to propose several property rights-based approaches, including Individual Fishing Quotas (IFQs or ITQs), which allocate units of harvest, and Territorial User Rights Fisheries (TURFs), which allocate units of space to private firms, cooperatives, or fishermen. Christopher Costello & Daniel T. Kaffine, *Marine Protected Areas in Spatial Property-Rights Fisheries*, 54 AUSTL. J. AGRIC. RES. ECON. 321, 321-41 (2010).

tended to view property as a “bundle of rights.”³⁶ In contrast, as can be traced back to the concept of dominium in Roman law, civil law jurisdictions still hold the timeless and “absolute” notion of ownership and there is no such thing as “relative” ownership.³⁷ For example, by subdividing property rights into right *in rem* and *in personam*, leases were originally viewed as only creating a contractual relationship in civil law. Underlying the principle is a denial of the unity of ownership. However, English law created the concept of tenure and thus ownership could apparently be divided between landlord and tenant.³⁸ As a result, with no “absolute ownership right,” the “bundle of rights” in common law can strengthen flexibility in the use of natural resources, although it is likely to increase the possibility of the disintegration of property, as the greater number of rights of exclusion that exist, the more likely it is that anti-commons will occur (or vice versa). So far, little evidence has been offered to support the argument that the fragmentation of property rights would lead to the underuse of natural resources in civil law jurisdictions.

To summarize, despite its growing influence, Heller’s insight leaves more questions open than it answers. Unlike the flow of one-way traffic, where all resources routinely move from open-access to exclusive-access, a property regime of natural resources is always (or perhaps typically) a mixture of many seemingly contradictory mechanisms. Therefore, taking into account the diversified resources system in the real world, I prefer to regard the evolution of

36. Abraham Bell & Gideon Parchomovsky, *Reconfiguring Property in Three Dimensions*, 75 U. CHI. L. REV. 1015 (2008); see also James E. Penner, *The Bundle of Rights Picture of Property*, 43 UCLA L. REV. 711 (1996).

37. After the new Dutch Civil Code of 1992, civil law jurisdictions are slowly moving toward to the notion of “relative” ownership. See Willem J. Zwolve, *Temporary and Conditional Ownership: Some Observations on Modern Dutch Property Law*, in PROPERTY LAW ON THE THRESHOLD OF THE 21ST CENTURY 333-45 (Gerrit van Maanen & André van der Walt eds., Maklu Uitgeverij 1996).

38. Kevin Gray, *Property in Common Law Systems*, in PROPERTY LAW ON THE THRESHOLD OF THE 21ST CENTURY, *supra* note 37 at 236–245; see also JESSE DUKEMINIER ET AL., PROPERTY 421-28 (7th ed., Aspen Publishers 2010).

property rights as being a Rubik's Cube rather than a one-dimensional spectrum.

III. THE TRANSITION OF COASTAL WATERS IN CHINA

A. *Characteristics of Coastal Waters*

The oceans were the last commons.³⁹ According to the tradition of ancient Rome, immovable property was confined to land and its attachment thereto. Historically, the sea has been excluded from the list of property and treated as the commons because of three characteristics:

Abundance—Viewed from the perspective of natural law, the sea has usually been regarded as an inexhaustible treasure. In Roman law, the sea was *res communis*, which suggests that it was common property and unsusceptible to private ownership.⁴⁰ If rights were violated when using the sea area, a penalty would be imposed as *actio iniurarium*.⁴¹ In 1609, Hugo Grotius argued that the sea belonged to no one and therefore no state could claim sovereignty over it.⁴² This concept, with its strong philosophical and rhetorical roots, was generally accepted.⁴³ Nevertheless, the debate was irrelevant from the view of property law. As a form of natural resource without scarcity, the sea (in the same way as sunshine or air) has neither

39. Rögnvaldur Hannesson, *The Privatization of the Oceans*, in PROPERTY RIGHTS IN MARINE FISHERIES, *supra* note 17, at 25.

40. Samuel C. Wiel, *Running Water*, 22 HARV. L. REV. 190, 190–215 (1909). Generally speaking, if the seas were *res communis*, they were free to be used by all; if the seas were *res nullius*, they were the property of no one. See DOUGLAS M. JOHNSTON, THE INTERNATIONAL LAW OF FISHERIES: A FRAMEWORK FOR POLICY-ORIENTED INQUIRIES (Martinus Nijhoff Publishers 1987).

41. Christin Gowar & C. J. Visser, *Actio Iniurarium—One Action, But Only One Iniuria? Le Roux v. Dey 2011 3 SA 274 (CC)*, 76 JOURNAL OF CONTEMPORARY ROMAN-DUTCH LAW 490, 490–98 (2013).

42. HUGO GROTIUS, THE FREEDOM OF THE SEAS (Ralph van Deman Magoffin trans., Oxford University Press 1916) (1609).

43. At the same time, an opposite view was taken by a particularly Scottish school of thought, which accorded propriety interests in the coastal waters to the coastal states. See RICHARD BARNES, PROPERTY RIGHTS AND NATURAL RESOURCES 173 (Bloomsbury Publishing 2009).

economic utility nor legal value. For this reason, the sea area has not been mentioned by legislators in either the French Civil Code or the German Civil Code.

Fluidity—Because of its mobility and fluidity, an exclusion strategy is difficult in the case of water.⁴⁴ In the civil law context, only those physical things that can be possessed exclusively would be classified as property (*right in rem*). Although property rights may be exercised with respect to “any valuable object of any conceivable kind”⁴⁵ in common law, only “tangible, unique and easily identifiable”⁴⁶ things can be treated as property. Due to its physically fluid nature, it appears that the permanent physical occupation of coastal waters would be “mission impossible.” In essence, it is difficult to define the ownership of waters in geographical terms, making it hard for legislators to place them on the list of movable or immovable property.

Publicity—Under classical liberal theory, which divides the public and private spheres, property rights have been placed entirely within the private sphere.⁴⁷ As a public trust resource, coastal waters serve the public—they are recognized to that end, and property rights are limited due to the nature of coastal waters as a public resource.⁴⁸ For example, if waters are navigable in the United States, all state-created property rights and private interests in these waters are subordinate to this overriding principle of navigation.⁴⁹ Therefore, providing an account of the public function of the seas is vital⁵⁰

44. Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445 (2008).

45. A. Irving Hallowell, *Nature and Function of Property as a Social Institution*, 1 J. LEGAL & POL. SOC. 115, 128 (1942).

46. Andrew Beckerman-Rodau, *Are Ideas Within the Traditional Definition of Property: A Jurisprudential Analysis*, 47 ARK. L. REV. 603, 605 (1994).

47. BARNES, *supra* note 43, at 63.

48. *State v. Shack* 277 A 2d 369, 372 (N.J. 1971).

49. See Joseph J. Kalo, *Introduction* to ALISON RIESER, DONNA R. CHRISTIE, JOSEPH J. KALO & RICHARD G. HILDRETH, *COASTAL AND OCEAN LAW: CASES AND MATERIALS* 1–3 (Thomson West 2007).

50. *Id.* According to the United States Congress, “the federal government had a direct responsibility for navigation and commerce in coastal waters and a shared interest in conservation and economic developments in coastal areas.”

and, as a result, coastal waters are not used in the same way as other resources.

B. Historical Background to the Transition

Broadly speaking, there are two threads running through the evolution of the resource regime in China: political power and private rights. For most of China's long history, the conception of property has been different from the distinction drawn in Western law, as in Roman law, between *imperium* and *dominium*,⁵¹ or political power and private rights.⁵² With rare exceptions, property in natural resources has been primarily viewed as a tool of political power in Chinese history. Therefore, it has been a long-standing source of controversy among modern scholars as to whether private law existed in the ancient period.⁵³

With the advent of Communist rule in 1949, ideological and institutional changes brought about profound amendments to codified laws. At variance with the survival-oriented peasant in traditional China and the capitalism of the West, China pursued a planned economy in accordance with Marxist–Leninist theory. According to Article 9 of the Constitution of the People's Republic of China, “all mineral resources, waters, forests, mountains, grassland, wasteland, beaches and other natural resources are owned by the state, that is, by the whole people, with the exception of the forests, mountains, grasslands, wastelands and beaches that are owned by collectives in

51. Geoffrey Samuel, *The Many Dimensions of Property*, in PROPERTY AND THE CONSTITUTION 40–45 (Janet Mclean ed., Hart Publishing 1999); See also Morris R. Cohen, *Property and Sovereignty*, 13 CORNELL L. Q. 8, 13 (1927). As M. R. Cohen noted, in contrast, “we must not overlook the actual fact that dominium over things is also imperium over our fellow human beings.”

52. A famous phrase in the *Book of Songs (shi jing)*, the first collection of poems in China, created in the 11th Century BC, states that “all the lands belong to the emperor.” Translated from the ancient Chinese phrase “*pu tian zhi xia, mo fei wang tu.*”

53. For a summary of these arguments, see Yu Jiang, *guan yu Zhong guo gu dai you wu min fa wen ti de zai si kao [Rethink Over the Question of Whether There was Private Law in Ancient China or Not]*, 6 XIAN DAI FA XUE (J. MODERN L. STUD.) 35, 35–45 (2001).

accordance with the law.” Obviously, all natural resources, including coastal waters, are therefore officially labeled as state property. However, in light of the economic reforms and opening-up policies that have been introduced since 1978, the concept of state property, which originated as a transplanted legal term, has steadily evolved into a Chinese-style institution serving social goals.⁵⁴ On the one hand, being state property, natural resource rights in China may not be transferred due to the rule of exclusivity, described as “inalienability entitlement” by Guido Calabresi and A. Douglas Melamed.⁵⁵ On the other hand, natural resources such as land, mines, and waters will be pushed into the marketplace with regard to their allocation, use, and transfer. Therefore, new types of property rights have to be created to resolve this paradoxical system.⁵⁶ China’s reformers are trying to steer a middle course between protecting individual rights-holders, who are “entitled to possess, use and seek proceeds from it in accordance with the law,” and upholding state ownership in accordance with the Constitution.⁵⁷

C. The Three Stages of the Transition

Should legislators consider the coastal waters to be immovable property? This is a controversial issue that has attracted nationwide attention to the legislative process on property law in China.⁵⁸ The

54. Bing Shui, *Zi Ran Zi Yuan Guo Jia Suo You Quan Shuang Jie Gou Zao Shuo* [Double-level Structure of State Ownership of Natural Resources], 35 FA XUE YAN JIU (CHINESE J. L.) 4, 4–18 (2013).

55. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

56. For example, many private rights embody the right to contracted management of land, the right to use construction land, the right to use house sites, the right to use seawaters, the mineral prospecting right, the mining right, the water intake right, and the right to use water areas or tidal flats for farming or fishery, etc. See *Wu quan fa* (2007) (P.R.C.), *supra* note 16, Art. 122–24, 135, 152.

57. *Id.* at Art. 117.

58. The Standing Comm. Nat’l People’s Congress solicited opinions over Property Law (Draft) in 2005. The most heated dispute centered on whether and how to define the right to use the sea area, with 11, 543 pieces of feedback sought nationwide.

logic behind this debate rests in the fact that the physical and economic features of coastal waters have changed at an unprecedented rate.

When it comes to the characteristic of *abundance*, coastal waters are becoming a scarce resource in the course of China's economic development. China has an expansive sea area, with a continental coastline of over 18,000 km, and an island coastline of over 14,000 km.⁵⁹ Coastal regions support over 40 percent⁶⁰ of the national population and over 60 percent⁶¹ of GDP, while accounting for only 13.5 percent⁶² of the total national land area. Legislators and the general public alike have realized that the nearshore sea area not only supplies important natural resources, but also constitutes a major property category. Therefore, the present demand on coastal resources is high.

As for the characteristic of *fluidity*, coastal waters can be partitioned by latitude and longitude using technological means, which accordingly makes geographical occupation possible. In traditional civil law, coastal waters are not deemed to be an object to which real rights can be attached due to their social and economic limitations; without a recognizable boundary, waters are unlikely to be exclusively accessed. However, with the development of modern technology and devices, a Global Positioning System (GPS) can easily distinguish demarcated sea areas. Furthermore, the term coastal waters not only refer to mobile and fluid water, but also embraces a three-dimensional space consisting of sea surface, seawater, seabed, and

59. *Marine Physical Geography*, 2013 Zhongguo hai yang tong ji nian jian 35 (2013 Marine Statistical Y. B. China) (Zhonghua Renmin Gongheguo guo jia hai yang ju [State Oceanic Administration P.R.C.]).

60. *Population at Year-end by Region*, 2014 Zhongguo tong ji nian jian 28 [2014 Statistical Y. B. China] (Zhonghua Renmin Gongheguo guo jia tong ji ju [National Bureau of Statistics P.R.C.]).

61. *Id.* at 221–22.

62. *Id.* at 211, 234.

sediment.⁶³ When viewed from this perspective, coastal areas could arguably be considered as immovable property.

In terms of *publicity*, this hardly poses an obstacle for public access because coastal waters belong to the state in China. More specifically, China's coastal waters are a mixture of state ownership and private property. State ownership is inalienable, while individuals can be granted the right to occupy, use, and withdraw specified coastal waters. This unique system, although imperfect, duly balances the potential conflict of public access and private use in China's coastal waters.

From the social point of view, what has occurred in China's coastal waters is an under-theorized "trial and error" process,⁶⁴ which can be divided into three stages:

The open-access stage (1950–1977)—this refers to the period when everyone could freely use the natural resources. Under this commons-like regime, every individual had the opportunity to be a free rider⁶⁵ because they obtained the resources free of charge.

The limited-access stage (1978–2006)—referring to the period when collective members were granted contractual rights to use coastal waters and other natural resources by the Family Contract Farming System (*Bao Chan Dao Hu*). Under this regime, some collective members were granted contractual rights rather than property rights (*right in rem*) to use and withdraw the waters, but they did not retain the right against the collective and other third parties. Despite

63. According to Art. 2 of *Zhonghua Renmin Gongheguo hai yu shi yong guan li fa* [The Law of the People's Republic of China on the Administration of the Use of Sea Areas] (promulgated by the Standing Comm. Nat'l People's Cong., Oct. 27, 2001, effective Jan. 1, 2002) 2002 Standing Comm. Nat'l People's Cong. Gaz. (P.R.C.), "sea area refers to internal waters, water surface, water body, seabed and sediment of territorial waters in the territory of the People's Republic of China."

64. For a brief introduction to this process, see Frank Xianfeng Huang, *The Path to Clarify: Development of Property Rights in China*, 17 COLUM. J. ASIAN L. 191 (2003).

65. Theodore Groves and John Ledyard, *Optimal Allocation of Public Goods: A Solution to the "Free Rider" Problem*, 45 ECONOMETRICA: J. OF THE ECONOMETRIC SOC. 783, 809 (1977).

the lack of stability and transferability,⁶⁶ the contractual instruments acted as a “compromise between formalism and pragmatism”⁶⁷ and succeeded in decreasing the number of free riders in the waters.

The exclusive-access stage (2007–2015)—this describes the period since the application of the Property Law (*Wu Quan Fa*). Broadly speaking, the exclusive-access stage could be argued to date back to 2001 when the Law of the People’s Republic of China on the Administration of Sea Areas (*Hai Yu Guan Li Fa*) was introduced to legally protect “any exclusive continuous use of seas within specific sea areas.”⁶⁸ However, this declaration functions only at the level of administrative law, and the right to use coastal waters was not treated as a property right until the execution of the Property Law in 2007. By entitling individuals to exclusively occupy, use, and withdraw the coastal waters, the Property Law has deprived the collective or state of the right to terminate the contract at will. In other words, under this rights-based regime, an individual’s right to exclusively use the waters was informally framed as a property right.⁶⁹

66. Based on a 1997 study, 66 percent of contracts had been adjusted by the collective more than once. See Peter Ho, *Who Owns China’s Land? Policies, Property Rights and Deliberate Institutional Ambiguity?*, 166 CHINA QUARTERLY 397 (2001).

67. Huang, *supra* note 64, at 221.

68. According to its definition, “[t]his law shall be applicable to any exclusive continuous use of the seas within specific sea areas of the interior waters or territorial seas for three months or longer.” See *hai yu shi yong guan li fa* (2002) (P.R.C.), *supra* note 63, Art. 2.

69. According to Art. 120 of *Wu quan fa* (2007) (P.R.C.), *supra* note 16, “the owner shall not interfere with the exercise of rights by the usufructuary” otherwise, according to Art. 37, individuals “may request compensation for the damages and may also request the infringing party to assume other civil liabilities.” In other words, as a usufruct, the right to exclusively use waters includes the possibility to oppose the state.

IV. THE EMPIRICAL REALITY OF COASTAL WATERS IN CHINA

A. *Does the Property Regime Lead to Anticommons?*

As previously noted, I regard the adoption of the Property Law in 2007 as the starting point for the exclusive-access stage. This is because the right to use waters, namely the “exclusive continuous use of seas within specific sea areas,”⁷⁰ has been informally treated as a property right by law. Under the property-right regime, the coastal waters have been fragmented into numerous small, fenced-off areas that individuals can use exclusively. This change raises two separate but related questions: Is the property-rights regime more efficient than ever? And, if yes, will too much fragmentation lead to underuse in accordance with Heller’s dynamic analytics?

1. *The Bottom-Up Model Versus the Top-Down Model*

Much has been written, particularly in the literature on law and economics, about policy instruments for fisheries and waters. Yet much of the literature has been clouded by the confusion that stems from the difference between (1) “water right” and “right to use waters,” and (2) “right to aquaculture” and “right to capture.” A water right entitles the rights-holder to capture and convey water, whereas the “right to use water” means that the rights-holder can continuously use the specified waters. The term “water right” does not concern fisheries.⁷¹ Yet fisheries revolve around two distinct methods of production in the economic literature. One is aquaculture, which requires the persistent occupation of the given waters, and the other, much more prevalent and older than aquaculture, is capture, which does not normally require persistent occupation. Further, it can be hypothesized that strong property rights are necessary for intensive aquaculture to thrive or, rather, that intensive aquaculture finds it hard to exist under weak property rights.

70. *Hai yu shi yong guan li fa* (2002) (P. R. C.), *supra* note 63, at Art. 2.

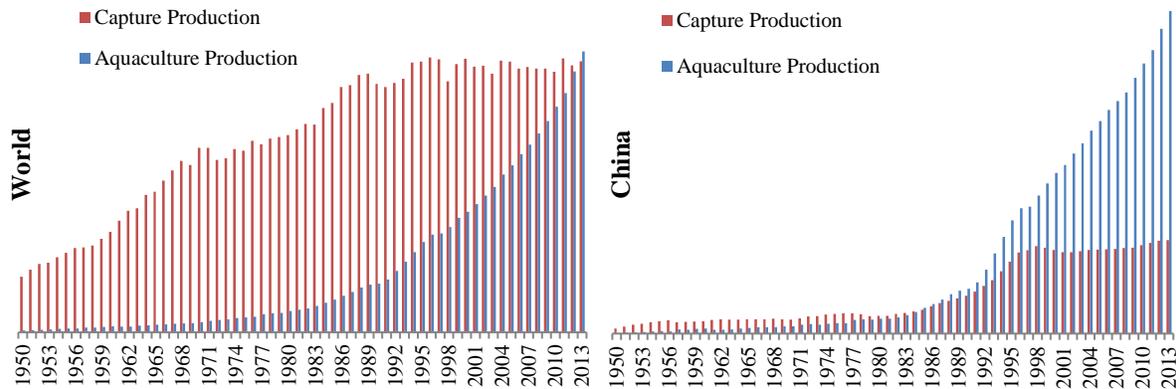
71. Here, I disregard the complicated situation whereby rights-holders not only use the waters to produce seafood, but also to convey the water elsewhere.

Clarification of this sort is helpful when studying the way in which the property-rights regime influences fishery productivity. When compared with capture production, primarily based on Richard Epstein's terms, I advocate that aquaculture should be handled as a bottom-up model because it aims to grant users the right to exclusive occupation.⁷² Conversely, I suggest that capture production should be categorized as a top-down model because it is regulated by such administrative tools as licensing and permits. To summarize, it is the bottom-up model which exemplifies the property-rights regime.

For the purposes of comparison, an overview of global fisheries reveals the imbalance between capture and aquaculture production. As Figure 2 shows, the level of aquaculture production in China is far higher than that of capture production, which is quite different from anywhere else in the world. Even though global aquaculture production has been on the rise for a long time, it is still nearly equal to capture production at the global level. A very distinctive picture emerges in China, where aquaculture production began to increase in 1978, marking the starting point of the *Limited-access stage (1978–2006)*. At the present time, China's capture production is significantly lagging behind aquaculture production (at around one-third of the level). These facts alone suggest that there is a huge imbalance between aquaculture and capture production.

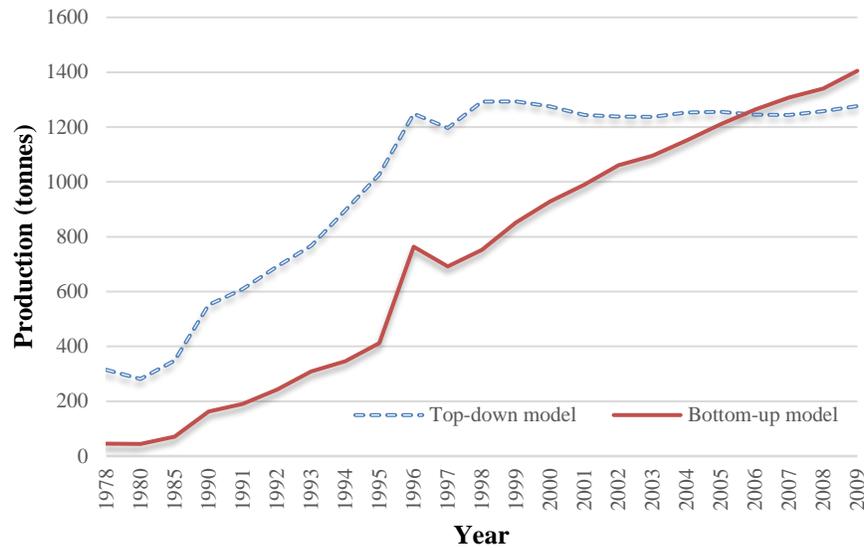
72. Both the top-down and the bottom-up system are well illustrated by Richard Epstein in his analysis of the allocation of parking spaces on public roads. Richard A. Epstein, *The Allocation of the Commons: Parking on Public Roads*, 31 J. LEGAL STUD. 515 (2002).

Figure 2. Capture Production & Aquaculture Production (1950–2013)⁷³



In addition, this imbalance between capture and aquaculture production indicates that the bottom-up model is more efficient than the top-down model. Figure 3 shows the data on Chinese coastal waters in more concrete terms. As noted, the top-down model represents capture production while the bottom-up model represents aquaculture production. Obviously, the curve of the bottom-up model rises more steeply. All things being equal, we would expect a tendency for aquaculture output to be far ahead of capture output. It is also worth pointing out that the year in which bottom-up production exceeded top-down for the first time coincided with the starting point of the *exclusive-access stage* (2007–2015).

73. Food and Agriculture Organization of the United Nations [FAO], Fisheries & Aquaculture Department, Statistics, Global Capture Production & Global Aquaculture Production, <https://perma.cc/EB9P-HDRC>; <https://perma.cc/SC36-NVXX>.

Figure 3. Two Models of Fisheries in Chinese Coastal Waters

Finally, it is possible to test the null hypothesis by means of SPSS analysis: that the three access stages will affect the models equally. I used a one-way, between-group ANOVA (analysis of variance) to analyze the data. Tukey's post-hoc comparisons were used to examine the differences between the models ($p < .01$). Each access stage affected the degree of production that the bottom-up model would bring about, $F(2, 61) = 85.14$, $p < .01$, $\eta^2 = .74$. The *exclusive-access stage* would result in more production ($M = 48311416.71$, $SD = 5843405.88$, $n = 7$) than both the *open-access stage* ($M = 987709.54$, $SD = 600227.89$) and the *limited-access stage* ($M = 15965825.52$, $SD = 12608218.91$).⁷⁴ Consequently, we can reject the null hypothesis.

74. To construct and analyze the figure, I used SPSS and reported the findings in accordance with APA style guidelines. See ADELHEID A. M. NICOL & PENNY M. PEXMAN, *DISPLAYING YOUR FINDINGS: A PRACTICAL GUIDE FOR CREATING FIGURES, POSTERS, AND PRESENTATIONS 12* (6th ed., American Psychological Association 2010).

As the data are statistically significant, we can conclude that the bottom-up model is more efficient than its counterpart model within Chinese coastal waters.

2. Data and Findings

The Chinese example also casts an interesting light on the question of whether the fragmented rights would lead to a tragedy of the anticommons. According to recent data, a total of 6,499,882.37 hectares of sea area have been allocated for exclusive use. The certificates of rights to use coastal waters amount to 191,524 and every certificate signifies an exclusive section of coastal waters. Mathematically, this indicates that the mean area of exclusive use is 33.93 hectares per certificate. I refer to this as the *fragmentation index* (FI) of coastal waters. In 2012, the total area reserved for aquaculture amounted to 2,180,927 hectares, which yielded a production total of 16,438,105 tons. Therefore, the mean output of aquaculture was 7.537 tons per hectare. I refer to this as the *production index* (PI) to formalize the discussion.

I collected fragmentation index and production index data from all eleven coastal provinces in China. The data was derived primarily from three sources: (1) the China Ocean Yearbook;⁷⁵ (2) the China Marine Statistical Yearbook;⁷⁶ and (3) the China Statistical Yearbook.⁷⁷ Table 1 lists a breakdown of this information during the period from 2002 to 2012. I will utilize this dataset to explore the relationship between fragmentation and production.

75. Zhongguo hai yang nian jian [Ocean Y. B. China] (Zhongguo hai yang nian jian bian zuan wei yuan hui [Ocean Y. B. China Compilation Comm.]).

76. Zhongguo hai yang tong ji nian jian [Marine Statistical Y. B. China] (Zhonghua Renmin Gongheguo guo jia hai yang ju [State Oceanic Administration P.R.C.]).

77. Zhongguo tong ji nian jian [Statistical Y. B. China] (Zhonghua Renmin Gongheguo guo jia tong ji ju [National Bureau of Statistics P.R.C.]).

Table 1. Fragmentation Index (FI) and Production Index (PI) in All Eleven Coastal Provinces in China

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	<i>FI/PI</i>										
Shandong	37.4/11.1	33.4/9.4	47.1/8.8	31.5/8.8	30/8.9	31.5/8.7	62.1/8.5	73.4/8.6	58.6/7.9	54/8	160.3/8.3
Jiangsu	289.4/2.4	208.5/2.6	137.5/2.9	173.7/3.1	190/3.4	180.3/4.2	-----	143.7/4.3	173.4/4.1	150.4/4.2	152.5/4.5
Fujian	14.2/20.5	16.1/20.6	9.3/20.3	13.1/20.3	11.8/20.5	13.8/24.9	7.5/23.5	4/21.9	26.9/22	20.7/22.2	27.1/22.9
Hebei	31.6/2.4	33.6/2.9	30.1/3.2	23.8/3.4	17.8/2.7	26.7/3.2	13.7/3.2	41.8/2.7	90/2.5	14.3/2.8	60/2.8
Hainan	12.4/7.9	7/8.9	8.8/9	8/10.5	6.9/11.2	6.1/19	1.1/13.5	2/13	14.6/12.7	16.8/13	25.7/13.6
Shanghai	90.5/3.5	202.8/5.9	----	202.8/7.4	110.3/5.2	555.4/2.7	-----	-----	-----	-----	-----
Liaoning	49.4/6.4	49/4.8	26.1/4.8	36.5/4.7	32/4.6	33/6.3	63.3/4.9	102.7/4.6	168.5/3	215.1/3.2	255.7/3.2
Guangdong	29.2/9.1	21.8/9.1	21.9/9.5	26.2/10	23.3/10.3	23.3/14	176.6/11.8	21.1/12	18.4/12.5	22/13	27.3/13.7
Zhejiang	14.1/7.3	17.9/7.8	49.9/7.9	24.5/7.8	24.4/8.1	30.1/15.2	39.4/8.7	34.3/9	22.2/8.8	54.4/9.3	21.8/9.6
Guangxi	2.7/13	3/13.4	4.8/13.8	3/14.4	2.8/14.5	5.7/16.2	9.2/20.6	14/22.2	10.3/17.1	14.9/17.7	9.4/18.4
Tianjin	48.4/1.4	287.6/1.7	18.2/2	26.3/2.3	27/3	68.8/2	41.3/3.2	65.2/3.3	42.2/3.6	42.9/3.2	21.8/3.6

FI = total entitled areas / number of rights-holders; PI = total production / total entitled areas

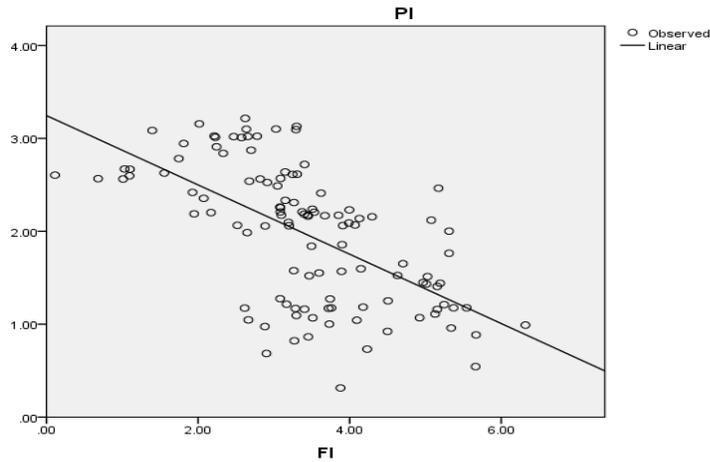
What does the data tell us? Regression analysis can help to test the hypothesis of whether the fragmented waters would lead to the anticommons. If Heller's hypothesis is assumed to be true, we might infer that when the scale of fragmentation increases, productivity will decrease. Or, to put it another way, the more we divide natural resources into small units, the greater the level of waste and underuse that will occur. To prove this assertion, there should be a positive correlation between the fragmentation index and the production index.

I analyzed the potential correlation between fragmentation and production by using Pearson's r .⁷⁸ Two variables correlated at $r(112) = .44$, $p < .001$, $r^2 = .193$. The fragmentation figure ranged from 1.12 to 555.4 ($M = 59.50$, $SD = 80.67$, $n = 114$). The production figure seen

78. NICOL & PEXMAN, *supra* note 74.

on a regular basis ranged from 1.37 to 24.92 ($M = 9.149$, $SD = 6.20$, $n = 114$).

Figure 4. Simple Linear Regression of FI and PI⁷⁹



As Figure 4 shows, I took production as the dependent variable and fragmentation as the independent variable. To improve the homogeneity of variance, I used a variance-stabilizing transformation. Linear regression analysis allowed me to predict PI (production index) from FI (fragmentation index), $F(1,112) = 64.42$, $p < .001$, with a slope of -0.37 and a Y-intercept of 3.25 . The fragmentation variable significantly predicted production ($p < .001$). When predicting production from fragmentation, I erred by 0.59 production rating points (Standard Error of the Estimate = $.59$).

Here, potential objections might be raised because I had not taken into consideration the possibility that other factors could affect the PI. For example, people might express doubts about whether lower productivity is caused by the level of economic development

79. All data in the model have been remedied by a variance-stabilizing logarithmic transformation.

rather than by the degree of fragmentation.⁸⁰ In order to increase the power of the statistics, I calculated and added the value of per capita GDP in the eleven coastal provinces because this variable can represent the level of economic development.⁸¹ I then used GDP as a covariate to conduct an analysis of covariance (ANCOVA).⁸² According to the result shown in Table 2, the FI and the PI still tend to be strongly correlated ($p < .001$) even when controlling for GDP. This result further supported my findings.

Table 2. Coefficients^a

Model	Unstandardized		Standardized	t	Sig.	95.0% Confidence	
	Coefficients		Coefficients			Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	3.223	.170		18.948	.000	2.886	3.560
GDP	.032	.035	.076	.903	.369	-.038	.101
FI	-.394	.052	-.639	-7.558	.000	-.498	-.291

a. Dependent Variable: PI

Taken as a whole, the statistical data show that the hypothesis is not true. There is a moderate correlation between fragmentation and production, but it is negative rather than positive. As a result, we can reject the hypothesis that high levels of fragmentation would lead to low production levels. We might then conclude, from an empirical

80. Economists have found that other factors such as geography, climate, and resource abundance might affect the productivity of natural resources. For instance, a study has shown evidence of a “curse of natural resources”: countries with great natural resources tend to grow more slowly than resource-poor countries, see Jeffrey D. Sachs & Andrew M. Warner, *The Curse of Natural Resources*, 31 EURO. ECON. Rev. 827, 827–838 (2001).

81. Robert J. Barro, *Economic Growth in a Cross Section of Countries*, 425 Q. J. ECON. 407, 433 (1991).

82. Covariate refers to a variable used in ANCOVA to statistically control for variance, which might be obscuring the effects of an independent variable.

standpoint, that there is no tragedy of the anticommons in China's coastal waters. Conversely, the more fragmented the areas, the higher the productivity. This, to a large extent, implies that there is a "comedy of the anticommons" in China's coastal waters. Therefore, based on the empirical evidence, my conclusion is the opposite of Heller's assumed theory.

B. Why a Gridlock Will Not Occur

Why does the anticommons hypothesis fail in practice? As I argued in part II of this article, Heller's theory incompletely (or imperfectly) interprets the complexity of the real world. At the very least, he makes no reference to circumstances where state ownership and private property are always integrated and coordinated as a solution to overcome gridlock.⁸³ The anticommons hypothesis assumes that too many rights lead to a potential hold-out problem or a breakdown in cooperation. However, this is not always true; sometimes players choose to cooperate with each other because they are aware that a non-cooperative strategy is not the best course of action. By way of illustration, we should consider the actual practice in China's coastal waters. Under the current regime, there are three main players: the state owner (the central government); ownership agents (the local governments); and private users (individual rights-holders). Theoretically, only the central government can represent the state to maintain ownership in China.⁸⁴ Without the local authority, it is almost impossible for the central government to exercise state ownership. Aligned with China's devolution of resources from

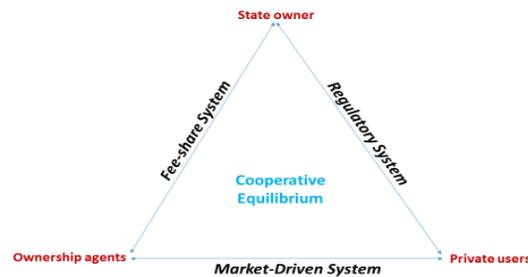
83. Although Heller has talked about an array of solutions to cure underuse in the anticommons, he still assumes a rigid dichotomy between open access and exclusive access and ignores the cooperative strategy between multi-level users. As he noted, "commons and anticommons tragedies mirror each other, so solutions for one may inform the other;" HELLER, *supra* note 5, at 182.

84. According to *hai yu shi yong guan li fa* (2002) (P.R.C.), *supra* note 63, at Art. 3, "[t]he sea areas shall belong to the state, and the State Council shall exercise ownership over the sea areas on behalf of the state."

central to local authorities,⁸⁵ local governments have the legal authority to approve and supervise the use of sea areas.⁸⁶ In order to distinguish them from the central government, which is the unique representative of ownership, I have designated local governments as ownership agents.

Along three critical dimensions, all players may enforce cooperative behavior. First, there is a fee-share arrangement between state owner and ownership agents. According to this system, 70 percent of the usage fee belongs to ownership agents while 30 percent is paid to the state owner.⁸⁷ Similar to the sharecropping contract between landlord and workers in agricultural history, the fee-share arrangement mitigates the risk of moral hazard, which can be caused by information asymmetry.⁸⁸

Figure 5. Legal Framework for Exercising Rights in China's Coastal Waters



85. Contrary to the more centralized reform in Eastern Europe and Russia, “China has emphasized economic reform through devolution of authority from the central to local governments.” Yingyi Qian & Barry R. Weingast, *Federalism as a Commitment to Preserving Market Incentives*, 11 J. ECON. PERSP. 83, 86 (1997).

86. Apart from large-scale use or “key state construction projects,” most applications to use coastal waters only need to be approved by local governments. See *hai yu shi yong guan li fa* (2002) (P.R.C.), *supra* note 63, Art. 7, 16–18.

87. See *Cai Zheng Bu Gu Yu Jia Qiang Hai Yu Shi Yong Jin Guan Li De Tong Zhi* [Notice of Ministry of Financial and State Oceanic Ministry on Collecting the Use Fee in 2007].

88. Joseph E. Stiglitz, *Incentives and Risk Sharing in Sharecropping*, 41 REV. ECON. STUD. 219, 219–55 (1974); Steven N. S. Cheung, *Private Property Rights and Sharecropping*, 76 J. POL. ECON. 1107, 1107–22 (1968).

Second, there is also a regulatory means to resolve the hold-out problem, namely the functional-divisions system. This system aims at “ensuring the sustained utilization of sea areas and promoting the development of the maritime economy” by planning all coastal waters.⁸⁹ In view of the process whereby the functional-divisions system is jointly completed by multi-level governments, to some extent it avoids the potential hold-out problem. Ideally, by means of a functional-divisions plan, which is treated as implied contractual terms, the state owner can impose an *ex ante* regulation as a solution to keep gridlock at bay. Normally, the hold-out phenomenon occurs where a large-scale project requires the consent of private users. However, such large-scale projects should be planned by a functional-divisions system. If this is the case, it implies that private users have accepted the content of the project in advance; if not, the adjustment of the functional-divisions plan associated with specified waters is a form of regulatory undertaking. No matter which situation materializes, the hold-out gridlock will not occur.

Finally, the market-driven system forms the basis of a solution to overcome gridlock. In essence, only when the negotiators believe that they will benefit from non-cooperative action will the anticommons occur. However, for private rights-holders in China’s coastal waters, the non-cooperative option is not the best game plan. Most of them gain exclusive-use rights by bidding or auction.⁹⁰ They have a strong incentive to avoid gridlock because underuse would seriously affect the market value of the waters in the remaining contractual terms. At the very least, refusing the deal means the loss of an opportunity to make a profit.⁹¹ Therefore, rational individuals are

89. *See hai yu shi yong guan li fa* (2002) (P.R.C.), *supra* note 63, at Art. 11.

90. For example, according to the related regulation in Shanghai, “[i]n case of an application for the use of sea areas for business purposes, the Municipal Oceanic Bureau shall organize bidding or an auction for the transfer of the right to use sea areas;” *Shang Hai Shi Hai Yu Shi Yong Guan Li Ban Fa* [Procedures of the Shanghai Municipality on the Administration of Use of Sea Areas 2006].

91. In contrast, the risk of gridlock is much higher in land use because the timeless ownership may weaken the rights-holder’s incentive to make a profit. However, the right to use waters is not timeless and thus refusing to make a deal

willing to accept a good deal as long as the price is right. The same is true for new users. As such the potential problem of a gridlock is avoided through negotiations.

V. CONCLUSION

When a Blackacre has to be used by multiple players, there are two options when it comes to allocating the resource: divide it into small fenced-off plots (imagine cutting a big birthday cake for party guests); or permit the players to use the resource simultaneously (imagine a park crowded with people). If this Blackacre refers to coastal waters, aquaculture and capture are representative samples of each allocation.

It is useful, then, to briefly contrast the two models. Borrowing Epstein's argument, I designate the former as a bottom-up regime, and the latter as a top-down one. Consistent with Demsetz's theory, the bottom-up regime avoids the tragedy of the commons because it internalizes potential externalities. But this statement begs the question: if the big birthday cake is cut into so many pieces, will it lead to waste? Heller's anticommons hypothesis says yes, but according to my findings, the answer is no.

As shown by my findings, people are willing to pay for legal rights which guarantee exclusive access, regardless of the relatively high cost. The statistical data further reveal that, when coastal waters are divided, there is a negative correlation between fragmentation and production. In comparison with Heller's assumed result, it implies that the more fragmented the waters, the higher the productivity that will occur. On this basis, I might conclude that, from an empirical standpoint, there is no tragedy of the anticommons in China's coastal waters.

is a lost opportunity in limited time. An assessment of the difference between land and waters exceeds the scope of this article, and must be deferred to a subsequent paper.

VI. APPENDIX

A. The value of per capita GDP in all eleven coastal provinces. The data derive primarily from two sources: (1) China Ocean Yearbook; (2) China Statistical Yearbook.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	<i>GDP</i>										
Shandong	11619	13628	16364	20023	23716	27721	32996	35894	41106	47335	51768
Jiangsu	14356	16708	19944	24214	28272	33331	39053	44253	52840	62290	68347
Fujian	13470	14941	16331	18468	21156	25607	29741	33437	40025	47377	52763
Hebei	9091	10487	12451	14737	16694	19746	23163	24581	28668	33969	36584
Hainan	7441	8273	9767	10804	12343	14477	17087	19254	23831	28898	32377
Shanghai	31575	35395	43994	48435	52782	59055	63980	69164	76074	82560	85373
Liaoning	12528	14258	15822	18974	21574	25648	31197	35149	42355	50760	56649
Guangdon	13273	15202	20705	24327	27705	32178	36082	39436	44736	50807	54095
Zhejiang	16323	19343	23652	26924	31038	36431	41226	43842	51711	59249	63374
Guangxi	5092	5631	7023	8746	10232	12491	14891	16045	20219	25326	27952
Tianjin	20369	24210	30380	35452	40412	45295	54034	62574	72994	85213	93173

B. The picture on the left shows the ichnography of sea areas in Lingshui Harbor, Hainan province. As this ichnography reveals, a Global Positioning System (GPS) can distinguish and locate the sectioned-off sea areas, and the inherent fluidity will not prevent coastal waters from being turned into property. The picture on the right shows aquaculture production in *Wenchang* County, Hainan province.

