KOREA MARITIME INSTITUTE

KMI International Journal of Maritime Affairs and Fisheries

KMI International Journal of Maritime Affairs and Fisheries is a comprehensive journal of ocean policy studies. It offers researchers, analysts and policy makers a unique combination of legal, political, social and economic analyses. The journal covers international, regional and national marine policies; management and regulation of marine activities, including fisheries, ports and logistics; marine affairs, including marine pollution and conservation and use of marine resources. This journal is published in June and December by the Korea Maritime Institute.

December 2010 **Volume** 2 **Issue** 2

Published by
Dr. Hak So Kim
President of Korea Maritime Institute

1652 Sangamdong Mapogu Seoul, 121-270, Korea
Telephone: +82 2 2105 2700 Facsimile: +82 2 2105 2800
Website: www.kmi.re.kr

Printed and bound by Seoul Advertisement

CONTENTS

Community fisheries management What structure and why?

Ragnar Arnason*

Received August 12, 2010; accepted November 29, 2010

ABSTRACT

Theory has shown and experience has verified that individual fishing rights such as territorial user rights (TURFs) and individual transferable quotas (ITQs) can be effective in overcoming the common property problem and generating economic efficiency in fisheries. Unfortunately, these property rights are not applicable to all fisheries. TURFs only work for species that are sufficiently sedentary to remain largely within individual TURFs. ITQs only work if the individual quota constraint can be sufficiently enforced and it turns out that in many fisheries the cost of this is simply prohibitively high. This applies not the least to the numerous artisanal fisheries around the world.

These limitations have drawn attention to the possibility of allocating not individual but collective rights to groups of harvesters. While noting that the type of rights conferred as well as the group receiving them may be quite varied, it is customary to refer to this arrangement as *community fishing rights*. Community fishing rights, of course, do not constitute a fisheries management regime. They merely endow the community with the formal powers and opportunity to implement an effective fisheries management regime. Obviously, there is no guarantee that this opportunity will be used.

This paper is concerned with identifying conditions under which community fishing rights are likely to enhance the economic efficiency of fishing. Such conditions can be seen as design principles that can assist fishing authorities around the world interested in setting up systems of community fishing rights.

Key words: fisheries management, community fishing rights, community fisheries management, fishing rights

* Professor, Department of Economics University of Iceland. E-mail: ragnara@hi.is

1. Introduction

Over the past thirty years or so, fisheries management has made substantial progress. Amongst fisheries management theorists there has now emerged a general agreement about which fisheries management systems work and which do not. More precisely, it has been established that only two classes of fisheries management systems, namely i) *corrective taxes* and ii) *property rights regimes*, are theoretically capable of generating lasting efficiency in fisheries (Arnason, 2007). Fisheries management by restrictions — such as total allowable catch, closed fishing areas and fishing seasons, restrictions on allowable fishing gear, limitations on fishing days, restrictions on the type and quantity of fishing capital etc. — has been found economically ineffective and, taking into account the cost of applying and enforcing these measures, possibly worse than nothing (Arnason, 1994; Arnason, 2007).

These theoretical results have been confirmed by experience. Worldwide it has been found that direct restrictions are both costly to apply and ineffective in improving the profitability of the fisheries (OECD, 1997; Schrank *et al*. 2003). At the same time fisheries management on the basis of property rights — sole ownership, territorial user rights (TURFs), individual quotas (IQs) and individual transferable quotas (ITQs) have been found beneficial (OECD, 1997; Shotton, 2000; Sutinen and Soboil, 2002). I have not been able to find any examples of taxation being employed as a means to manage fisheries.

Sole ownership and TURFs have limited applicability in ocean fisheries; sole ownership for socio-political reasons and TURFs for biological and technological reasons.[1] IQs and ITQs, on the other hand, are widely and increasingly employed. Indeed, by my recent count 22 fishing nations have already adopted ITQs as their primary fisheries management tool and about 25 % of the global ocean fish catch is currently taken under ITQs.[2] Experience with ITQs has generally been favourable. Under ITQs, fishing effort has usually decreased, fish stocks improved or stopped and, most importantly, economic rents have increased (Hatcher *et al*., 2002; Costello *et al*., 2008). Broadly speaking, it appears that ITQ systems, once they have been perfected, are capable of bringing fisheries reasonably close to the optimal point.

Unfortunately, ITQs, just as sole ownership and TURFs, do not seem to be applicable to all fisheries. There are two fundamental reasons for this; i) too high enforcement costs and ii) political opposition.

In some fisheries the cost of enforcing the ITQ constraint is simply too high relative to the benefits. This applies in particular to fisheries characterized by one or more of the

1. Most species of fish are too migratory to stay within a relatively small exclusive area.
2. These nations are New-Zealand, Australia, USA, Canada, Greenland, Iceland, Holland, Norway, Denmark, Sweden, Estonia, Germany, UK, Portugal, Spain, Russia, Morocco, Namibia, South Africa, Chile, Peru, Falkland.

following; i) a high number of small fishing units, ii) numerous low tech landing places, iii) high unit value of the catch (relative to the going wage), iv) readily accessible local consumer markets and v) little secondary processing and transportation of the catch. These factors make observation of harvested quantity difficult and, consequently, render the cost of enforcing individual quota constraints high.[3]

In many communities there is a high degree of antagonism to the marketization and economic rationalization that ITQs entail. The rationality of and reasons for these sentiments are not of concern in this paper. It suffices to note that this antagonism, in addition to making enforcement costlier, often translates into political opposition that makes it impossible to adopt ITQs. Thus, in the fisheries where these sentiments are sufficiently strong, the ITQ system is not a feasible option for fisheries management.

Thus, looking at the world as a whole, there are numerous fisheries in which neither TURFs nor ITQs are feasible. This applies to all kinds of fisheries but is perhaps most obvious in the labour intensive, low income artisanal type of fisheries that are typical in the less industrialized parts of the world including South-East Asia and Africa. These fisheries, although small scale and low tech, are economically important because they often represent subsistence activity, provide much needed high quality protein in low income areas and, taken as a whole, account for a high proportion of the global harvest of fish for human consumption (FAO, 2000; World Bank and FAO, 2008).

This observation has drawn attention to the possibility of allocating not individual but collective rights to groups of harvesters. While noting that the type of rights conferred and the nature of the recipient group may be quite varied, it is convenient to refer to this type of arrangements as *community fishing rights*.

The fundamental economic rationale for allocating collective fishing rights is the belief that the group or community receiving these rights is somehow more able than the central authority to improve the economic efficiency of the fishing activity (Berkes *et al*., 1989; Hanna, 1990; Ostrom, 1990; Ostrom and Gardner, 1993; McKay, 2000 Walker *et al*., 2000). In addition many authors seem to feel that this kind of an arrangement is socially more appropriate (Jentoft, 1985; Ostrom, 1990; McKay and Jentoft, 1998). A possible third reason for the surging interest in community fishing rights is that governments, frustrated by the complicated and seemingly intractable problems of fisheries management, are seeking a face-saving way to move the problem from their desks to someone else's.

This paper is primarily concerned with the first rationale for community fishing rights, namely that this arrangement is conducive for enhancing economic efficiency in the harvesting activity. This outcome, however, is by no means a forgone conclusion. Community fishing rights does not constitute a fisheries management regime. They merely constitute a delegation of the authority to manage the fishery to the community. The

3. Recent studies have shown that the cost of fisheries management often constitutes a very high fraction of the gross revenue of the fishery (Arnason *et al*., 2000; Schrank *et al*., 2003).

members of the community are still faced with the fundamental problem of designing and implementing a good fisheries management regime. The success of that undertaking depends fundamentally on the various parameters of the situation including the quality of the community rights, the number, composition and culture of the community members, the biological and economic situation and various other factors.

Members of a community with collective fishing rights find themselves in a situation where they have to play bargaining games with their fellow members. The games are firstly about what rules to adopt; both fisheries management rules and, more fundamentally, rules for decision making. Secondly the games are about measures to be taken within the existing set of rules. These measures may for instance concern the total allowable catch in the community. It should be intuitively clear that the outcomes of these bargaining games depend in a fundamental way on the group dynamics in the community and the rules under which the game is played.

The aim of this paper is to consider the nature of these bargaining games and to identify conditions under which the community management of fisheries on the basis of community rights is likely to succeed in increasing the economic efficiency of the harvesting activity.

Before proceeding it should be noted that community fisheries management is nothing new. When a group of households find themselves utilizing a limited natural resource, they have a great incentive to develop and enforce common utilization rules. Thus, especially in the absence of a centralized authority, community fisheries management may well emerge spontaneously. Indeed, as it turns out, there are numerous cases of large and small communities managing their fishing activities both in inland water-bodies and the ocean (*e.g.* Ostrom, 1990; Scott, 2008). According to Ostrom (1990), these community management units often appear to have been moderately successful. Unfortunately, in many instances, these community management structures seem to have been largely destroyed by the advent of larger centralized authority and its usurpation of fisheries management power (Ruddle, 1989; Ostrom, 1990; Scott, 2008). From that perspective, the present interest in community fishing rights and fisheries management represents a certain return to a previous arrangement.

The sharing of the right or power to manage fisheries may be seen to span a continuum from the exclusively (100%) the national government to exclusively the community. Anything in between these extremes can be referred to as government/community co-management. Some degree of co-management is, of course, what is most often the case in the real world although one party or the other may have most of the rights. In this paper, community fishing rights will refer to the situation where the community holds certain well-specified fishing rights and can, at least to a great extent, decide how these rights are used.

The paper is organized broadly as follows. The next section reviews the main arguments for the belief that community fishing rights may indeed increase economic efficiency in fishing and the empirical and experimental evidence on the matter. An important conclusion of this section is that the outcome of community fisheries management is quite varied. There are both cases of apparent success and failures. Which applies seems to depend on the particulars of each situation. The following section, section 2, attempts to specify conditions under which community fisheries rights are likely to lead to good fisheries management. As will become apparent, most of these conditions are neither very specific nor powerful in the sense of guaranteeing particular outcomes. Nevertheless, this chapter concludes with a set of recommendations for the set up of community fishing rights and management. The third section of the paper then discusses the possible application of community fisheries management to the fisheries around the world. Finally, the last section summarizes the main results of the paper.

2. What is the attraction of community fisheries management?

The fundamental economic rationale for allocating community fishing rights is that the community is at better improving the efficiency of the fisheries than the government. Increased efficiency may stem from three main sources. First, it is possible that the community will indeed be able to manage the local fishery better than the central authority. Second, it is possible, even likely, that the community may be able to enforce whatever fisheries management system it chooses more effectively and less expensively than the central authority. Third, community management of fisheries represents the devolution of power from the central government to a much smaller community of fishers. Decentralization of this kind makes it possible to reduce the size of government activities and, consequently, rent seeking and taxation. This is usually regarded as contributing to overall economic efficiency (Buchanan and Tullock, 1962). Let us now examine the first two of these rationales a bit more closely.

There are a number of reasons why the community may manage fisheries better than the central government. These reasons have to do with i) information, ii) incentives and iii) responsibility.

Effective fisheries management depends on good information. The crucial information relates to the fish stocks and their biology, the economics of the fishing fleet and market and price information. There can be little doubt that the fishermen are always much better informed about their own profit functions than any centralized authority. The same applies to information about local fishing conditions and stocks. It is also likely, that the fishermen are or can be better informed about price and market conditions than

the central government. Finally, if at all relevant to them, fishermen would probably be better informed about the overall fish stock conditions and their dynamics than the central government.[4] After all, the fishermen's own income and possibly family welfare depends on collecting all relevant information and interpreting it correctly.

Central authority officials first of all have difficulties collecting the necessary information as explained above. Secondly, they have much less incentives than the actual fishermen to effectively process the information the gather and to draw the correct inferences from it. After all, they are not risking their own money by being slow, ineffective or even wrong. On top of this, the centralized authority and its staff often have other agendas than maximizing the value of the fishery, even when that is their ostensible task.

Finally, community fisheries management puts the responsibility for management squarely on the shoulders of the fisheries community itself. If the community fails in this management, it will most likely have to suffer the consequences. Even in western type welfare societies, is unlikely that social safety nets will be as easily forthcoming when fishing communities fail in managing their own fisheries than when the central authority fails in its fisheries management function. Hence, this added responsibility contributes to even greater effort by the community members to conduct their fisheries management effectively.

The cost of enforcing fisheries management rules has turned out to constitute a substantial fraction of the gross value of the fisheries (Arnason *et al*., 2000; Schrank *et al*., 2003). There are reasons to believe that if communities of fishermen conduct the fisheries management these costs can be substantially reduced. Again the main reason for this is belief is information. The predominant part of most enforcement activities is usually the collection of information about the relevant activities.[5] There can be no doubt that fisheries communities, at least if they are not to large, are much better placed to obtain information about the operations of individual fishermen than any centralized authority. In fact, in most fisheries communities I know about, most everything of significance concerning the fishery is common knowledge. It follows that the fisheries communities can economize greatly on the information collection part of enforcement. Fisheries communities are also much better placed to impose the necessary sanctions than the central authority. Unlike the central authority, which has to follow formal rules, the community has all sorts of informal penalties at its disposal. Not the least can it drawn on the very effective powers of social sanctions in various forms.

Thus, it appears that fisheries communities can almost certainly enforce fisheries management rules much more effectively and inexpensively than any central authority.

4. It is important to realize that under the common property arrangement, this kind of biological information is of little relevance to the fishermen.
5. This is often referred to as monitoring and surveillance in the fisheries management literature.

There are further reasons for the attraction of community fisheries management of a more social or socio-political nature. First, awarding fishing rights and the authority to manage fisheries to communities clearly contributes to their greater independence of the communities as well as their ability to control their own destination. Community independence and autonomy, in turn, are frequently mentioned as one of the objectives of social arrangements. Second, fisheries management has proven an intractable and politically unrewarding task for many national governments. Therefore, any politically acceptable method for removing this obligation from the list of government responsibilities is automatically welcomed.

There are many community-based fisheries management systems in the world. Most of them are in fairly small traditional fisheries and the quality of the community rights and the overall set-up usually deviates quite a bit from what would be ideal for economic efficiency. Nevertheless, according to reports mainly in the anthropological and social science literature, many of these systems exhibit a marked ability to avoid the worst excesses associated with the common property arrangement (*e.g.* Ostrom, 1990; Ostrom and Gardner, 1993; McKay, 2000). There is also some experimental evidence (Walker *et al.*, 2000) supporting the hypothesis that community management may indeed, under certain circumstances, lead to a degree of economic efficiency in fisheries.

It is important to realize, however, that the outcomes of community fisheries management, both as reported from the field and in experiments, are quite widely spread. There are relative failures as well as successes. This suggests that it is not the mere existence of a community fisheries management that counts. The actual set-up of the community management and the particulars of each situation seem to be crucial.

3. Making community management work: Design principles

We now turn our attention to conditions that increase the probability that community management will result in an efficient fishery.

Assume the following setting:

- There is group of economic agents. We refer to this group as a community. Although we do not need to be overly concerned about the composition of this community at this stage, we may take it that it consists of both individuals and companies some of which may not necessarily be in the fishing profession. In the real world, the community would for instance often be a fishing village.

- The community collectively receives fishing rights. These community fishing rights may be of various kinds. They may for instance be TURFs, *i.e*. territorial user rights, or they may be harvest quotas, *i.e*. rights to a certain quantity of harvest or a share in the harvest of a species for a period of time. They could even be a combination of the two. In any case, these fishery rights constitute a collective property right.
- The community has the right to manage these rights. This means that it can for instance organize the fishing activity, allocate individual rights to members, set rules for harvesting and enforce these rules. In the interest of simplicity we assume that these community management rights are not constrained.

Now as already pointed out, there is no guarantee that the community will be able to use these collective management powers to manage the fishery well or even better than the government did before. However, there are certain conditions which increase the probability of this happening. Since the government in awarding the fisheries management rights to the community can to a certain extent create these conditions, we refer to them as design principles.

3.1 A high quality community property right

In the economic profession it is commonly argued that the economic efficiency of asset utilization increases with the quality of the property right in the asset (Demsetz, 1967; Arnason, 2000; Scott, 2000; Arnason, 2007b). By the same token, less than perfect property rights lead to less than full efficiency.

According to Scott (1996), the most crucial components of a property rights are:

- Security
- Exclusivity
- Permanence
- Transferability

As discussed in Arnason (2000), it is convenient to measure these properties on a scale from zero to unity, *i.e*. [0,1], with unity indicating the fullest extent of that property. It is not difficult to show that any deviation from the unitary value of these properties will result in loss of economic efficiency (Arnason, 2007). A property right with unitary values for each of its components is referred to as a perfect property right.

It immediately follows that community fisheries management can not be fully

efficient unless the collective property right is perfect.[6] This means that it must be secure, exclusive, permanent and transferable. Full security means that the right cannot be challenged or challenges can be brushed off at zero costs.

Exclusivity means that others cannot infringe on the rights and the rights-holder can utilize the subject of the right in any way he wants. Full exclusivity is generally very hard to ensure in ocean fisheries. Fish are mobile and usually not easily fenced in. Therefore, rights to particular fish are usually meaningless. Poaching is also hard to defend against. Finally, fisheries are often subject to policy interference by various segments of the population. What count here, therefore, are formal exclusive rights and the ability of the community to defend these rights.

Permanence means that the right is formally forever in the same way as any other property right. Permanence does not, of course, imply that the community will hold these rights forever. It merely means that if the rights are to be withdrawn full compensation must be paid. Permanence thus means that the community does not involuntarily have to give these rights. In practice a very long time horizon is sufficient for efficiency.

Transferability merely means that the community can transfer its rights to someone else if it wants to. If transferability is restricted, efficiency may suffer in the sense that someone else, perhaps another community, may be able to achieve higher efficiency in harvesting than the community in which the fishing right resides. Note, however, that while security, exclusivity and a certain degree of permanence are essential for the community fishing right to generate economic efficiency, transferability is not to the same extent essential. Thus, in many cases, restrictions on transferability of the fishing right to other communities could be imposed without seriously reducing the efficiency of fishing.

These considerations have clear implications for setting up community fishing rights. If efficiency is desired, these fishing rights should be as secure, exclusive, permanent and transferable as possible.

3.2 Decision making processes

The community will not be able to conduct fisheries management unless it can make decisions that are binding for community members. A necessary condition for that is that there is a decision making process in the community that enjoys sufficient support or at least acceptance by community members. This process consists of a decision making body (or bodies) and procedures.

In principle this decision making process can be anything. Generally, however, to enjoy the necessary support, it has to have sufficient basis in the culture and traditions

6. This, however, is not sufficient for efficiency because the community consists of members with nonexclusive rights.

of the community. Thus, in some cultures this decision making process has to be sufficiently democratic, possibly with a formal association, annual meetings where key decisions are made and an executive board. In other cultures, the decision making process could be in the hands of the elders of the community or even the traditional chief.

Irrespective of the set up of the decision making process, it is crucial that it is structured in a way that makes it capable of making decisions sufficiently expediently and is responsive to the economic wants of the community. At the same time, the transaction or bargaining costs of the decision making process should, to the extent possible, be minimized. Clearly certain decision making structures are more capable of attaining this than others. Presumably the government awarding the community rights can require the adoption of certain decision making processes or at least influence what decision making processes are set up

Note that a formal decision making process does not eliminate the need for bargaining. It merely defines when, where and in which way bargaining may take place. It should be intuitively clear, however, that if this is done in the appropriate way, the bargaining may be greatly facilitated.

3.3 Inclusive membership

It is certainly conceivable to set up a community with collective fishing rights with voluntary participation. This means that individual fishermen can stay out of, or even opt out of the community at a later stage, and still retain fishing rights. In fact, this arrangement would be in accordance with our usual idea of freedom of association in human societies. However, in the case of fisheries this would be ill-advised.

First, and most fundamentally, this possibility goes right against the exclusivity of the community rights. If outsiders can fish from the same stocks or harvest quotas as the community, then clearly community exclusivity is reduced. As a result, the arrangement can never be fully efficient.

Second, and perhaps more damagingly, this arrangement reintroduces the familiar common property problem. Thus, unless outsiders are subject to firm binding restrictions on expansion, they will expand until their private marginal benefits of expansion are zero. This will happen in particular, if the fisheries community undertakes fisheries management that enhances the fish stocks. Thus, in this case, all such efforts by the fisheries community will be fruitless. In this way, the outsiders will undermine and ultimately nullify all attempts by fisheries community to increase the efficiency in their fishery. As a result there will be no long term improvements in overall fisheries management.

This prognosis is further exacerbated by the fact that members of the fisheries community will have an incentive to leave the community. If the community fisheries management is to be at all successful, it must constrain the fishing effort of its members.

Thus, as is formally shown in the Appendix (Proposition 1), each of these members could do better outside the community, where he is unconstrained, than within. Thus, the community is continuously subject to fundamental fission forces of this kind. It follows that if it is possible to opt out of the community, this is very likely to happen, especially if this can occur with impunity and there are already outsiders operating.

The practical implications are clear. For a fisheries community to be able to increase efficiency it must be inclusive in the sense that it includes all fisheries operators. It must form a closed shop, so to speak. Alternatively, any outsiders must be subject to restrictions that are at least as binding as those faced by members of the community (Proposition 1 of the Appendix).

3.4 Homogeneity of members

Bargaining within a fisheries community about what fisheries policy to adopt is unlikely to lead to an economics efficient outcome unless the members of the community have identical profit functions or some further restrictions on the bargaining scope are introduced. This is formally shown in the Proposition 2 in the appendix, but it is not difficult to provide an intuitive explanation.

Consider for instance a fisheries community composed of fishermen and fishworkers. For simplicity let us assume that each group consists of identical individuals with identical technology. The fishworkers get their benefits from remuneration for processing the fish. Let's assume that their benefits increase with the volume of fish processed. The fishermen, on the other hand, get their benefits as profits from the fishing operation. Under these circumstances, the fishermen would like to see a fisheries policy that maximizes the present value of profits in the fishery. In biomass equilibrium, this corresponds to the optimal economic yield (OEY). Assuming a reasonably well functioning market system,[7] this, incidentally, is also the socially optimal policy. The fishworkers, on the other hand, would normally like to see a fisheries policy that maximizes the harvest volume over time. In biomass equilibrium this would correspond to the maximum sustainable yield (MSY). These policies do not in general coincide. Thus, there are conflicting interests and these two groups find themselves in a game-theoretic situation. Since both groups belong to the same fisheries community, the game is probably a bargaining or co-operative game. The evolution of this game and its equilibrium (if it exists) depends on many factors, including the respective threat points of both groups and procedures for decision making. Most likely the equilibrium outcome will be a convex combination of the two policies.[8]

7. *I.e.* that prices are true.
8. This would follow from all conventional bargaining game solutions including the Nash bargaining and the Shapley value solution (Friedman, 1987).

That is to say, the bargaining equilibrium harvest will lie in the interval between the optimal sustainable yield (OSY) and the maximum sustainable yield (MSY). However, it is only the former that is socially optimal.

If the composition of the fisheries community is more heterogeneous, including for instance local suppliers to the fishing activity such as boat makers, and fishing gear makers, the range of desired fisheries policies will, obviously, expand further. As a result, the equilibrium outcome of the bargaining game may diverge even further from the social optimum.

The practical implication of all this is that, in the interest of economically efficient fisheries policy, fisheries communities should, to the extent possible, be composed of fishermen only. Other members of the fishing community should not be included. If they are, that is liable to reduce the efficiency of the fisheries operation.

Note, that by fishermen in this context, we are referring to fishing firms or vessel owners, not the hired labour working in the harvesting sector. Hired fishing labour is typically paid a share of the value of the catch. Therefore, it is interested not so much in the profitability of the fishing operations[9] as it is in the volume and value of the harvest. Thus, hired fishing labour, much like the processing sector, prefers a fisheries policy that is closer to the maximizing the present value of harvest volumes than would be socially most appropriate.

Note, moreover, that even if the fishing community consists of fishermen or fishing firms only, the problem of conflicting objectives is not eliminated. If the fishermen are not homogeneous in the sense of having identical profit functions they will still pursue different fisheries policies. As formally shown in propositions 2 and 3 in the appendix, unless individual pay-offs are monotonically increasing functions of aggregate profits, the outcome of the bargaining game will normally not maximize the aggregate profits. In other words, it will normally not be efficient.

3.5 Pay-offs as shares in aggregate benefits

There is a set-up, *i.e.* limitation on the scope for bargaining, which that virtually guarantees that the fisheries community will converge to the most efficient fisheries policy. This is the case where each member's pay-off depends positively on (is a montonically increasing function of) the aggregate profits from the fishery. In this case, moreover, the composition of the members of the fisheries community is of no consequence, except perhaps along the dynamic path toward bargaining equilibrium.

9. At least not fully, although the interest they have in profitability depends on the extent to which their remuneration depends on net profits.

A proposition to this effect is formally proved in the appendix (Proposition 3). However, the basic intuition is fairly easy to grasp. If each member's pay-off increases with the aggregate pay-off, his optimal strategy is clearly to work toward the maximization of aggregate benefits. Thus, in the bargaining game, each member's ideal policy is the one that maximizes aggregate profits. As a result, the equilibrium solution to the bargaining game will be the most efficient fisheries policy. Note that this applies to all possible dimensions of the fisheries policy including the management regime itself as well as the management measures. Moreover, since views regarding the maximization of aggregate benefits will differ only in so far as information sets and, perhaps, risk attitudes differ, the bargaining process will become unusually easy and the speed by which the equilibrium solution is reached is increased.

Interestingly, as is also proven in Proposition 3 in the appendix, if pay-offs are shares in aggregate profits, the same result applies even when the members of the fisheries community do not bargain but act in isolation as in competitive games.[10] The fundamental reason is the same. If each member's pay-off is increasing in the aggregate pay-off, his interest lies in employing his controls to maximize the aggregate pay-off independently of what the other players do. Thus, on the basis of his expectations as to what the other players will do, each agent will pick the policy that maximizes aggregate pay-offs. The only equilibrium to this game is the overall profit maximizing fisheries policy.

It is interesting to note that this is exactly the game situation the shareholders (owners) in limited (or incorporated) companies find themselves in. Their pay-offs depend entirely on the profitability of the company. Hence, it is in their common interest to try to maximize these profits and hence the market value of the company.

This suggests that one way to facilitate this process, is to organize the fisheries community as limited company with the members of the community as share-holders. Such a company would run the fishery as a business, setting its own TAC and either operating its own fishing fleets or contracting the harvesting operations out. In principle this should work. It should be noted, however, that compared to the conventional fishery, this company would be subject to the familiar management problems of creating the appropriate incentives for its employees or contractors and enforcing the necessary fisheries management rules.

It should also be noted that the a system of individual transferable quota shares, *i.e.* the ITQ system, has the property of making each member's pay-off an increasing function of aggregate profits. This is because, as long as the market for quotas is reasonably efficient, the value of each member's quotas will depend on the average profitability of each unit of quota share (Arnason, 1990). Therefore, each member's optimal strategy is to try to advocate fisheries policies that maximize the aggregate profits in the fishery. Notice, that the ITQ system, being decentralized, has certain management advantages over the

10. Perhaps voting may be regarded as a competitive game.

fisheries corporation.[11]

These results are clearly of great importance. They give what approximates sufficient conditions for fisheries communities to be economically efficient. The catch, however is that to achieve this particular set-up is itself a game. The fundamental pay-off in this game is the allocation of shares to individual players. While the actual allocation is no consequence for economic efficiency, it is of great consequence for individual players. Hence, it seems likely that this game will be played with great intensity and it may take a long time to reach an agreement. Indeed, referring to our earlier results, especially Proposition 2, there is no guarantee that this game will lead to a resolution.

In view of this, it seems advisable that the fisheries authority granting rights to the community attempt to impose a priori rules that either stipulate i) sharing of aggregate benefits and the individual shares or ii) procedures to determine the shares within a reasonable timeframe.

3.6 Practical guidance: Summary

The foregoing discussion has generated certain design principles for setting up fisheries communities for the purpose of fisheries management:

3.6.1 High quality rights

The fisheries rights awarded to the community should be as high quality property rights as possible. This means that they should be i) as secure, ii) as long term, iii) as exclusive and iv) as transferable between communities as possible.[12]

3.6.2 Decision making processes

Effective decision making processes are essential for the community fisheries management to work. Therefore, the government or any other body awarding the community rights should make it a precondition that appropriate decision making processes be in place in the community.

3.6.3 Inclusive membership

It should neither be possible to stay out of or opt out of the fisheries community. This means that in order to retain fishing rights, fishermen must be included in a fisheries community. If this is not possible, it is imperative that the activities of outside fishermen be constrained by other means.

---

11. The fisheries corporation could, of course, actually adopt the ITQ system for its internal operations.
12. Regarding the proper interpretation of these attributes of property rights see section 2.1 and Arnason (2000, 2007).

3.6.3 Homogeneity

The membership of the communities should be as homogeneous as possible. This implies that the communities should, to the extent possible, only include fishermen or, preferably, vessel owners. Also, this means that the communities should not be to large, neither geographically nor socially (*i.e.* encompassing different social groups)

3.6.4 Individual benefits as a function-of aggregate benefits

To the extent possible, the fisheries communities should adopt rules that make individual benefits (pay-offs) depend positively on collective benefits. As discussed in section 2.5 this could be accomplished by organizing the community as a limited company with the members as share holders or the adoption of ITQs within the community. No doubt, other arrangements having similar effects could be thought of.

Notwithstanding these design principles, it is, of course, imperative to regard each case as unique and allow for its special features in the design of the community rights to be conferred.

Thus, in addition to the above design principles, the government or a more immediate authority dealing with the fishery and conferring the communal fishing rights should follow certain procedures. This involves:

- Laying down basic rules for the structure and decision making within the communities
- Signing a contract of rights and obligations with each community
- Providing expert (biological, economic and managerial) advice on running the communities and the fisheries
- Include the communities in centralized fisheries management decisions including the setting of overall TACs of stocks exploited by more than one community etc.

4. Practical application: Some thoughts

Although, apparently attractive there are certain problems with communal fishing rights in the many artisanal fisheries situations around the world. These problems have primarily to do with the exclusivity of the community fishing rights and the enforcement of these rights.

4.1 The problem of exclusivity

As already mentioned, most commercial fish stocks are quite migratory relative to the range of reasonably sized fishing communities. As a result, communities can hardly be given exclusive rights to fish stocks. In many places of the world, moreover, the geographical distance between coastal communities is often quite small. This means that the different local communities tend to harvest from the same stocks, even when stock migrations are minimal. This means that as far as stock exclusivity is concerned, it is normally not possible to define communal TURFs, at least not effectively. Communal TURFs, however, can work well to reduce gear conflict and crowding.[13]

For these reasons, it seems that many community fishing rights have to be, at least partly, defined in terms of community fishing quotas. Note that this does not exclude the possibility of the community having an exclusive TURF as well. It only means that as far as extraction rights are concerned, these would have to be based on communal quotas for all but the most sedentary species.

4.2 Enforcement of the quota constraint

Community fishing quotas must be enforced. If they are not, the situation quickly degenerates into the common property problem with the communities competing for shares in declining catches from dwindling fish stocks.

At first glance, it may appear that the need to enforce community fishing quotas reintroduces the need to monitor landings which was one of the reasons ITQs may not be feasible to begin with. In the case of community quotas, however, the enforcement problem is much simplified. Most importantly, with community quotas, it is possible to hold the community responsible for violations instead of its individual members. As a result, at least if the communal penalty is high enough, the community will force its members to adhere to its quota constraint. This has great advantages both in terms of the cost of monitoring — community members know each others catch rates, and individual penalties — the community can impose social penalties that are substantially more painful for the violator than a centralized fisheries authority can.

Let us, for the sake of argument assume that dockside monitoring is too expensive or infeasible for other reasons to be conducted. Then the following procedure for enforcing the quota constraint appears feasible.

13. In fact, I would be surprised if it was found that the current fishing communities have not imposed informal rules to reduce the problem of crowding and gear conflict between different communities of fishermen as well as within each community.

i) To obtain fishing rights the fishing community must sign a contract with the fisheries authority. This should have the status of a normal business contract, stipulating the rights and obligations of the parties. In the case of a quota right, the contract should stipulate procedures (such as reporting, verifying and possibly tagging landings) and penalties for violations.
ii) The community should be report landings daily by boat and buyer.
iii) The fisheries authority would do (inexpensive) spot checks.
iv) If a volume of catch that has not been reported is identified, the community as a whole would be subject to a penalty.
v) This penalty would be either financial or in terms of a quota reduction.
vi) The penalty should be high enough to make the expected value of individual violations highly negative to the community as a whole. Note that since the penalty is based on a business contract and it is the community, not individual fishermen, that is penalized it is much easier to make the penalty high enough.

Under these conditions, the community would be induced to enforce the quota constraint on its individual members. Hence all the advantages of decentralized control (virtually self-control) would be achieved.

4.3 Likely outcomes

A priori, it is of course very difficult to predict the outcome of this kind of an arrangement. Much depends on the execution of this system by the fisheries authority, the set-up of the fisheries communities and how their members would react to this new opportunity set. Assuming reasonably good execution and community set-up, a gradual movement toward economic efficiency within the communities seems the most likely outcome. Economic efficiency probably requires a radical restructuring of the fishery. The important point, however, is that this would occur over a period of time and, more importantly, at the pace chosen by the fisheries communities themselves.

5. Conclusions

Economic efficiency in fishing can only be achieved by appropriate fisheries management regime. Property rights-based regimes such as sole ownership, TURFs and ITQs have been found to lead to substantial improvement in the economic efficiency of fisheries. However, when these arrangements are not technically or socially feasible — and there are many examples of that — community fisheries management on the basis of

community fishing rights constitutes a promising alternative.

Community fisheries management exhibits several attractive properties. First, and most importantly, it may lead to lead to economically efficient fisheries within the confines of the community. In fact, given that the community set-up is in accordance with principles identified in this paper, this outcome is quite likely. Second, community management is highly likely to greatly reduce the costs of fisheries enforcement. Third, community fishing rights represents a decentralization that allows smaller government. Fourth, community fishing rights provides fisheries communities with a greater control of their own future.

However, the efficiency of community management of fisheries depends very much on the overall set up of the communities. First, and most importantly, the community rights must be high quality ones. Secondly, the community must be inclusive. Outsiders, unbound by community rules, can easily thwart community efforts to increase fisheries efficiency by expanding their operations. Thirdly, the fisheries community should be as homogeneous as possible. Preferably it should consist exclusively of vessel owners or individual fishing rights holders. Fourthly, it would be extremely helpful if it could be arranged that the benefits to individual members of the fisheries community be increasing functions of the aggregate benefits to the community as a whole. If this is the case, it is almost certain that the fishery will be as efficient as the quality of the communal property right allows.

The large and economically important artisanal fishing sector of the world, is often not very amenable to management on the basis of ITQs. It appears, on the other hand, to be well suited to community management on the basis of community fishing rights. However, for maximum benefits, the set-up for a community rights-based system must be carefully designed and the application tailored to each particular situation.

References

Arnason, R. (1990) Minimum Information Management in Fisheries, Fisheries. *Canadian Journal of Economics* 23, pp.630-653.

Arnason, R. (1994) Theoretical and Practical Fisheries Management. *Managing Fishery Resources*, E. Loayza (ed). *World Bank Discussion Papers* 217, pp.3-10.

Arnason, R. (2000) Property Rights as a Means of Economic Organization. In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper* 401(1). Food and Agriculture Organization of the United Nations, Rome.

Arnason, R., R. Hannesson and W.E. Schrank (2000) Costs of fisheries management: The Cases of Iceland, Norway and Newfoundland. *Marine Policy* 24, pp.233-43.

Arnason, R. (2007) Fisheries Management: Basic Principles. In *Fisheries and Aquaculture*, [Ed. Patrick Safran], in *Encyclopedia of Life Support Systems (EOLSS)*, Developed under the auspices of the UNESCO, Eolss Publishers, Oxford, UK. (http://www.eolss.net)

Arnason, R. (2007b) Property Rights Quality and Economic efficiency of Fisheries Management Regimes: Some Basic Results. In T. Bjorndal, D. Gordon, R. Arnason and R. Sumaila (eds.) *Advances in Fisheries Economics*. Blackwell Publishing, Oxford.

Berkes, F., D. Feeny, B. J. McCay and J.M. Acheson (1989) The benefits of the commons. *Nature* 340, pp.91-93.

Buchanan, J. M. and G. Tullock (1962) The *Calculus of Consent: Logical foundations for constitutional democracy*.

Christy, F. T. (2000) Common Property Rights: An Alternative to ITQs. In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper* 401(1). Food and Agriculture Organization of the United Nations, Rome.

Costello, C., S. D. Gaines and J. Lynham (2008) Can Catch Shares Prevent Fisheries Collapse. *Science* 321, pp.1678-1681.

Demsetz, H. (1967) Toward a Theory of Property Rights. American Economic Review 57, pp.347-59.

FAO (2000) *The State of World Fisheries and Aquaculture*. Food and Agriculture Organization of the United Nations. Rome.

Friedman, J. W. (1986) *Game Theory with Applications to Economics*. Oxford University Press, Oxford

Hanna, S. S. (1990) The Eighteenth Century English Commons: A Model for Ocean Management. *Ocean & Shoreline Management* 14, pp.58-163.

Hatcher, A., S. Pascoe, R. Banks and R. Arnason (2002) *Economic Evaluation of Fish Quota Management and Appraisal of ITQ Systems*. Cemare, Portsmouth.

Jentoft, S. (1985) Models of fishery management: The cooperative approach. *Marine Policy* 9, pp.322-331.

McCay, B. J. (2000) Community Based Approaches to the "Fisherman's Problem". In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries*

Technical Paper 401(1). Food and Agriculture Organization of the United Nations, Rome.

McCay, B. J. and S. Jentoft (1998) Market or Community Failure? Critical Perspectives on Common Property Research. *Human Organization* 57, pp.21-29.

Nash, J. F. (1953) Two-person Cooperative Games. *Econometrica* 21, pp.128-40.

OECD (1997) *Towards Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources*. Organization of Economic Cooperation and Development, Paris.

Ostrom, E. (1990) *Governing the Commons: The Evolution of Institutions for Collective Actions*. Cambridge University Press, New York.

Ostrom, E. and R. Gardner (1993) Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work. *Journal of Economic Perspectives* 7, pp.93-112.

Pontryagin, L. S, V. S. Boltyanski, R. V. Gramkeldize and E. F. Mishchenko (1962) The Mathematical Theory of Optimal Processes. Wiley, New York.

Ruddle, K. (1989) The Organization of Traditional Inshore Fishery Management. In P.A. Neher, R. Arnason and N. Mollet (eds.) *Rights Based Fishing*. Kluwer, Dordrect.

Schrank W., R. Arnason and R. Hannesson (eds.) (2003) *The Cost of Fisheries Management*. Ashgate, Aldershot.

Scott, A. D. (1996) The ITQ as a Property Right: Where it came from. How it Works and Where it is Going. In B.L. Crowley (ed.) *Taking Ownership: Property Rights and Fisheries Management on the Atlantic Coast*. Atlantic Institute for Market Studies, Halifax.

Scott, A. D. (2000) Introducing Property in Fisheries Management. In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper* 401(1). Food and Agriculture Organization of the United Nations, Rome.

Scott, A. D. (2008) The Evolution of Resource Property Rights. Oxford University Press, New York.

Shotton, R. (2000) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper* 401(1). Food and Agriculture Organization of the United Nations, Rome.

Sutinen, J. G. and M. Soboil (2003) 'The Performance of Fisheries Management Systems and theEcosystem Challenge. In M. Sinclair and G. Valdimarsson (ed.), *Responsible Fisheries in the Marine Ecosystem.* The Food and Agriculture Organization of the United Nations, Rome.

Walker, J. M., R. Gardner, A. Herr and E. Ostrom (2000) Collective Choice in the Commons: Experimental Results on Proposed Allocations Rules and Votes. *The Economic Journal* 110, pp.212-34.

World Bank and FAO (2008) The Sunken Billions: The Economic Justification for Fisheries Reform. The World Bank, Washington DC.

Appendix

Basic Propositions

The decisions taken by the fisheries community may be regarded as the outcome of games that occur within the community. To make progress in analysing these games we need to specify the conditions. To focus on the essentials, we'll adopt a very simple framework.

A1. Each agent seeks to maximize his profits

A2. Each agent's profits are given by the concave function: $\Pi(q(i), x; i)$,

where the index i refers to the agent, $q(i)$ represents his harvest and x the biomass level.

A3. Biomass evolves according to equation $\dot{x} = G(x) - q$,

where $G(x)$ is the natural growth function of the biomass having the usual properties[14] and q denotes the aggregate harvest.

Lemma 1

All management that constrains individual harvest may be represented as a charge on harvest. Moreover, this charge is increasing in the marginal profits of harvest.

Proof:

When harvest is indirectly constrained by tax on harvest the result follows immediately from the expression:

$$\Pi(q(i), x; i) - \tau \cdot q(i)$$

where τ is the tax rate. Differentiating this expression w.r.t.. harvest establishes the second part of the lemma.

14. *I.e.* concave and dome-shaped.

When harvest is directly constrained, each company attempts to solve the problem:

$$\max_{q(i)} \int_0^{\infty} \Pi(q(i), x; i) \cdot e^{-rt} dt$$

where τ represents the constraint.

The necessary conditions for solving this problem (Pontryagin *et al*. 1962) include:

i) $\Pi_{q(i)} = \lambda(i) + \mu(i)$,

ii) $\bar{q}(i) = q(i) \Rightarrow \mu(i) > 0$[15] .

where $\lambda(i)$ represents the firm's evaluation of the shadow value of biomass and $\mu(i)$ the marginal cost of its harvest constraint.

Now, if the constraint on harvest is binding, ii) shows that $\mu(i)$ is positive. Therefore, by i), $\mu(i)$ can be regarded as the unit charge on harvesting, and an equivalent solution could be derived by writing the profit function without a constraint as:

$$\Pi(q(i), x, i) - \mu(i) \cdot q(i).$$

This establishes the first part of the lemma. Differentiating the above expression w.r.t. $q(i)$ establishes the second part.

Note: If the firm is operating at the maximum of it's average profit function (which would be the case for the marginal (least profitable) firm in the industry or all firms if they are equally efficient), average and marginal profits would be equal and $\mu(i)$ would be exactly the average profits of the firm.

Proposition 1

Let a fishery be managed by a fisheries community. Then, if the community is successful in managing the fishery, it benefits individual companies to leave the community provided only that i) the community does not collapse and ii) leaving does not incur any penalties.

Proof:

According to Lemma 1, if the management is successful, the harvesting constraint is equivalent to a positive charge on the harvest. Thus, if the two conditions of the proposition, *i.e*. conditions i) and ii) hold, profits can be increased by leaving the community. QED.

15. Provided of course, that the constraint is actually binding, *i.e*. $\Pi_{q(i)}(q_{\max}) - \lambda(i) > 0$

Proposition 2

If firms are not identical and benefits are not transferable between players, the Nash equilibrium bargaining solution will generally not lead to the most efficient fishery.

Proof:

We will prove this proposition in a simplified framework to two players and equilibrium biomass. Eextending the proof to N players and an evolving biomass is straight-forward but much messier.

Assume, without loss of generality, that the equilibrium biomass level has been agreed upon. This implies that the two players' equilibrium value functions (discounted future profits in equilibrium) depend on the allocated catch levels only. Write these two value functions respectively as $\Pi(q(1),\bar{x};1)$ and $\Pi(q-q(1),\bar{x};2)$, where, it will be recalled, q is the aggregate catch satisfying the condition = 0.

Now, the harvest allocation, *i.e.* level of $q(1)$, that maximizes aggregate profits is

$$\Pi_{q(1)}(1)-\Pi_{q(2)}(2)=0,$$

where $\Pi_{q(1)}(1)\equiv\partial\Pi(q(1),\bar{x};1)/\partial q(1)$ and $\Pi_{q(2)}(2)\equiv\partial\Pi(q(1),\bar{x};2)/\partial q(1)$.

However, there is no reason to expect that bargaining will ever reach this point. One easy way to see this is to note that aggregate profit maximization may easily entail that one of the firms has no harvest. Obviously, without transferable benefits, however, this can never constitute a bargaining solution.

To make the argument a bit more formal, us look at the Nash bargaining solution to this game. For convenience assume that each firm's threat point is to opt out, *i.e.* to harvest nothing. Then, according to the Nash bargaining solution (Nash 1953, Friedman 1986), the equilibrium solution to this game is defined by

$$\max_{q(1),q(2)}\ \Pi(q(1),\bar{x};1)\cdot\ \Pi(q(2),\bar{x};1)$$

Subject to the condition $q(2)=q-q(1)$.

This obviously implies

$$\Pi_{q(1)}(1)-(\Pi(1)/\Pi(2))\cdot\ \Pi_{q(2)}(2)=0.$$

So, comparing this to the aggregate profit maximization shows that at least Nash bargaining will not lead to an efficient solution unless $\Pi(2)=\Pi(1)$, *i.e.* the firms have identical profits at the bargaining solution. This happens, if the firms are identical but is virtually inconceivable otherwise.

Proposition 3

If all members of a fisheries community receive pay-offs that are monotonically increasing in the aggregate pay-off, then the Nash bargaining solution is economically efficient. Moreover, the Nash competitive solution and the Nash bargaining solutions are identical

Proof:

We will prove this proposition in a simplified framework similar to the one used in Proposition 2. Assume two players only. Assume also, without loss of generality that the equilibrium biomass level has been agreed upon. Write the corresponding two value functions respectively as $\Pi(q(1),\bar{x};1)$ and $\Pi(q-q(1),\bar{x};2)$, where q is the aggregate catch satisfying the condition that $G(x)-q=0$.

Given these specifications, aggregate profits are:

$$\Pi(q(1))=\Pi(q(1),\bar{x};1)+\Pi(q-q(1),\bar{x};2).$$

Obviously, maximization of aggregate profits implies

$$\Pi q(1)=0.$$

Now let the two allocation or sharing functions be $\psi(\Pi(q(1));1)$ and $\psi(\Pi(q(1));2)$ where both functions are monotonically increasing in the aggregate profits.

Under the circumstances defined, the Nash bargaining solution is defined by:

$$\max_{q(1)} \psi(\Pi(q(1));1)\cdot\ \psi(\Pi(q(1));2)$$

Solving this problem requires

$$[\psi_{\Pi}(\Pi(q(1));1)+\psi_{\Pi}(\Pi(q(1));2)]\cdot\ \Pi_{q(1)}=0$$

Since, both allocation functions are monotonically increasing, this obviously implies

$$\Pi_{q(1)}=0.$$

which, of course, is the condition for maximizing aggregate profits.

To prove the second part of the theorem note that the optimal strategy of each (or all players) is always to maximize aggregate profits. More formally, for (an arbitrary) fishing firm 1, the maximization problem is:

$$\max_{q(1)} \psi(\Pi(q(1));1)$$

But, since $\psi(\Pi(q(1));1)$ is monotonic, this implies the condition $\Pi_{q(1)} = 0$. QED

Note 1: The importance of the second part of the proposition is that if pay-offs are monotonically increasing in the aggregate pay-off bargaining is not even necessary. Competitive game-playing will lead to the jointly optimal bargaining outcome.

Note 2: The game-situation of shareholders in a limited company is very similar to the premises of Proposition 3.

Note 3: The game situation of holders of tradable share rights in a fishery such as ITQs, is very much along the lines of Proposition 3. However, a system of non-tradable shares, *i.e.* an IQ system, does not exhibit this property.

International maritime delimitation process

Jianjun Gao*

Received July 19, 2010; accepted November 29, 2010

ABSTRACT

International maritime delimitation is a process consists of several stages. Recently, international tribunals tend to follow a uniform process for delimitation, that is, first drawing an equidistance line, then considering whether there are factors calling for the adjustment or shifting of that line. However, the ultimate goal of maritime delimitation is to achieve an equitable solution, which is the requirement of the governing rule and is of higher rank than the application of equidistance. Where equidistance can not contribute to effecting an equal division of the area of overlapping entitlements, which would happen in some continental shelf delimitation, it is not appropriate to start the delimitation by a provisional equidistance line. The role of the relevant circumstances in delimitation has shifted from indicating the delimitation method to verifying that the result of the application of the provisional equidistance line, is not, in light of the particular circumstances of the case, perceived as inequitable, and, if necessary, to modifying the provisional line.

Key words: maritime delimitation, equidistance, relevant circumstances, disproportionality test

* Professor, Department of International Law, China University of Political Science and Law. Address: No. 25, Xitucheng Road, Haidian District, Beijing, 100088, China. E-mail: gaojianjun@yahoo.com.

1. Introduction

According to the United Nations Convention on the Law of the Sea (LOS Convention),[1] the delimitation of the continental shelf/exclusive economic zone (EEZ) between states with opposite or adjacent coasts "shall be effected by agreement on the basis of international law [⋯], in order to achieve an equitable solution".[2] On the other hand, the rule of customary law in this regard, which "has been developed since 1958 in case-law and State practice",[3] is based upon equitable principles and relevant circumstances,[4] and thus called "equitable principles/relevant circumstances rule".[5]

The International Court of Justice (ICJ) has repeated that maritime "[d]elimitation is a process".[6] The recent decisions in this regard indicate that the international tribunals tend to pay much more attention to the process of delimitation than before. Particularly, in its latest decision on maritime delimitation dispute, the *Black Sea* case (Romania v. Ukraine),[7] the ICJ expounded the process of delimitation in the name of "delimitation methodology", and declared that "When called upon to delimit the continental shelf or exclusive economic zones, or to draw a single delimitation line, the Court proceeds in *defined stages*"[8] (emphasis added). From the perspective of the development of international rules on maritime delimitation, it is certainly important to examine the delimitation stages that the ICJ indicated in this case. Meanwhile, it is equally important to reveal how the delimitation process has evolved within the jurisprudence of the international tribunals, as well as the reasons hidden behind this evolution. These are the purposes of this paper. Indeed, the international tribunals have applied three different kinds of process in the maritime delimitation until now. The first three parts of the paper are devoted to the three processes that have been followed by the international tribunals in consequence, while the fourth part will focus on the reasons behind the evolution, and suggest what delimitation process should be followed in the future.

---

1. Opened for signature on 10 Dec. 1982 and entered into force on 16 Nov. 1994. http://www.UN.org/ depts/los.
2. LOS Convention, arts. 74(1) and 83(1)
3. Case concerning Maritime Delimitation and Territorial Questions between Qatar and Bahrain (Qatar v. Bahrain), *ICJ Reports* 2001, p.40 [Qatar v. Bahrain], para.231.
4. See Maritime Delimitation in the Area between Greenland and Jan Mayen (Den. v. Nor.), *ICJ Reports* 1993, p.38 [Jan Mayen], para.56.
5. Qatar v. Bahrain, para.231.
6. North Sea Continental Shelf (FRG/Den.; FRG/Neth.). *ICJ Reports* 1969, p.3 [North Sea Continental Shelf], para.18. See also *ibid*., para.20; Continental Shelf (Tunisia/Libya), *ICJ Reports* 1982, p.18 [Tunisia/Libya], paras.44&106; Delimitation in the Gulf of Maine (Canada/U.S.), ICJ Reports 1984, p.246 [Gulf of Maine], paras.115&215; Continental Shelf (Libya/Malta), *ICJ Reports* 1985, p.13 [Libya/Malta], para.65.
7. Maritime Delimitation in the Black Sea (Romania v. Ukraine), Judgment of 3 Feb. 2009, *ICJ Reports* 2009, p.61 [Black Sea].
8. Black Sea, para.115.

2. "Relevant circumstances → delimitation method (delimitation line) → proportionality test or other considerations"

In order to delimit an equitable boundary, a court has to resort to a method or combination of methods. Before the 1985 *Libya/Malta* case, the ICJ had always emphasized that "each specific case is, in the final analysis, different from all the others, that it is monotypic and that, more often than not, the most appropriate criteria, and the method or combination of methods most likely to yield a result consonant with what the law indicates, can only be determined *in relation to each particular case and its specific characteristics*"[9] (emphasis added). It followed that in international law there would be no single method of delimitation that may be applied to all or most delimitations. In order to find out a method which can result in an equitable solution in a given delimitation case, one should have regard for "its peculiar circumstances",[10] because "the appropriateness of the equidistance method or any other method for the purpose of effecting an equitable delimitation is a function or reflection of the geographical and other relevant circumstances of each particular case. The choice of the method or methods of delimitation in any given case [···] has therefore to be determined in the light of those circumstances."[11] Thus, examination of the relevant circumstances of a particular case is bound to be the first stage in such maritime delimitation process as dominated by the "monotypic" doctrine, with the view to determine the appropriate method of delimitation. The second stage is to draw a delimitation line by the use of the method determined in the first stage. Finally, proportionality test and/or other circumstances may be resorted to, in order to make sure that the delimitation line as constructed is equitable. In short, this kind of delimitation process can be summarized as follows: "relevant circumstances → delimitation method (delimitation line) → proportionality test or other considerations".

Before the 1993 *Jan Mayen* case, the ICJ followed this three-stage process in maritime delimitation by large. Thus, in the 1982 *Tunisia/Libya* case, after examining the relevant circumstances which characterize the delimitation in the case, the ICJ decided that it should divide the delimitation area into two sectors and apply a specific method of delimitation in each sector to achieve an overall equitable solution. In the sector closer to the coast of the parties, influenced by the conducts of the parties in respect of their petroleum concessions, the ICJ selected a straight line that run at a bearing of approximately 26 degrees east of north; while in the second sector, the delimitation line was to run parallel to a

9. Gulf of Maine, para.81.
10. Tunisia/Libya, para.132.
11. Case concerning the Delimitation of the Continental Shelf between the United Kingdom of Great Britain and Northern Ireland, and the French Republic, Decision of 30 Jun. 1977, reprinted in 18 ILM 397 (1979) [Anglo-French], para.97.

line drawn from the most westerly point of the Gulf of Gabes bisecting the angle formed by a line from that point to Ras Kaboudia on the Tunisian coast and a line drawn from that same point along the seaward coast of the Kerkennah Islands (Tunisia).[12] Finally, the ICJ calculated the ratio between the relevant coastlines of the parties and the ratio between the sea-bed areas appertaining to each party following the method indicated by the Court, and concluded that "This result [⋯] seems to the Court to meet the requirements of the test of proportionality as an aspect of equity."[13]

In the 1984 *Gulf of Maine* case between the US and Canada, the Chamber of the ICJ, having considered the relevant circumstances of the case, decided that the delimitation line should consist of three segments.[14] As regards the first segment, the one belonging to the innermost sector of the Gulf, the Chamber drew from point A, the obligatory point of departure for the delimitation line chosen by the parties, two lines respectively perpendicular to the two basic coastal lines of the parties, and selected the bisector of the reflex angle formed by these perpendiculars as the course of the delimitation line.[15] Regarding the second segment close to the mouth of the Gulf, the Chamber delimited an adjusted median line.[16] As for the third segment outside of the Gulf, the Chamber drew a perpendicular to the closing line of the Gulf.[17] Finally, the Chamber ascertained the equity of the third segment of the delimitation line by proving that the overall result of this sector was not "likely to entail catastrophic repercussions for the livelihood and economic well-being of the population of the countries concerned".[18] However, the Chamber thought that "such verification is not absolutely necessary where the first two segments of the line are concerned."[19] Thus, for the first segment of the delimitation line, the Chamber followed a two-stage process: "relevant circumstances → delimitation method (delimitation line)". Attention should be paid to the second segment of the delimitation line, where the Chamber considered that a "two-stage operation" was entailed: "it has first to make its choice of an appropriate practical method for use in provisionally establishing a basic delimitation, and [⋯] it must then ascertain what corrections to it are rendered indispensable by the special circumstances of the case".[20] In fact, the Chamber applied a three-stage process in this segment: having emphasized the geographic situation that the coasts of the two parties were opposite in this sector, the Chamber delimited a median line, and then made a correction to the line, taking the "difference in length between the respective coastlines

12. Tunisia/Libya, para.133.
13. *Ibid*., para.131.
14. Gulf of Maine, paras.207-208.
15. *Ibid*., para.213.
16. *Ibid*., para.222.
17. *Ibid*., para.224.
18. Gulf of Maine, paras.237-238.
19. *Ibid*., para.231.
20. *Ibid.*, para.215.

of the two parties which border on the delimitation area" and the location of the small Seal Island (Canada) into account.[21] Thus, to some extent, the process of "provisional equidistance line → special circumstances → delimitation line" was followed in the delimitation of the second segment. Of course, provisionally drawing an equidistance line had not been granted the status of the starting point of the delimitation process until then.

In the 1985 *Libya/Malta* case, the ICJ, having considered the arguments of the parties, declared that "the tracing of a median line between those coasts, by way of a provisional step in a process to be continued by other operations, is the most judicious manner of proceeding with a view to the eventual achievement of an equitable result."[22] Accordingly, a provisional median line was drawn as the first step in the process of delimitation, then this median line was adjusted by being transposed northwards through 18' of latitude due to the marked difference between the length of the coastlines of the parties,[23] and finally, the Court resorted to the test of proportionality to prove the equity of the result.[24] Thus, the ICJ followed a four-stage process in this case: "relevant circumstances → provisional equidistance line → special circumstances → delimitation line → proportionality test". Except for the last stage concerning the proportionality test, the delimitation process in this case is almost the same as the process that the Chamber followed in the *Gulf of Maine* case for the delimitation of the second segment. However, though an equidistance line was used as the provisional delimitation line in both of these two cases, there exist some fundamental differences between them in the sense that, the ICJ in the *Libya/Malta* case emphasized the close relationship between the entitlement to the maritime area and the delimitation rules, while the Chamber did not pay much attention to this issue in the *Gulf of Maine* case. According to the ICJ in the *Libya/Malta* case, "It therefore seems logical to the Court that the choice of the criterion and the method which it is to employ in the first place to arrive at a provisional result should be made in a manner consistent with the concepts underlying the attribution of legal title."[25] On the other hand, the ICJ pointed out in the last part of the Judgment that "The fact that the Court has found that, in the circumstances of the present case, the drawing of a median line constitutes an appropriate first step in the delimitation process, should not be understood as implying that an equidistance line will be an appropriate beginning in all cases, or even in all cases of delimitation between opposite States."[26] In other words, equidistance is not "the only permissible point of departure. The application of equitable principles in the particular relevant circumstances may still require the adoption of another method, or combination of methods, of delimitation, even from the outset."[27] In this sense, the process

21. *Ibid*., paras.218&222.
22. Libya/Malta, para.62.
23. *Ibid*., para.79.
24. *Ibid*., paras.74-75.
25. *Ibid*., para.61.
26. *Ibid*., para.77.

of delimitation in the *Libya/Malta* case continued to be dominated by the "monotypic" doctrine, though the ICJ has for the first time emphasized that the application of equity "should display consistency and a degree of predictability; even though it looks with particularity to the peculiar circumstances of an instant case, it also looks beyond it to principles of more general application."[28]

The arbitral tribunals generally adhered to the same delimitation process during this period of time too. In the 1977 *Anglo-French* case, the arbitral court declared that it "will begin by identifying the geographical and other features which establish the legal framework for its decision regarding the course of the continental shelf boundary".[29] Having considered the actual circumstances of the Channel Islands region, the arbitral court decided that "the situation demands a twofold solution. First, in order to maintain the appropriate balance between the two States in relation to the continental shelf as riparian States of the Channel with approximately equal coastlines, [⋯] the primary boundary between them shall be a median line, [and] [⋯] the Channel Islands themselves are to be disregarded".[30] The second part of the solution is to delimit a second boundary to the north and west of the Channel Islands, thus leaving to the Channel Islands a 12- nautical-mile zone of seabed and subsoil.[31] However, the arbitral court did not resort to the proportionality test as the last step of delimitation. So the tribunal court applied a two-stage process in this case: "relevant circumstances → delimitation method (delimitation line)".

In the 1985 *Guinea/Guinea-Bissau* case, the arbitral tribunal, by referring to circumstances which it considered relevant in the present case, particularly the nature of the coastlines of the parties and the general configuration of the West African coast, delimited a line.[32] Then the tribunal, by considering other circumstances, including, *inter alia*, the structure and nature of the continental shelf, the proportionality of the surfaces to be attributed to the lengths of the coasts, the economic and security circumstances, established whether the chosen line effectively led to an equitable result.[33] So the process of delimitation in this case can be summarized as: "relevant circumstances → delimitation method (delimitation line) → proportionality and other circumstances".

In the 1992 *St. Pierre and Miquelon* case between Canada and France, the arbitral tribunal declared that "The delimitation process begins, as a rule, by identifying [⋯] the geographical context of the dispute".[34] After examining the geographical factors and the

27. *Ibid*., para.43.
28. *Ibid*., para.45.
29. Anglo-French, para.232.
30. *Ibid*., para.201.
31. *Ibid*., paras.202-203.
32. Guinea/Guinea-Bissau Maritime Delimitation Case, Decision of 14 Feb. 1985, reprinted in 77 International Law Reports 636 (1988) [Guinea/Guinea-Bissau], paras.90-112.
33. *Ibid*., paras.113-129.
34. Delimitation of the Maritime Areas between Canada and France, Award of 10 Jun. 1992, reprinted in 31 ILM 1145 (1992) [St. Pierre and Miquelon], para.25.

arguments of the parties, the tribunal decided that, in order to reach an equitable result, it was necessary to examine separately two different sectors of the delimitation area.[35] With respect to the western seaward projection of the French islands' coasts, the tribunal thought "A reasonable and equitable solution for the western sector would be to grant to Saint Pierre and Miquelon an additional twelve nautical miles from the limit of its territorial sea, for its exclusive economic zone".[36] In the second sector towards the south and the southeast, the French islands were granted a corridor- shaped maritime zone, extending to the distance of 200 nautical miles with approximately 10.5 nautical miles in breadth.[37] Then, the tribunal examined the relevance of the fishery and mineral resources to assure itself that the solution reached was not "radically inequitable".[38] Finally, the tribunal checked the result by resorting to the proportionality test and concluded that the requirements of this test had been satisfied.[39] Therefore, the delimitation process in this case is: "relevant circumstances → delimitation method (delimitation line) → resources considerations → proportionality test".

The following table is the summary of the delimitation processes that were followed by the international tribunals before the 1993 *Jan Mayen* case. One can learn from it that within all of these delimitation processes, the first stage is to examine the relevant circumstances of the particular case in order to determine the method which can be used to establish a delimitation line. On the other hand, these processes show some variance over the stages following the establishment of the line. While in five operations of delimitation the international tribunals continued to resort to the proportionality test or other considerations,[40] they did not do so in the other three delimitations.[41] Furthermore, while the test of proportionality was the final check in three delimitations,[42] it was not assigned to play this role in other cases.

35. St. Pierre and Miquelon, para.66.
36. *Ibid*., para.69.
37. *Ibid*., para.71.
38. *Ibid*., para.88.
39. *Ibid*., para.93.
40. They are: the Tunisia/Libya case; the third segment of delimitation in the Gulf of Maine case; the Libya/Malta case; the Guinea/Guinea-Bissau case, and the St. Pierre and Miquelon case.
41. They are: the first two segments of delimitation in the Gulf of Maine case, and the Anglo-French case.
42. They are: the Tunisia/Libya case; the Libya/Malta case, and the St. Pierre and Miquelon case.

Table 1. The delimitation process before 1993

Cases		Delimitation process
Tunisia/Libya		"relevant circumstances → delimitation method (delimitation line) → proportionality test"
Gulf of Maine	segment 1	"relevant circumstances → delimitation method (delimitation line)"
	segment 2	"relevant circumstances → delimitation method (provisional equidistance line) → special circumstances → delimitation line"
	segment 3	"relevant circumstances → delimitation method (delimitation line) → resource"
Libya/Malta		"relevant circumstances → provisional equidistance line → special circumstances → delimitation line → proportionality test"
Anglo-French		"relevant circumstances → delimitation method (delimitation line)"
Guinea/Guinea-Bissau		"relevant circumstances → delimitation method (delimitation line) → proportionality and other circumstances"
St. Pierre and Miquelon		"relevant circumstances → delimitation method (delimitation line) → resources considerations → proportionality test"

Source: made by the author.

3. "Provisional equidistance line → special circumstances → delimitation line"

This delimitation process stemmed from the provisions of Article 12, paragraph 1, of the 1958 Convention on the Territorial Sea and the Contiguous Zone,[43] which concerns the delimitation of the territorial sea and has been regarded as having a customary character.[44] Article 15 of the LOS Convention is virtually identical to it, providing that "Where the coasts of two States are opposite or adjacent to each other, neither of the two States is entitled, failing agreement between them to the contrary, to extend its territorial sea beyond the median line every point of which is equidistant from the nearest point on the baselines from which the breadth of the territorial seas of each of the two States is measured. The above provision does not apply, however, where it is necessary by reason of historic title or other special circumstances to delimit the territorial seas of the two States in a way which is at variance therewith." This provision is often referred to as the "equidistance/special circumstances" rule. In the view of the ICJ, "The most logical and widely practised approach is first to draw provisionally an equidistance line and then to consider whether that line must be adjusted in the light of the existence of special circumstances".[45] Thus, the

43. Done on 29 Apr. 1958 and entered into force on 10 Sep. 1964. United Nations, Treaty Series 516, p.205.
44. Qatar v. Bahrain, para.176.
45. *Ibid*.

delimitation process of the territorial sea governed by this rule is: "provisional equidistance line → special circumstances → delimitation line".

As far as the delimitation of the continental shelf is concerned, the "equidistance/special circumstances" rule was also contained in Article 6 of the 1958 Convention on the Continental Shelf.[46] The ICJ held in the 1969 *North Sea Continental Shelf* cases that "A rule was of course embodied in Article 6 of the Convention", "according to which the delimitation of continental shelf areas between adjacent States must, unless the Parties otherwise agree, be carried out on an equidistance-special circumstances basis".[47] In the *Anglo-French* case, the arbitral tribunal clearly declared that "Article 6 [⋯] does not formulate the equidistance principle and 'special circumstances' as two separate rules. The rule there stated in each of the two cases is a single one, a combined equidistance-special circumstances rule."[48] In the delimitation concerning the Atlantic region, which was governed by Article 6 of the 1958 Convention, the tribunal began by employing the equidistance method, and then adjusted the result in the light of special circumstances, namely the existence of the Scilly Isles.[49] This was the first time that the process of "provisional equidistance line → special circumstances → delimitation line" had been followed by the international tribunal in the continental shelf delimitation.

In the 1993 *Jan Mayen* case, the ICJ was asked to delimit the continental shelf boundary and the fishery zone boundary between Denmark and Norway: while Article 6 of the 1958 Convention was applicable to the delimitation of the continental shelf, the customary law governed the delimitation of the fishery zone.[50] In this case, the Court not only accepted the expression of "equidistance/special circumstances rule" contained in Article 6 of the 1958 Convention, but also found that "It cannot be surprising if an equidistance-special circumstances rule produces much the same result as an equitable principles-relevant circumstances rule in the case of opposite coasts, whether in the case of a delimitation of continental shelf, of fishery zone, or of an all-purpose single boundary."[51]

---

46. Article 6 provides that "1. Where the same continental shelf is adjacent to the territories of two or more States whose coasts are opposite each other, the boundary of the continental shelf appertaining to such States shall be determined by agreement between them. In the absence of agreement, and unless another boundary line is justified by special circumstances, the boundary is the median line, every point of which is equidistant from the nearest points of the baselines from which the breadth of the territorial sea of each State is measured. 2. Where the same continental shelf is adjacent to the territories of two adjacent States, the boundary of the continental shelf shall be determined by agreement between them. In the absence of agreement, and unless another boundary line is justified by special circumstances, the boundary shall be determined by application of the principle of equidistance from the nearest points of the baselines from which the breadth of the territorial sea of each State is measured". The Convention on the Continental Shelf was adopted on 29 Apr. 1958 and entered into force on 10 Jun. 1964. United Nations, *Treaty Series* 499, p.311.
47. North Sea Continental Shelf, para.69.
48. Anglo-French, para.68.
49. *Ibid*., para.248.
50. Jan Mayen, para.44.
51. *Ibid*., para.56.

As regards the delimitation of the continental shelf, the Court held that "since it is governed by Article 6 of the 1958 Convention, and the delimitation is between coasts that are opposite, it is appropriate to begin by taking provisionally the median line between the territorial sea baselines, and then enquiring whether 'special circumstances' require 'another boundary line'. *Such a procedure is consistent with the words in Article 6*, 'In the absence of agreement, and unless another boundary line is justified by special circumstances, the boundary is the median line'"[52] (emphasis added). The Court continued to add that "even if it were appropriate to apply, not Article 6 of the 1958 Convention, but customary law concerning the continental shelf as developed in the decided cases, it is in accord with precedents to begin with the median line as a provisional line and then to ask whether 'special circumstances' require any adjustment or shifting of that line".[53] As regards the delimitation of the fishery zone, in the view of the Court, it was also "proper to begin the process of delimitation by a median line provisionally drawn."[54] Then, having completed its examination of the geophysical and other circumstances, the ICJ decided to adjust the provisional median line such as to attribute a larger area of maritime space to Denmark, in the light of the disparity of coastal lengths between the parties as well as the need to ensure an equitable access to the resources in this region.[55] Compared with the process of delimitation in the *Libya/Malta* case, the ICJ in this case did not examine the relevant circumstances prior to its decision that a provisional equidistance line should be employed as the starting point for the delimitation, nor did the Court repeat the warning it made in 1985 that one should not understand that "an equidistance line will be an appropriate beginning in all cases, or even in all cases of delimitation between opposite States".[56] By contrast, the ICJ in the present case emphasized that "it is in accord with precedents to begin with the median line as a provisional line",[57] because "in the case of opposite coasts [⋯], the tendency of customary law, like the terms of Article 6, has been to postulate the median line as leading prima facie to an equitable result."[58] Besides, the Court, after adjusting the provisional median line in the light of the special circumstances of the case, did not resort to the proportionality test as the final check. Thus, the *Jan Mayen* case is the first case where the international tribunal applied the "provisional equidistance line → special circumstances → delimitation line" process in such maritime delimitation as governed by the customary law,[59] though limited to the delimitation between the opposite coasts.

52. *Ibid*., para.49.
53. *Ibid*., para.51.
54. *Ibid*., para.53.
55. *Ibid*., paras.90-92.
56. Libya/Malta, para.75.
57. Jan Mayen, para.51.
58. *Ibid*., para. 56.
59. The applicable law to the delimitation of the fishery zone in the Jan Mayen case was customary rule. See Jan Mayen, para.52.

In the 2001 *Qatar v. Bahrain* case, where the ICJ was required to draw "a single maritime boundary between the maritime areas of sea-bed, subsoil and superjacent waters appertaining respectively to" the parties,[60] the Court followed the same process as in the *Jan Mayen* case, expressly stating that "For the delimitation of the maritime zones beyond the 12-mile zone it will first provisionally draw an equidistance line and then consider whether there are circumstances which must lead to an adjustment of that line."[61] The Court further noted that "the equidistance/special circumstances rule, which is applicable in particular to the delimitation of the territorial sea, and the equitable principles/relevant circumstances rule [⋯] with regard to the delimitation of the continental shelf and the exclusive economic zone, are closely interrelated".[62] It is worth noting that, compared with the *Jan Mayen* case where the delimitation was to be effected between opposite coasts, the coasts of the parties in the northern sector of the present case "are no longer opposite to each other but are rather comparable to adjacent coasts".[63] Thus, the presumption in favour of equidistance, established in the case law relating to states with opposite coasts, began to apply in the case of states with adjacent coasts.[64]

One year later, the ICJ followed the same process again in the *Cameroon v. Nigeria* case to determine "a single line of delimitation for the coincident zones of jurisdiction",[65] where the coasts of the parties are adjacent.[66] The Court declared that it "has on various occasions made it clear what the applicable criteria, principles and rules of delimitation are when a line covering several zones of coincident jurisdictions is to be determined. They are expressed in the so-called equitable principles/relevant circumstances method. This method, which is very similar to the equidistance/special circumstances method applicable in delimitation of the territorial sea, involves first drawing an equidistance line, then considering whether there are factors calling for the adjustment or shifting of that line in order to achieve an 'equitable result'".[67] At last, the ICJ for its first time delimited a strict equidistance line as the boundary between the respective maritime areas of the parties.[68]

However, in the 2007 *Nicaragua v. Honduras* case, the ICJ did not follow the process of "provisional equidistance line → special circumstances → delimitation line" in the single maritime delimitation between the adjacent coasts of the parties' mainland,

60. Qatar v. Bahrain, *ibid*., paras.31&168.
61. *Ibid*., para.230.
62. *Ibid*., para.231.
63. *Ibid*., para.170.
64. See Arbitration between Guyana and Suriname (Guyana v. Suriname), Arbitral Tribunal constituted pursuant to Article 287, and in accordance with Annex VII, of the United Nations Convention on the Law of the Sea, Arbitration Award of 17 Sep. 2007 [Guyana v. Suriname], para.338.
65. Case concerning the Land and Maritime Boundary between Cameroon and Nigeria (Cameroon v. Nigeria: Equatorial Guinea Intervening), *ICJ Reports* 2002, p.303 [Cameroon v. Nigeria], para.286.
66. Cameroon v. Nigeria, para.30.
67. *Ibid*., paras.288&290.
68. *Ibid*., paras.305-307.

because "[g]iven the set of circumstances in the current case it is impossible for the Court to identify base points and construct a provisional equidistance line for the single maritime boundary delimiting maritime areas off the Parties' mainland coasts".[69] The particular circumstances of the case are, Cape Gracias a Dios, where the Nicaragua-Honduras land boundary ends, is a sharply convex territorial projection abutting a concave coastline on either side to the north and south-west, with the consequence that the pair of base points to be identified on either bank of the River Coco at the tip of the Cape would assume a considerable dominance in constructing an equidistance line, and, given the close proximity of these base points to each other, any variation or error in situating them would become disproportionately magnified in the resulting equidistance line. Moreover, the sediment carried to and deposited at sea by the River Coco has caused the coastline to the north and south of the Cape to exhibit a very active morpho-dynamism, which "might render any equidistance line so constructed today arbitrary and unreasonable in the near future".[70] Therefore, it was the physical geography that made the ICJ give up the application of a provisional equidistance line, though it also noted that neither party had as its main argument a call for an equidistance line as the most suitable method of delimitation.[71] At last, the ICJ applied the bisector method to bisect "the angle created by the linear approximations of coastlines".[72] It is worth noting that, the ICJ not only emphasized that "equidistance remains the general rule",[73] but also explained the reason why the bisector method was chosen in the following words: this method "has proved to be a viable substitute method in certain circumstances where equidistance is not possible or appropriate", and "may be seen as an approximation of the equidistance method" in instances where any base points that could be determined by the Court are inherently unstable.[74] Thus, the ICJ more complemented the process of "provisional equidistance line → special circumstances → delimitation line" than betrayed it in this case.

69. Territorial and Maritime Dispute between Nicaragua and Honduras in the Caribbean Sea (Nicaragua v. Honduras), Judgment of 8 Oct. 2007, *ICJ Reports* 2007, p.659 [Nicaragua v. Honduras], para.280.
70. *Ibid*., para.277.
71. *Ibid*., para.275. The ICJ noted in the Tunisia/Libya case that "The Court must take this firmly expressed view of the Parties into account. If however the Court were to arrive at the conclusion, after having evaluated all relevant circumstances, that an equidistance line would bring about an equitable solution of the dispute, there would be nothing to prevent it from so finding even though the Parties have discarded the equidistance method." Tunisia/Libya, para.110.
72. Nicaragua v. Honduras, paras.287-298.
73. *Ibid*., para.281.
74. *Ibid*., para.287. In the view of the ICJ, the equidistance method approximates the relationship between two parties' relevant coasts by taking account of the relationships between designated pairs of base points, while the bisector method comparably seeks to approximate the relevant coastal relationships, but does so on the basis of the macro-geography of a coastline as represented by a line drawn between two points on the coast. *Ibid*., para.289. The Court added that one of the practical advantages of the bisector method is that a minor deviation in the exact position of endpoints, which are at a reasonable distance from the shared point, will have only a relatively minor influence on the course of the entire coastal front line. *Ibid*., para. 294.

4. "Provisional equidistance line → relevant circumstances → delimitation line → disproportionality test"

In the 2009 *Black Sea* case, the ICJ changed its process of delimitation that it had consistently followed since the *Jan Mayen* case, and expounded a three-stage process for maritime delimitation: "provisional equidistance line → relevant circumstances → delimitation line → disproportionality test". First, the Court will establish a provisional delimitation line, using methods that are geometrically objective and also appropriate for the geography of the area in which the delimitation is to take place. "So far as delimitation between adjacent coasts is concerned, an equidistance line will be drawn unless there are compelling reasons that make this unfeasible in the particular case [⋯]. So far as opposite coasts are concerned, the provisional delimitation line will consist of a median line between the two coasts".[75] The construction of the provisional equidistance line is "heavily dependent on the physical geography", and at this initial stage the Court is not yet concerned with any relevant circumstances that may obtain.[76] In the view of the ICJ, such an approach is "[i]n keeping with its settled jurisprudence on maritime delimitation".[77] At the second stage, the Court will consider whether there are factors calling for the adjustment or shifting of the provisional equidistance line in order to achieve an equitable result, because the course of the final line should result in an equitable solution.[78] Within this context, the ICJ noted that "the so-called equitable principles/relevant circumstances method may usefully be applied, as in these maritime zones this method is also suited to achieving an equitable result".[79] Finally, and at a third stage, the Court will verify that the line (a provisional equidistance line which may or may not have been adjusted by taking into account the relevant circumstances) does not, as it stands, lead to an inequitable result by reason of any marked disproportion between the ratio of the respective coastal lengths and the ratio between the relevant maritime area of each state by reference to the delimitation line.[80]

Compared with the delimitation practice of the ICJ during the period from the *Jan Mayen* case till the *Nicaragua v. Honduras* case, the delimitation process defined by the ICJ in the *Black Sea* case resumed resorting to the disproportionality/proportionality test as the final stage, which had been applied by the ICJ before the *Jan Mayen* case as well as the arbitral tribunals. Moreover, though the ICJ has tended to start the delimitation process by a provisional equidistance line since the *Jan Mayen* case, it remained to treat the "equitable principles/relevant circumstances" as the basic rule or method of the delimitation,

75. Black Sea, para.116.
76. *Ibid*., para.118.
77. *Ibid*.
78. *Ibid*., para.120.
79. Nicaragua v. Honduras, para.271.
80. Black Sea, para.122.

thus usually mentioned it before the commencement of the delimitation operation.[81] According to the ICJ, the "equitable principles/relevant circumstances" "involves first drawing an equidistance line, then considering whether there are factors calling for the adjustment or shifting of that line in order to achieve an 'equitable result'".[82] However, in the *Nicaragua v. Honduras* case, because the ICJ could not construct a provisional equidistance line as the starting point of the delimitation due to the physical geography of the case,[83] the ICJ retreated back from its previous position and stated that "As to the plotting of a single maritime boundary [⋯], the so-called equitable principles/relevant circumstances method may usefully be applied, as in these maritime zones this method is also suited to achieving an equitable result"[84] (emphasis added). The words "may" and "also" imply that the ICJ here listed the equitable principles/relevant circumstances method, on the one hand, and the other methods more than the equidistance, such as the bisector used in this case, on the other hand, side by side. Since equidistance, which is the first step in the equitable principles/relevant circumstances method, "remains the general rule",[85] the equitable principles/relevant circumstances method remains the basic method in the single maritime delimitation. In the *Black Sea* case, the ICJ repeated its views concerning the equitable principles/relevant circumstances method that it made two years earlier in the *Nicaragua v. Honduras* case, however, it did so only in the second stage of the delimitation process which it indicated in this case, instead of in the general part, as it did before.[86] Thus, the ICJ in this case did not treat the equitable principles/relevant circumstances method as the general rule for maritime delimitation. Furthermore, the way in which the ICJ mentioned the equitable principles/relevant circumstances method seemed that it listed this method side by side with equidistance that it mentioned in the first stage. Thus, it can be argued that the ICJ seemingly intended to replace the equitable principles/relevant circumstances method with the new one that it put forward in this case, which can be called "equidistance/relevant circumstances" method. Though the ICJ did not use this term officially in the *Black Sea* case, the arbitral tribunal in the *Barbados v. Trinidad and Tobago* case did use it,[87] and the arbitral tribunals had already followed the process of delimitation mentioned by the ICJ in the *Black Sea* case since 1999.

81. Qatar v. Bahrain, para.230; Cameroon v. Nigeria, para.288.
82. Cameroon v. Nigeria, para.288; Nicaragua v. Honduras, para.271.
83. Nicaragua v. Honduras, para.280.
84. *Ibid*., para.271.
85. *Ibid*., para.281.
86. Black Sea, paras.120&115-116.
87. Case between Barbados and the Republic of Trinidad and Tobago (Barbados v. Trinidad and Tobago), Arbitral Tribunal constituted pursuant to Article 287, and in accordance with Annex VII, of the United Nations Convention on the Law of the Sea, Arbitration Award of 11 Apr. 2006, reprinted in XXVII RIAA 147 (2008) [Barbados v. Trinidad and Tobago], para.242.

Source: *Black Sea* case, ICJ Judgment, p.133.

Figure 1. The maritime delimitation in the 2009: *Black Sea* case

In the 1999 *Eritrea/Yemen* arbitration, the arbitral tribunal declared that "It is a generally accepted view, as is evidenced in both the writings of commentators and in the jurisprudence, that between coasts that are opposite to each other the median or equidistance line normally provides an equitable boundary in accordance with the requirements of the Convention",[88] so "the Tribunal has taken as its starting point, as its fundamental point of departure, that, as between opposite coasts, a median line obtains."[89] After a careful consideration of the arguments of the parties, the general question of fishing in the Red Sea, the petroleum agreements, and the traditional fishing regime in this area, the tribunal

88. Eritrea-Yemen Arbitration (Second Stage: Maritime Delimitation), Permanent Court of Arbitration, Award of 17 Dec. 1999, reprinted in XL ILM 983 (2002) [Eritrea/Yemen], para.131.
89. *Ibid*., para.83.

decided that "the international boundary shall be a single all-purpose boundary which is a median line and that it should, as far as practicable, be a median line between the opposite mainland coastlines. This solution is not only in accord with practice and precedent in the like situations but is also one that is already familiar to both Parties".[90] Having determined the effect of islands present in the delimitation area upon the median line, the tribunal delimited the boundary line. Finally, the tribunal resorted to the proportionality test and concluded that "the line of delimitation it has decided upon results in no disproportion."[91] Therefore, the process of delimitation in this case is: "provisional equidistance line → circumstances → delimitation line → proportionality test".

In the 2006 *Barbados v. Trinidad and Tobago* case, the arbitral tribunal stated in the section titled "The delimitation process" that, "The determination of the line of delimitation [⋯] normally follows a two-step approach. First, a provisional line of equidistance is posited as a hypothesis and a practical starting point. While a convenient starting point, equidistance alone will in many circumstances not ensure an equitable result in the light of the peculiarities of each specific case. The second step accordingly requires the examination of this provisional line in the light of relevant circumstances, which are case specific, so as to determine whether it is necessary to adjust the provisional equidistance line in order to achieve an equitable result [⋯]. This approach is usually referred to as *the 'equidistance/relevant circumstances' principle*"[92] (emphasis added). And the tribunal decided that it would undertake this process of delimitation in this case.[93] Having drawn the delimitation line, the tribunal stated that "it remains to examine the outcome in the light of proportionality, as the ultimate test of the equitableness of the solution".[94] However, the tribunal did not calculate the ratio of the lengths of the coasts and the ratio of the areas appertaining to parties, but emphasized that "proportionality is not a mathematical exercise that results in the attribution of maritime areas as a function of the length of the coasts of the Parties or other such ratio calculations, an approach that instead of leading to an equitable result could itself produce inequity. Proportionality is a broader concept, it is a sense of proportionality, against which the Tribunal can test the position resulting from the provisional application of the line that it has drawn, so as so avoid gross disproportion in the outcome of the delimitation".[95] So the process of delimitation in this case is: "provisional equidistance line → relevant circumstances → delimitation line → proportionality test".

90. *Ibid*., para.132.
91. *Ibid*., para.168.
92. Barbados v. Trinidad and Tobago, para.242. The arbitral tribunal here referred to the Qatar v. Bahrain case and the Cameroon v. Nigeria case.
93. Barbados v. Trinidad and Tobago, para.245.
94. *Ibid*., para.376.
95. *Ibid*. See also *ibid*., paras.238-240.

In the 2007 arbitration between Guyana and Suriname, the tribunal declared that "In the course of the last two decades international courts and tribunals dealing with disputes concerning the delimitation of the continental shelf and the exclusive economic zone have come to embrace a clear role for equidistance. The process of delimitation is divided into two stages. First the court or tribunal posits a provisional equidistance line which may then be adjusted to reflect special or relevant circumstances."[96] It went on to add that "Articles 74 and 83 of the Convention require that the Tribunal achieve an 'equitable' solution. The case law of the International Court of Justice and arbitral jurisprudence as well as State practice are at one in holding that the delimitation process should, in appropriate cases, begin by positing a provisional equidistance line which may be adjusted in the light of relevant circumstances in order to achieve an equitable solution. The Tribunal will follow this method in the present case".[97] Finally, the tribunal checked the relevant coastal lengths for proportionality and came up with nearly the same ratio of relevant areas as it did for coastal frontages.[98] Thus, the process of delimitation in this case is: "provisional equidistance line → relevant circumstances → delimitation line → proportionality test".

5. The future: "provisional equidistance line → relevant/special circumstances → delimitation line"

5.1 Relevant/special circumstances

Compared with the delimitation process of "relevant circumstances → delimitation method (delimitation line) → proportionality test" that was generally followed by the international tribunals before the 1993 *Jan Mayen* case, the most distinguishing change in the delimitation methodology indicated by the ICJ in the *Black Sea* case is the exchange of the places between "relevant circumstances" and "delimitation method (equidistance)" in the process of delimitation. It reflects the change of the roles that the relevant circumstances are designed to play in achieving an equitable solution.

In the past, the relevant circumstances- "This concept can be described as a fact necessary to be taken into account in the delimitation process",[99] was used to indicate what the delimitation method is to be.[100] In the words of the arbitral court of the *Anglo-French*

96. Guyana v. Suriname, para.335.
97. *Ibid*., para.342.
98. *Ibid*., para.392. Besides, the tribunal observed that as the parties had not chosen to argue the relative distribution of living and non-living natural resources throughout these zones, the tribunal did not take these matters into account. *Ibid*.
99. Jan Mayen, para.55.

case, "whether the use of the equidistance principle or some other method is appropriate for achieving an equitable delimitation is very much a matter of appreciation in the light of the geographical and other circumstances."[101] Therefore, "it is the geographical and other circumstances of any given case which indicate and justify the use of the equidistance method as the means of achieving an equitable solution rather than the inherent quality of the method as a legal norm of delimitation."[102] And if the evaluation of relevant circumstances "leads the Court to an equitable delimitation on a different basis, there is no need for it to give any further consideration to equidistance".[103] In this sense, relevant circumstances under customary law refer to those circumstances "which are 'relevant' to the choice of the most equitable method of delimitation (including equidistance as a possible method)",[104] rather than to those modifying the application of the prescribed method,[105] therefore different from "special circumstances" of Article 6 of the 1958 Convention, which "are those circumstances which might modify the result produced by an unqualified application of the equidistance principle".[106] Thus, though the two concepts both are intended to enable the achievement of an equitable result,[107] the ways in which they function are different: while the "relevant circumstances" positively pursue the equitable solution, the "special circumstances" passively avoid the inequitable result.

However, under the process of "provisional equidistance line → relevant circumstances → delimitation line → disproportionality test", the ICJ "is not yet concerned with any relevant circumstances that may obtain" at the initial stage of delimitation,[108] and the function of the relevant circumstances "is to verify that the provisional equidistance line, drawn by the geometrical method from the determined base points on the coasts of the Parties *is not*, in light of the particular circumstances of the case, *perceived as inequitable*. If such would be the case, the Court should adjust the line in order to achieve the 'equitable solution'"[109] (emphasis added). Thus, "Although it is a matter of categories which are different in origin and in name", the relevant circumstances under customary law tend to be assimilated to the special circumstances under Article 6 of the 1958 Convention.[110]

100. Evans, M. D. (1989) Relevant Circumstances and Maritime Delimitation, p.80.
101. Anglo-French, para.70.
102. *Ibid*.
103. Tunisia/Libya, para.110.
104. Jan Mayen, (Shahabuddeen, J., sep. op.).
105. Evans, M. D. *ibid*, p.80.
106. Jan Mayen, para.55.
107. *Ibid*., para.56.
108. Black Sea, para.118.
109. *Ibid*., para.155.
110. Jan Mayen, para.56. See also the Nicaragua v. Honduras case, where the ICJ used the term "legally relevant 'special circumstances", Nicaragua v. Honduras, para.304.

5.2 Equidistance

The direct reason behind the change of the function of the relevant circumstances in the maritime delimitation is that, a provisional equidistance line has been recognized as the starting point for most of maritime delimitations, so it is not necessary, before the choice of the delimitation method in a given case, to evaluate the relevant circumstances of this case anymore. In the light of the requirement that the maritime delimitation should achieve an equitable solution, such delimitation processes imply that the international tribunals accept that the application of equidistance will contribute to the achievement of this ultimate goal. However, though the international tribunals recognize that equidistance "has a certain intrinsic value because of its scientific character and the relative ease with which it can be applied,"[111] they have not acknowledged that equidistance has inherent equity. This may be due to the fact that, as the ICJ rightly observed in its first decision regarding the maritime delimitation, the 1969 *North Sea Continental Shelf* cases, the equidistance "constitutes a method capable of being employed in almost all circumstances," but the use of this method can "under certain circumstances" produce inequitable results.[112] In this sense, "the equidistance method is just one among many and [⋯] there is no obligation to use it or give it priority".[113] About forty years later, the above-mentioned judgments of the equidistance remain true, and "in particular circumstances, there may be factors which make the application of the equidistance method inappropriate".[114] Then why an equidistance line has been accepted by the international tribunals as the starting point of the delimitation in most cases?

This change was attributable to the alteration of the attitudes of the international tribunals to the certainty of the rules on maritime delimitation in general, and the role of the equidistance method in achieving an equitable solution in particular.

As mentioned above, before the 1985 *Libya/Malta* case, the ICJ and arbitral tribunals emphasized the peculiar circumstances of each specific case, but ignored the general application of delimitation rules.[115] In a much quoted passage, the ICJ declared

---

111. Nicaragua v. Honduras, para.272. The ICJ here quoted the statements of the arbitral tribunal in the Guinea/Guinea-Bissau case, Guinea/Guinea-Bissau, para.102. See also the North Sea Continental Shelf cases, where the ICJ held that "It has never been doubted that the equidistance method of delimitation is a very convenient one, the use of which is indicated in a considerable number of cases. It [⋯] has the virtue that if necessary, [⋯] any cartographer can de facto trace such a boundary on the appropriate maps and charts, and those traced by competent cartographers will for all practical purposes agree." North Sea Continental Shelf, para.22.
112. North Sea Continental Shelf, paras.22&24.
113. Guinea/Guinea-Bissau, para.102.
114. Nicaragua v. Honduras, para.272.
115. Gulf of Maine, para.81. The ICJ stated in the Tunisia/Libya case that "Clearly each continental shelf case in dispute should be considered and judged on its own merits, having regard to its peculiar circumstances; therefore, no attempt should be made here to overconceptualize the application of the principles and rules

that "It is, however, the result which is predominant; the principles are subordinate to the goal. The equitableness of a principle must be assessed in the light of its usefulness for the purpose of arriving at an equitable result. It is not every such principle which is in itself equitable; it may acquire this quality by reference to the equitableness of the solution."[116] Thus, customary international law is expected to "only provide a few basic legal principles, which lay down guidelines to be followed with a view to an essential objective. It cannot also be expected to specify the equitable criteria to be applied or the practical, often technical, methods to be used for attaining that objective", both of which "can only be determined in relation to each particular case and its specific characteristics."[117] Since "each case of delimitation is a *unicum*", it is certain that none method is applicable for all maritime delimitation.[118] Thus, any recourse to a method chosen beforehand is excluded, and the method to be used can come only as a result of objective legal reasoning.[119] In the light of the requirement that any delimitation must achieve an equitable result, such an approach is not wrong, but absent of consistency and predictability, and thus has given rise to serous criticism.[120] In the *Libya/Malta* case, the ICJ turned to emphasize the certainty of the delimitation rules, and declared that "While every case of maritime delimitation is different in its circumstances from the next, only a clear body of equitable principles can permit such circumstances to be properly weighed, and the objective of an equitable result, as required by general international law, to be attained."[121] Compared with the other methods of delimitation, the practical convenience and certainty of application undoubtedly are the advantages of equidistance. In the words of the ICJ, "no other method of delimitation has the same combination of practical convenience and certainty of application."[122] However, these practical advantages of the equidistance method still cannot suffice of themselves to convert it into the starting point of the delimitation.

As far as the relationship between equity and equidistance is concerned, although the ICJ held in the *North Sea Continental Shelf* cases that "Equity does not necessarily imply equality",[123] it did not say that "Equity does not imply equality". By contrast, the Chamber of the ICJ in the 1986 *Frontier Dispute* case declared that "Although 'Equity does not necessarily imply equality' [⋯], where there are no special circumstances the

relating to the continental shelf." Tunisia/Libya, para.132.

116. Tunisia/Libya, para.70.
117. Gulf of Maine, para.81.
118. See Guinea/Guinea-Bissau, para.89.
119. *Ibid*., para.102.
120. See *e.g*., Bravender-Coyle, P. The Emerging Legal Principles and Equitable Criteria Governing the Delimitation of Maritime Boundaries between States, 19(3) Ocean Development and International Law (1988), p.199; Jan Mayen, (Schwerbel, J., sep. op.); Dallmeyer, D. G., and DeVorsey, L. Jr. (eds.), Rights to Oceanic Resources: Deciding and Drawing Maritime Boundaries (Martinus Nijihoff Pub. 1989), p.149.
121. Libya/Malta, para.76. See also *Ibid*., para.45; Jan Mayen, para.58.
122. North Sea Continental Shelf, para.23.
123. *Ibid*., para.91.

latter is generally the best expression of the former".[124] This may explain why judicial decisions on the basis of the customary law governing maritime delimitation between opposite coasts have likewise regarded the median line as a provisional line that may then be adjusted or shifted in order to ensure an equitable result, because in the case of delimitation between opposite coasts, the effects of irregularities in the coastline of each state are, broadly, offset by the effects of irregularities in the coastline of the other, therefore a median line, by dividing equally the distance between the coasts of the parties, will result in a generally equal division of the maritime area between the parties,[125] thus creating an impression of equity. On the other hand, in the case of laterally adjacent states, the distorting effects of certain factors on the course of the line, under certain conditions of coastal figuration, will "produce their maximum effect in the localities where the main continental shelf areas lie further out",[126] and "the further from the coastline the area to be delimited, the more unreasonable are the results produced".[127] Therefore, the international tribunals have always tended to take more prudent attitude towards the applicability of the equidistance method in the delimitation between adjacent coasts. The latest example in this regard was provided by the ICJ in the *Black Sea* case. While the Court accepted that there maybe exist "compelling reasons that make" the drawing of an equidistance line "unfeasible" in the delimitation between adjacent coasts, it did not mention any exceptions to the applicability of equidistance in the delimitation between opposite coasts.[128] But those compelling reasons that make the drawing of an equidistance line unfeasible in the delimitation between adjacent coasts may well occur in the delimitation between opposite coasts. For example, in the second segment of the delimitation in the *Tunisia/Libya* case, "The major change in direction undergone by the coast of Tunisia seems to the Court to go some way, though not the whole way, towards transforming the relationship of Libya and Tunisia from that of adjacent States to that of opposite States",[129] however, the equidistance method was not used because the segment was to begin at a point not on any possible equidistance line.[130]

Indeed, there is no essential difference in the process of delimiting the maritime areas between opposite states and that of delimitations between adjacent states, because the rules of delimitation prescribed, whether in paragraph 1 and paragraph 2 of Article 6 of the 1958 Convention, or in Articles 74 and 83 of the LOS Convention, are the same.[131] Under these rules, it is the appropriateness to achieve an equitable solution in a particular

124. Frontier Dispute Case (Burkina Faso/Mali), *ICJ Reports* 1986, p.554, para.150.
125. Anglo-French, para.103.
126. North Sea Continental Shelf, para.59.
127. *Ibid*., para.89(a)
128. Black Sea, para.116.
129. Tunisia/Libya, para.126.
130. Nicaragua v. Honduras, para.288.
131. Anglo-French, para.242.

case that determines the applicability of equidistance, instead of the case being legally considered the delimitation between "opposite" or between "adjacent" states.[132] Furthermore, it is worth noting that the object of delimitation is not the maritime areas between the coasts concerned, but the so-called "area of overlapping entitlements, in the sense of overlap between the areas which each State would have been able to claim had it not been for the presence of the other State",[133] because unless there is an area over which all parties have an equally legitimate claims, there would be no maritime delimitation dispute.[134] It is in this sense that the ICJ held in the *North Sea Continental Shelf* cases that "The continental shelf area off, and dividing, opposite States, can be claimed by each of them to be a natural prolongation of its territory. These prolongations meet and overlap, and can therefore only be delimited by means of a median line; [⋯], such a line must effect an equal division of the particular area involved.[⋯] This type of case is therefore different from that of laterally adjacent States [⋯], whereas a median line divides equally between the two opposite countries areas that can be regarded as being the natural prolongation of the territory of each of them, a lateral equidistance line often leaves to one of the States concerned areas that are a natural prolongation of the territory of the other".[135] It is also in this sense that the Chamber of the ICJ declared that the equidistance method "is inspired by and derives from a particular equitable criterion: namely, that the equitable solution, at least prima facie, is an equal division of the areas of overlap of the continental shelves of the two litigant States."[136] Thus, the equitable criterion "that in principle, while having regard to the special circumstances of the case, one should aim at an equal division of areas where the maritime projections of the coasts of the States [⋯] converge and overla p"[137] is the object, while "equidistance [⋯] is a geometrical approach that can be used to give legal effect to this 'criterion long held to be as equitable as it is simple'".[138] It follows that the equity of equidistance depends upon whether it can achieve an equal division of the area of overlapping entitlements, referring to the area bounded by the outer limits of maritime areas to which all of the parties have entitlements on the basis of international law,[139] instead of the maritime areas between the coasts concerned.

However, where the continental shelf area to be delimited consists of two separate natural prolongations, one exceeds 200 nautical miles from the coast and the other does not, a provisional equidistance line between the coasts concerned can not effect an equal

132. *Ibid*., para.240.
133. Jan Mayen, para.59. In this judgment, the ICJ also referred to this area as the "area of overlapping potential entitlement". *Ibid*., para.19.
134. Evans, M. D. *ibid*., pp.65-66.
135. North Sea Continental Shelf, paras.57-58.
136. Gulf of Maine, para.115.
137. *Ibid*., para.195
138. Nicaragua v. Honduras, para.287.
139. Note that, the area of overlapping entitlements is different from the "area of overlapping claims", which refers to the area between the two lines representing the parties' claims. See Jan Mayen, paras.18&59.

division of the area of overlapping entitlements,[140] which is bound by the 200 nautical miles limit of the narrow-margin state, and the natural prolongation limit of the wide-margin state,[141] but "leaves to one of the States concerned areas that are a natural prolongation of the territory of the other".[142] It should be pointed out that this type of case would occur in the continental shelf delimitation not only between the adjacent coasts, but also between the opposite coasts. It is obvious that there can be no basis for the use of a provisional equidistance line as a starting point in any such delimitation, whether the delimitation is to be effected between opposite coasts or between adjacent coasts, because there is no point in beginning the process with a method that shows no *prima facie* likelihood of success in the achieving an equitable solution as required by international law.[143]

5.3 Proportionality

According to the process of delimitation indicated by the ICJ in the Black Sea case, at the final stage, the Court will resort to the disproportionality test.[144] The requirement of proportionality stems from the observations of the ICJ in the *North Sea Continental Shelf* cases, where it declared that "A final factor to be taken account of is the element of a reasonable degree of proportionality which a delimitation effected according to equitable principles ought to bring about between the extent of the continental shelf appertaining to the States concerned and the lengths of their respective coastlines".[145] It is worth noting that, at that time, proportionality was only one of the three "factors" that should be taken into account in the course of delimitation, side by side with the general configuration of the coasts of the parties, as well as the physical and geological structure of the continental shelf areas involved, but not included in "the principles and rules of international law applicable to the delimitation".[146] However, the ICJ in the *Tunisia/Libya* case singled proportionality out of the relevant circumstances, and expressly put forward the concept

140. For more discussion, see Gao, J.-J. (2009) International Rules on the Continental Shelf Delimitation, *KMI International Journal of Maritime Affairs and Fisheries*, pp.91-116.
141. Article 76, paragraph 1, of the LOS Convention provides that "The continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance."
142. North Sea Continental Shelf, para.58.
143. See the arguments of Canada against the application of the equidistance method in the St. Pierre and Miquelon case. St. Pierre and Miquelon, para.62. However, "the physical structure of the sea-bed ceases to be important when the object [···] is to establish a single, all purpose delimitation both of the sea-bed and the superjacent waters". *Ibid*., para.47.
144. Black Sea, para.122.
145. North Sea Continental Shelf, para.98.
146. *Ibid*., para.101(D).

"test of proportionality" and treated it "as an aspect of equity".[147] It follows that if the delimitation line does not bring about "a reasonable degree of proportionality" between the maritime areas appertaining to the parties and the lengths of their respective coastlines, or if the line leads to "any significant disproportionality by reference to the respective coastal lengths and the apportionment of areas that ensue",[148] it would be regarded as an inequitable result. Thus, "proportionality becomes the last stage of the test of the equity of a delimitation. It serves to check the line of delimitation that might have been arrived at in consideration of various other factors."[149]

Until now, in all of the cases where the proportionality test was resorted to, the conclusions of the international tribunals have always been that the requirements of this test had been met. This fact was mainly attributable to the flexibility of the operation concerning the proportionality test. First of all, "the identification of the relevant coasts and the relevant areas is so much at large that virtually any variant could be chosen, leading to widely different results".[150] Diverse techniques have in the past been used for assessing coastal lengths, and no clear requirements of international law have been shown in this respect.[151] Moreover, the international tribunals sometimes even did not endeavour to achieve a predetermined arithmetical ratio in the relationship between the relevant coasts and the maritime areas, but just made a broad assessment of the equitableness of the result.[152] Second, various international tribunals have drawn different conclusions over the years as to what disparity between these two ratios would constitute a significant disproportionality which suggested the delimitation line was inequitable.[153] In the light of these uncertainties, one scholar has seriously criticized that the test of proportionality is "a procedure that pretends to be scientific" from which anyone can draw "almost whatever inferences one wishes", and the figures indicated by the international tribunals "are no more and no less convincing than those put forward by the Parties".[154] He added that "It may perhaps be said that an unfavourable test is unlikely and has never occurred, but is not this precisely because the data on which the arithmetical test is based are in reality selected so as to confirm a predetermined result?"[155] And in the view of the tribunal in the *Barbados v.*

147 Tunisia/Libya, para.131.

148. Black Sea, para.210.

149. Barbados v. Trinidad and Tobago, para.240.

150. Libya/Malta, para.74.

151. Black Sea, para.212.

152. See *e.g.*, Libya/Malta, para.75; Barbados v. Trinidad and Tobago, para.376.

153. In the Tunisia/Libya case, the two ratios are 1:1.94(coastline lengths) and 1:1.5(areas), para.131; in the St. Pierre and Miquelon case, the two ratios are 1:15.3(coastline lengths) and 1:16.4(areas), para.93; in the Eritrea/Yemen case, the two ratios are 1:1.31(coastline lengths) and 1:1.09(areas), para.168; in the Guyana v. Suriname case, the two ratios are 1:1.17(coastline lengths) and 1:1.04(areas), para.392; in the Black Sea case, the two ratios are 1:2.8(coastline lengths) and 1:2.1(areas), para.215. So the variance between the two ratios ranges from 0.13 (Guyana v. Suriname) to 1.1(St. Pierre and Miquelon).

154. St. Pierre and Miquelon, (Prosper Weil, dis. op. para.24).

Trinidad and Tobago case, proportionality is "a sense of proportionality".[156] It is worth noting that even the ICJ recognized that "This checking can only be approximate,"[157] but it emphasized that "These measurements are necessarily approximate given that the purpose of this final stage is to make sure there is no significant disproportionality."[158]

Another more embarrassing question concerning the test of proportionality is what would happen if the test indicated a great disproportion between the ratio of coastline lengths and those of areas? "Would the judge or arbitrator then be bound, in order to arrive at a more proportionate result, to adjust the line which he states he has arrived at by other methods? A negative reply would deprive the proportionality test of all significance. An affirmative reply would be tantamount to converting proportionality into the dominant principle of delimitation".[159] In the *Black Sea* case, the ICJ, having calculated the ratios of the respective coastal lengths and the relevant areas, stated that "The Court is not of the view that this suggests that the line as constructed [⋯] requires any alteration".[160] Thus, it seems that the ICJ would adjust the delimitation line constructed through the first two stages in the case the line, "as it stands, lead to an inequitable result by reason of any marked disproportion".[161] Meanwhile, the Court emphasized that "The continental shelf and exclusive economic zone allocations are not to be assigned in proportion to length of respective coastlines."[162] It appears that the ICJ tries to remove the doubt on the role of proportionality in the delimitation by designing the disproportionality test as an ex post facto means to make sure that the delimitation line leads to no great disproportionality, rather than any reasonable degree of proportionality.[163] However, the question remains that how the Court is going to adjust the delimitation line constructed through the first two stages if the test of disproportionality fails. As mentioned above, until now no such a case has occurred and the ICJ has not tackled this issue either. Indeed, the fact that the test of disproportionality is designed by the ICJ as the "final stage" of delimitation[164] indicates that the Court has never envisaged that the test of disproportionality may fail in certain cases. Thus, the real role of the test of disproportionality is to evidence, rather than to "check on"[165] the equitableness of the delimitation line constructed through the first two

155. *Ibid*., para.25.
156. Barbados v. Trinidad and Tobago, para.376.
157. Black Sea, para.212.
158. *Ibid*., para.214.
159. St. Pierre and Miquelon, (Prosper Weil, dis. op. para.25).
160. Black Sea, para.216.
161. *Ibid*., para.122.
162. *Ibid*., para.211.
163. The ICJ stated that "This is not to suggest that these respective areas should be proportionate to coastal lengths" (*ibid*., para.22), and agreed with the observation that "it is disproportion rather than any general principle of proportionality which is the relevant criterion or factor" (*ibid*., para.210).
164. Black Sea, para.214.
165. *Ibid*., para.211.

stages.

Under the delimitation process of "relevant circumstances → delimitation method (delimitation line) → proportionality test", the test of proportionality, as a means of proving that the delimitation line established by the method indicated by the relevant circumstances can be considered satisfactory, may be necessary, because this process pays all of its attention to the result and does not believe in the equitable character of the method or the delimitation process, therefore confirming the equitableness of the delimitation line naturally becomes the key element for the whole delimitation operation. The reason why "A final check for an equitable outcome entails a confirmation that no great disproportionality of maritime areas is evident by comparison to the ratio of coastal lengths",[166] is mainly because the coast is "the basis of entitlement over maritime areas"[167] and equity requires that a state with an extensive coastline should not be rendered similar to a state with a restricted coastline.[168] However, under the process of "provisional equidistance line → special/relevant circumstances → delimitation line", the emphasis has been transferred from the delimitation result to the delimitation process *per se*, the resulting line is deemed to be equitable because "the equitable solution is the *result* of a delimitation process. To say that result can be changed by reference to a set of considerations by which the result alone is judged to be inequitable denies the legal nature of the process".[169] In practice, the equitableness of the delimitation line constructed under this process has been checked carefully for any relevant circumstances that might have warranted adjustment, and therefore need not be proven by the means of the proportionality or disproportionality test any more.[170]

It is worth noting that to say that the test of proportionality/disproportionality is not necessary under the process of "provisional equidistance line → special/relevant circumstances → delimitation line", is not to suggest that this delimitation process should not consider the disproportion between the lengths of the coasts of the parties. In fact, decisions of international courts and tribunals have shown that, where disparities in the lengths of coasts are particularly marked, they may "treat that fact of geography as a relevant circumstance that would require some adjustments to the provisional equidistance line to be made".[171] And this may be one reason why the ICJ in the *Libya/Malta* case, having

166. *Ibid*., para.122.

167. Barbados v. Trinidad and Tobago, para 239. The tribunal in the Guinea/Guinea-Bissau case stated that the rights which a State may claim to have over the sea are related to the coasts and to the manner in which they border this territory. Guinea/Guinea-Bissau, para 119.

168. North Sea Continental Shelf, para 91.

169. Evans, M. D. Relevant Circumstances and Maritime Delimitation, pp.86-87.

170. In this context, one may recall the statements of the arbitral court in the Anglo-French case, where the court did not consider that the adoption in the North Sea Continental Shelf cases of the criterion of a reasonable degree of proportionality "means that this criterion is one for application in all cases. On the contrary, it was the particular geographical situation of three adjoining States situated on a concave coast which gave relevance to that criterion in those cases". Anglo-French, para.99.

171. See Black Sea, para.164. Note that various international tribunals have drawn different conclusions over

moved the provisional median line northwards through 18' of latitude due to the marked disparities between the coastal lengths of the parties, could conclude that the delimitation result "met the requirements of the test of proportionality".[172]

6. Conclusions

The essence of the maritime delimitation process is the delimitation methodology, and the evolution of the delimitation process reflects the development of international rules on maritime delimitation. Recently, international tribunals tend to follow a uniform process for delimitation, that is, first drawing an equidistance line, then considering whether there are factors calling for the adjustment or shifting of that line in order to achieve an equitable result, whether they are called upon to delimit the continental shelf or EEZ, or to draw a single delimitation line, whether the delimitation is to be effected between opposite coasts or between adjacent coats, or whether the delimitation is governed by the customary law, Articles 74/83 of the LOS Convention, or by Article 6 of the 1958 Convention. However, the ultimate goal of maritime delimitation is to achieve an equitable solution, which is the requirement of international law and is of higher rank than the application of equidistance. Where equidistance can not contribute to effecting an equal division of the area of overlapping entitlements, which would happen in some continental shelf delimitation, it is not appropriate to start the delimitation by a provisional equidistance line, because this line will leave to one of the states concerned areas that are a natural prolongation of the territory of the other. This type of case may occur in the delimitation between adjacent coasts as well as between opposite coasts. Besides, the physical geography in a particular case may also make the application of a provisional equidistance line unfeasible.

The role of the relevant circumstances in delimitation has changed from indicating the delimitation method to verifying that the result of the application of the provisional equidistance line is not, in light of the particular circumstances of the case, perceived as inequitable, and, if necessary, to modifying the provisional line. Thus, the relevant circumstances under customary law tend to be assimilated to the special circumstances of

---

the years as to what disparity in coastal lengths would constitute a marked disparity. *Ibid*., para.213. For example, in this case, though the ratio of the coastal lengths of the parties is approximately 1:2.8 (Romania: Ukraine), "however, the Court sees no such particularly marked disparities between the relevant coasts of Ukraine and Romania that would require it to adjust the provisional equidistance line at this juncture. Although there is doubtless a difference in the length of the relevant coasts of the Parties, the Court [⋯] cannot disregard the fact that a good portion of the Ukrainian coast which it considers as relevant projects into the same area as other segments of the Ukrainian coast, thus strengthening but not spatially expanding the Ukrainian entitlement". Black Sea, paras.215&168.

172. Libya/Malta, para.78. In this case, the ratio of the coastal lengths of the parties is 1:8 (Malta:Libya). *Ibid*., para.68.

Article 6 of the 1958 Convention.

The role of the test of proportionality or disproportionality is to prove, rather than to check, the equitableness of the delimitation line constructed upon other factors. Where an equidistance line is used as the starting point of the delimitation, it is not necessary to resort to the test of proportionality at the final stage, because the equitableness of the delimitation line constructed upon equidistance has been checked carefully for any relevant circumstances that might have warranted adjustment, though the marked disparities in the lengths of coasts may be treated as a relevant circumstance.

To sum up, the general process of international maritime delimitation should be: "provisional equidistance line → relevant/special circumstances → delimitation line".

References

Arbitration between Guyana and Suriname, Arbitral Tribunal constituted pursuant to Article 287, and in accordance with Annex VII, of the United Nations Convention on the Law of the Sea, Arbitration Award of 17 Sep. 2007.

Bravender-Coyle, P. (1988) The Emerging Legal Principles and Equitable Criteria Governing the Delimitation of Maritime Boundaries between States. *Ocean Development and International Law* 19(3), pp.171-227.

Case between Barbados and the Republic of Trinidad and Tobago, Arbitral Tribunal constituted pursuant to Article 287, and in accordance with Annex VII, of the United Nations Convention on the Law of the Sea, Arbitration Award of 11 Apr. 2006. *RIAA* 27, pp.147-251.

Case concerning Maritime Delimitation and Territorial Questions between Qatar and Bahrain. *ICJ Reports 2001*, p.40.

Case concerning the Delimitation of the Continental Shelf between the United Kingdom of Great Britain and Northern Ireland, and the French Republic, Decision of 30 Jun. 1977, reprinted in 18 ILM 397 (1979)

Case concerning the Land and Maritime Boundary between Cameroon and Nigeria (Cameroon v. Nigeria: Equatorial Guinea Intervening), *ICJ Reports* 2002, p.303.

Continental Shelf (Tunisia/Libya), ICJ Reports 1982, p.18.

Continental Shelf (Libya/Malta), ICJ Reports 1985, p.13.

Convention on the Territorial Sea and the Contiguous Zone, done on 29 Apr. 1958 and entered into force on 10 Sep. 1964. United Nations, *Treaty Series* 516, p.205.

Convention on the Continental Shelf, done on 29 Apr. 1958 and entered into force on 10 Jun. 1964. United Nations, *Treaty Series* 499, p.311.

Delimitation in the Gulf of Maine (Canada/U.S.), *ICJ Reports* 1984, p.246.

Delimitation of the Maritime Areas between Canada and France, Award of 10 Jun. 1992, reprinted in 31 ILM 1145 (1992)

Dallmeyer, D. G. and L. DeVorsey (1989) (eds.) Rights to Oceanic Resources: Deciding and Drawing Maritime Boundaries. Netherlands: Martinus Nijihoff Pubulishers.

Eritrea-Yemen Arbitration (Second Stage: Maritime Delimitation), Permanent Court of Arbitration, Award of 17 Dec. 1999, reprinted in XL ILM 983 (2002)

Evans, M. D. (1989) Relevant Circumstances and Maritime Delimitation. Clarendon Press, Oxford.

Frontier Dispute Case (Burkina Faso/Mali), *ICJ Reports* 1986, p.554.

Guinea/Guinea-Bissau Maritime Delimitation Case, Decision of 14 Feb. 1985, reprinted in 77 International Law Reports 636 (1988)

Maritime Delimitation in the Area between Greenland and Jan Mayen (Den. v. Nor.), *ICJ Reports* 1993, p.38.

Maritime Delimitation in the Black Sea (Romania v. Ukraine), Judgment of 3 Feb. 2009,

ICJ Reports 2009, p.61.

North Sea Continental Shelf (FRG/Den.; FRG/Neth.), *ICJ Reports* 1969, p.3.

Territorial and Maritime Dispute between Nicaragua and Honduras in the Caribbean Sea (Nicaragua v. Honduras), Judgment of 8 Oct. 2007, *ICJ Reports* 2007, p.659.

United Nations Convention on the Law of the Sea, opened for signature on 10 Dec. 1982 and entered into force on 16 Nov. 1994

Pollution in paradise: A conceptual model of beach pollution and tourism

- Links between beach pollution and tourism -

Karen Dyson*

Received November 16, 2010; accepted December 23, 2010

ABSTRACT

The beach has traditionally been viewed as a place of recreation and healing, however pollution from marine debris is increasingly becoming a problem. A potential paradox is created where more attractive sites become more popular and subsequently more degraded due to pollution, which degrades the quality of experience. Although many studies have identified this as an issue, it is unknown how visitors, pollution, and other factors interact with one another. Here the Broker-Local-Tourist (BLT) model is used as a basic framework in an attempt to explore the interactions between tourism and beach pollution. What emerges is a rich description of the different groups contributing to beach pollution, and how this pollution impacts them in turn. This place-based conceptual model provides a useful tool for examining interactions between pollution and tourism and illuminates potential avenues for developing effective pollution prevention measures and avenues for future research.

Key words: marine debris, nature-based tourism, conceptual model, beach pollution, Broker-Local-Tourist (BLT) model

* PhD. Candidate, University of Washington, Box 355740, Department of Urban Design and Planning, Seattle, WA. 98195-5740 E-mail: kld36@u.washington.edu

1. Introduction

Since ancient times, the beach has been viewed as a place for recreation and healing. Modern ideas of the beach can be traced back to 19th century England, when a day trip or summer at the beach became an institution. In much of the modern world, beaches provide not only an important escape but also a crucial source of tourism revenue for beach communities.

However, tourists' beach experiences can be negatively impacted by modern pollutants including plastics and styrofoam. Rapid increases in population and the intensity of recreational beach use compound pollution issues and threaten the attractiveness of recreation areas (Sun and Walsh, 1998; Gregory, 1999). The paradox that beautiful locations attract tourists, who subsequently degrade the location leading to its abandonment as a desirable location has been noted by a number of writers (*e.g*, Gregory, 1999). In summary,

> *The exponential growth of tourist numbers and their spread to previously quite remote regions of the world has highlighted the potentially paradoxical character of nature-based tourism. The more attractive a site (usually due to its rich biological and/or cultural values), the more popular it may become, and the more likely it is that it will be degraded due to heavy visitation, which in turn may diminish the quality of the experience. Many studies have identified this as an issue of concern, yet it is still unclear how the various factors interact with each other, or indeed whether one necessarily leads to another. (Hillery et al., 2001)*

Unfortunately, the problem is accelerating. Between 1994 and 1998 it has been shown that the debris on the coast of the UK doubled and increased 100 fold in parts of the Southern Ocean.

This paper lays out a framework that can be used to holistically examine the interactions between marine debris and tourism, as well as the impacts they have on each other. Using a broad literature review and building on Miller and Auyong's Broker-Local-Tourist (BLT) model, the conceptual model developed here begins to address the question of "how the various factors interact with each other" (Miller *et al*., 1999; Hillery *et al*., 2001).

2. Starting point

The conceptual model developed here builds on the Broker-Local-Tourist Model developed by Miller and Auyong (Miller *et al*., 1999), and adapts it to focus on a particular issue (beach pollution) in a specific place (a beach). The model's components are briefly explained here to provide context for the model.

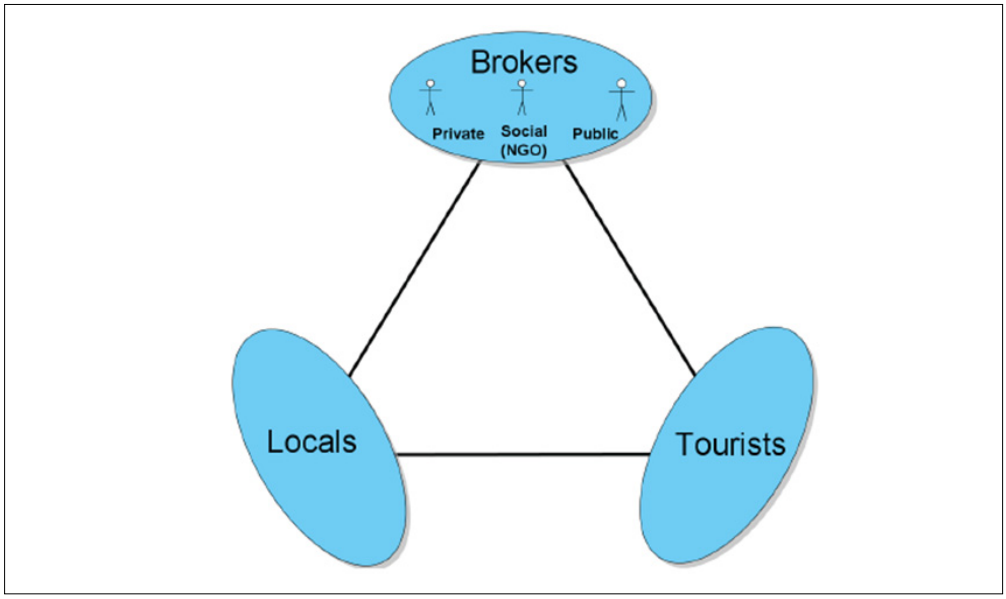
2.1 Beach pollution

Beach pollution as defined here as any item that appears on beaches as the result of man's activity (following Sommerville, 2003). Beach pollution is largely derived from three sources, litter deposited on the beach, litter deposited on land that makes its way to the beach, and marine debris that washes onto the beach (*e.g*. Willoughby *et al*., 1997; Somerville, 2003). Here, litter is defined as solid waste that is discarded by humans, including material that has been discarded illegally. Marine debris is defined as "any man-made object discarded, disposed of, or abandoned that enters the coastal or marine environment" (NOAA, 2007). For the purposes of this model, the term marine debris will be used to refer to all persistent solid waste in coastal or marine ecosystems, beach litter will be used to refer to solid waste, both organic and non-organic, on beaches, and litter will be used to refer to illegally dropped waste, generally in urban areas.

It should be understood that all three terms are referring to essentially the same waste materials, just in different locations. These include plastics of all shapes and sizes, glass, metal, Styrofoam, pieces of wood products, rubber, derelict fishing gear, and derelict vessels, along with items found in storm water discharge such as syringes and cigarette butts (Cho, 2005; Shiomoto and Kameda, 2005; NOAA, 2007; Willoughby, 1997; Santos *et al*., 2005).

2.2 Broker-Local-Tourist model

Miller and Auyong's Broker-Local-Tourist model (Figure 1) classifies the components of a tourism system into three groups. *Brokers* are those who are professionally involved in the tourism industry, and consist of *private sector brokers*, those who belong to the tourism industry, *public sector brokers* who regulate, legislate, and plan for tourism, and *social movement brokers* (or NGO brokers), who address tourism issues from outside the government and industry (Miller *et al*., 1999). Brokers are neither uniformly for or against tourism, and broker-broker conflicts are very common (Miller *et al*., 1999).



Source: Miller *et. al.* (1999)

Figure 1. The Broker-Local-Tourist model

Locals are those who reside in the same community or district where tourism occurs, however their income does not come from the tourism industry (Miller *et al*., 1999). This group may consist, for example, of teachers, fishermen, or store clerks. Different local groups may be affected by tourism in different ways, and may hold different opinions concerning tourism.

Tourists are those who travel to a location for a relatively short period of time, either for business, recreation, or education (Miller *et al*., 1999). The tourists of a beach environment are involved in activities on the beach itself, and activities in the near-shore waters such as swimming, wading, recreational fishing, and recreational boating. Tourist subgroups include recreational boaters and fishermen and beach users. Here, anyone who is involved in recreational activities on the beach or marine environments is considered tourists, even if they would otherwise be considered locals. Although generally locals participating in beach recreation would still be considered locals, the pollution impacts that this group has on the beach and marine environment while recreating are fundamentally different than in the normal course of their life. Therefore, it is thought necessary that recreating locals be considered tourists for the purposes of this study.

3. Literature review

The conceptual model developed here is based on the available literature. Issues identified in the literature addressed four different questions: first, how do people contribute to marine debris and beach litter, and second, how does marine debris and beach litter affect people? This pattern emerged quickly and created the framework of two-way interactions for the model. Further, it became apparent from the literature that each of the local and tourist groups would need to be subdivided based on the different ways these groups contributed to and were affected by marine debris. Third, the literature identifies a number of factors unique to a specific beach that influence the degree of beach pollution. Finally, some of the literature was focused on mitigating people's contribution to marine debris and beach litter or reducing the impact that this pollution had on people. These three main discussions in the literature are summarized here and provide the framework for the conceptual place based tourism model developed.

3.1 How do beach brokers, locals, and tourists contribute to marine debris and beach litter?

Marine debris comes from four major sources: recreation and tourism litter, sewage related debris, fishing debris, and shipping waste (Somerville, 2003). The majority of marine debris originates from land-based sources. One study found that in 7 of 9 locations surveyed the major source of pollution was land based (Topping, 2000). A brief overview of the contributions of brokers, locals, and tourists to marine debris and beach litter can be found in Table 1.

Table 1. The contributions to beach litter and marine debris by brokers, locals, and tourists found in the literature

BLT model component	Contribution to beach litter and marine debris
Brokers	
Private brokers	Sewage waste and construction debris from land based private brokers (Green, 2005; Hall, 2001; Martinez-Ribes *et al*., 2007)
	Garbage and discarded fishing gear from broker led recreational boating and fishing and the cruise ship industry (Klein 2003)
Public brokers	Poor legislation, enforcement, urban planning, and sewer maintenance (de Araujo and da Costa, 2007; Green, 2005; Ofiara and Brown, 1999)
NGO brokers	Unknown
Locals	
Local residents	Garbage can become storm water discharge, sewage overflow, or landfill runoff (Allsopp, 2006)
Local industry	Construction materials from development sites, hand cleaning and air-blasting media particles, other manufacturing materials (Martinez-Ribes *et al*., 2007; Derraik, 2002)
Local fishermen	Fisheries: Abandoned or lost fishing gear, garbage (Oigman-Pszczol and Creed, 2007) Aquaculture: Styrofoam used for buoyancy and other materials (Cho, 2005)
Local boaters	Solid waste lost overboard
Tourists	
Beach tourists	Disposal of food containers, cigarettes, and other materials on the beach (Allsopp *et al*., 2006)
Recreational boaters	Garbage discarded or lost overboard (Backhurst and Cole, 2000; Gregory, 1999)
Recreational fishermen	Garbage and fishing gear discarded or lost overboard (Allsopp *et al*., 2006)

3.1.1 Contributions from brokers

Land-based private sector brokers, such as those running hotels, restaurants, and other beach-side attractions are a major source of beach litter and marine debris. For example, in Thailand hotels have caused local rivers to become excessively polluted with waste due to an artificial lagoon constructed for the benefit of tourists (Green, 2005). Additionally, some hotels have in-house sewage systems which can back up and discharge into nearby bodies of water during heavy rain (Hall, 2001; Green, 2005). The construction of hotels and other development can also create marine debris (Martinez-Ribes *et al*.., 2007).

Private sector brokers can also run recreational boating, fishing, and other water-based experiences. These activities can contribute significantly to marine debris and beach litter though accidental or purposeful loss of waste and fishing equipment. Additionally, cruise ships release large quantities of solid waste every day, including some particles of incinerated plastics and larger items of marine debris lost overboard (Klein, 2003). This is a large source of marine debris, and greatly contributes to beach litter when cruise ships are in ports or shallow water.

Public sector brokers can contribute to marine debris and beach litter indirectly through poor legislation and enforcement. The lack of urban planning in sea-side urban centers has been blamed for the creation of beach litter and marine debris (De Araujo and da Costa, 2007; Green, 2005). Landfill runoff may be more likely because of improper siting which places the landfill near a body of water. Through poor maintenance and planning, public brokers can increase the amount of sewage and wastewater that overflow into local bodies of water. In New Jersey, as in many other locales around the world, waste water from sewage treatment plants contaminates beaches due to old or faulty equipment or poor management practices (Ofiara and Brown, 1999).

NGO brokers are not generally thought of as sources of marine debris and beach litter. However it is possible that their outreach activities could contribute to pollution. In a case examined later, it was found that distributing pamphlets describing the effects of marine debris and beach litter and plastic bags for tourists to place their trash in only exacerbated the beach litter problem.

3.1.2 Contributions from locals

Locals, or those not directly connected to beach tourism but who live in the beach community, contribute to marine debris in two major ways. The first is through litter thrown away in the street that is washed into the ocean, and the second is through sewer waste.

Some municipalities have storm drain systems designed to carry rain water to the nearest body of water. Heavy rains wash litter from the streets into the ocean these systems (Allsopp, 2006). Locals' garbage can also be washed from landfills into oceans during heavy rain events (Allsopp, 2006). Other municipalities have combined sewer systems designed to carry sewage and storm water. In heavy rain events, these systems can be pushed beyond capacity, leading to untreated sewage waste as well as street litter being discharged. This is a major source of land-based marine debris (Allsopp, 2006).

Local industry can also contribute to marine debris. Construction material, such as bricks or plastic tubes, is a frequent component of marine debris in areas that are being developed, and in these areas it can be a major input (Martinex-Ribes *et al*., 2007). Some local industries may use cleaning media that consists of very small particles which always pass through sewage treatment and into the oceans (Derraik, 2002). Additionally, local production facilities can release various plastics and other manufacturing materials.

Local fishermen contribute to beach litter and marine debris through abandoned or lost fishing gear and waste that is lost overboard (Oigman-Pszczol and Creed, 2007). Although MARPOL Annex V prohibits dumping, the ease of this disposal method leads some to think that it will persist far into the foreseeable future (Gregory, 1999). Local aquaculture operations can contribute Styrofoam, which is used for buoyancy, as well as other materials (Cho, 2005).

3.1.3 Contributions from tourists

Tourists, both local and from out of town, are a major source of beach litter (Topping, 2000). While the exact percentage depends on the beach, one study found that approximately 70% of beach litter could be attributed to beach users (Ivar do Sul and Costa, 2007). Tourists themselves realize this; individual beach users attribute beach litter to beach users as a group, although individuals are unlikely to admit littering (Santos, 2005; Hillery *et al*., 2001; Priskin, 2003). Beachgoers often leave food and drink packaging, as well as plastic beach toys and cigarette butts on the beach (Allsopp, 2006). Recreational fishing gear is also commonly left as litter.

Tourists participating in recreational boating or aboard cruise ships also contribute significantly to beach litter and marine debris. Items such as food packaging, plastic bags, and fishing gear are often 'lost' overboard, either purposefully or inadvertently (Allsopp, 2006). In New Zealand, recreational boaters were found to be the major source of marine debris in some areas (Backhurst and Cole, 2000). Further, recreational boaters are notorious for being unaware of the MARPOL Annex 5 regulations regulating marine disposal of waste (Gregory, 1999).

Tourists can also contribute to marine debris through street litter and sewer waste as discussed in the previous section.

3.2 How does beach litter and marine debris affect components of the BLT model?

As beach tourism is so closely tied to beach aesthetics "the greatest impact associated with visual pollution, such as beach litter, is … the economic loss associated with the reduction of amenities" (Tudor and Williams, 2006).Obviously, these amenity reductions affect the bottom line of private brokers and the enjoyment of the tourist. However, these negative effects also affect public brokers and locals through reduced community income and depleted fish stocks.

It is possible that marine debris and beach litter could have positive effects as well. Unfortunately, very few examples of positive impacts occur in the literature. It is unknown if this is because there are no documented cases, or if no researcher has made this a field of inquiry. A brief overview of the effects of beach litter and marine debris on brokers, locals, and tourists can be found in Table 2.

Table 2. The effects on brokers, locals, and tourists attributed to beach litter and marine debris in the literature

BLT model component	Effect of beach litter and marine debris
Brokers	
Private brokers	Reduced tourist visits, reduced revenue, damage to resort image, costs incurred from beach clean-ups (Tudor and Williams, 2006; Ballance *et al*., 2000)
	Damage to propellers, shafts and engine failure, and maritime accidents caused by marine debris (Gregory, 1999; Cho, 2005)
Public brokers	Costs incurred from beach clean-ups of municipal beaches and marine areas, damage to public broker boats such as ferries, accidents caused by marine debris (Topping, 2000; de Araujo and de Costa, 2007; Somerville *et al*., 2003; Gregory, 1999; Cho, 2005)
NGO brokers	Unknown
Locals	
Local residents	Depressed economy from reduced tourism revenue, reduced fish consumption, possible intangible costs, health and safety hazards (Ofiara and Brown, 1999; Tunstall and Penning-Rowsell, 1998; Gregory, 1999; Ivar do Sul and Costa, 2007)
Local industry	Unknown
Local fishermen	Fisheries: Reduced catches, vessel and equipment damage, lost hours from marine debris buildup (Gregory, 1999; Ofiara and Brown, 1999; Ivar do Sul and Costa, 2007; Cho, 2005; Somerville *et al*., 2003) Aquaculture: Unknown
Local boaters	Vessel damage (Gregory, 1999)
Tourists	
Beach tourists	Reduction in beach enjoyment, health and safety hazards (Gregory, 1999; Ivar do Sul and Costa, 2007; Ofaria and Brown, 1999; Backhurst and Cole, 2000; Santos *et al*., 2005)
Recreational boaters	Vessel damage (Gregory, 1999; Topping, 2000)
Recreational fishermen	Lower catch per hour or trip, reduced enjoyment, increased travel costs, lower quality or safety (Ofiara and Brown, 1999; Gregory, 1999)

3.2.1 Impacts on brokers

Many studies have found that clean beaches are one of, if not the, most important factor to tourist beach selection and enjoyment. “Tourists associate the presence of wastes along the coasts with polluted beaches and poor water quality, and hence littered beaches are a major deterrent to tourism” (Martinez-Ribes *et al*., 2007). In Wales, for all 19 beaches studied, ‘clean litter-free sand’ and ‘clean water’ were the first and second most important factors in beach selection (Tudor, 2006). These results have been mirrored for beaches with a wide variety of characteristics in England (Tunstall, 1998), South Africa (Balance *et al*., 2000), and Brazil (Santos *et al*., 2005), among others.

In South Africa, 85% of both out of town tourists and local tourists would avoid visiting beaches with more than 2 items of litter per square meter, and 97% of visitors would avoid visiting if the beach had more than 10 large items per square meter (Ballance *et al*., 2000). As a result, areas that are dependent on tourism can face serious hardship due to beach litter pollution (Oigman-Pszczol and Creed, 2007). It should also be noted that local tourists, even more so than out of town tourists, are very sensitive to information about beach degradation (Tunstall, 1998).

The effects of these aesthetic preferences include "a loss of tourist days producing damage to the leisure and tourism infrastructure; damage to commercial activities, *e.g*. fisheries, dependent on tourism; and damage to the resort image" (Tudor and Williams, 2006). Furthermore, if the media reports on a marine debris wash-up event, beaches that are not affected by the event will also see reduced visitation numbers and lost revenue (Ofiara and Brown, 1999).

Public and private brokers, such as municipal beaches or beach resorts, are often required to clean beaches of beach litter frequently to continue attracting tourists. This results in much higher maintenance costs, as beach cleaning is quite expensive. In South Africa, cleaning costs for the Cape Metropolitan area for 1994-5 was R3.5 million, which is very expensive when compared to the value of these beaches (Ballance *et al*., 2000). These efforts have since increased in scope and cost (Ballance *et al*., 2000). Publicly owned community beaches and local and national parks − all the responsibility of public brokers − are also subject to increased maintenance costs which the community must pay for (Topping, 2000; de Arajo and de Costa, 2007; Somerville *et al*., 2003).

Boating accidents have also been caused by marine debris, impacting public and private brokers who are boating operators, as well as local commercial boaters and trade fishermen and boating tourists (Gregory, 1999). Fishing gear discarded by local fishermen can become entangled in a boat's propellers or shafts, causing engine failure (Cho, 2005). In Korea, 204 maritime accidents occurred between 1996 and 1998 as a direct result of marine debris, and England reported 180 cases of marine debris fouling propellers during 1998 (Cho, 2005). In one particularly dramatic example, marine debris entangled both shafts and the right side propeller of an overloaded ferry, contributing to the vessel capsizing and sinking, resulting in 292 deaths (Cho, 2005). One harbor, trying to avoid accidents such as these, spent 15,000 GBP per year clearing the harbor of floating debris (Cho, 2005).

3.2.2 Impacts on locals

When marine debris and beach litter cause tourists to avoid private brokers, as mentioned above, it negatively impacts the economy of tourism dependent communities. As a result, local businesses are often harmed, even if they are not directly involved in the tourism industry (Ofiara and Brown, 1999). This phenomenon is known as 'multiplier effects' (Ofiara and Brown, 1999).

Local fishermen who rely on populations of near-shore fish for their livelihood are very vulnerable to events which harm their fish stocks (Gregory, 1999; Ofiara and Brown, 1999; Ivar do Sul and Costa, 2007). Fisheries can be harmed through "outright mortality, loss of fish habitat and spawning grounds, and decreases in recruitment and gain in weight" (Ofiara and Brown, 1999). Ghost fishing caused by local fishermen's discarded nets can also cause high mortality of commercially valuable species. In Korea, 200 kg of king crab was found in derelict nets in one harbor (Cho, 2005). Fish stocks harmed in this way will result in fishermen catching fewer fish, resulting in decreased incomes and possibly economic hardship.

Catches can also be contaminated with marine debris, resulting in persistent difficulty with debris accumulation in nets, catches contaminated with debris, and nets snagging on debris (Cho, 2005). Additionally, the fishing industry can suffer financial losses due to fishing vessel damage and equipment damage, as well as the lost fishing time that results (Somerville *et al*., 2003). Shellfish fisheries may need to be completely shut down if a health hazard is suspected. Furthermore, locals who own boats, even if they are not fishermen, are subject to the hazards of marine debris as described in the brokers section (Gregory, 1999).

Similarly, locals who enjoy dining on locally caught fish, and especially shellfish, are faced with safety issues if, sewage contaminates local waters or the marine debris contains medical waste (Ofiara and Brown, 1999). This can in turn reduce the prices that locals are willing to pay for local seafood, further depressing local economies (Ofiara and Brown, 1999).

It is also possible that locals, and possibly tourists as well, will find that the devaluation of the beach goes beyond any lost community income or reduced enjoyment of beach facilities. The existence value − the pleasure derived from knowing something exists − along with the other intangible benefits of a clean beach is something that no study has yet examined.

3.2.3 Impacts on tourists

When marine debris and beach litter make beaches unpalatable, tourists are harmed because their beach experiences are less enjoyable (Ofaria and Brown, 1999; Backhurst and Cole, 2000). This is especially true when beach litter is sewage derived, or is perceived to be sewage-derived even if it is not (Tunstall, 1998). Even at urbanized beaches, the illusion of being in and interacting with a 'natural' litter free environment is very important (Tunstall, 1998). The reactions people have to high levels of beach litter can be very strong. Some of the comments taken from a logbook in New Zealand, for example, read "…feel sickened by the sight of so much plastic and glass pollution on the beach…" and "pollution disturbing" (Gregory, 1999).

This loss of enjoyment derived from the beach experience can be approximated using willingness to pay studies. These studies determine the amount a consumer, or in this case tourist, would be willing to spend to increase the quality of the beach they are visiting. Estimates of this range quite a bit, and are often tied to tourist's incomes and other complex factors, but one estimate put the value of a linear foot of clean beach at 14$/year (Cho, 2005).

The impacts on tourist beachgoers can also be more physical − 30% of beach users surveyed had suffered problems caused by beach litter, mostly from cutting themselves on glass and other sharp materials (Santos *et al*., 2005). The incidence of human diseases, along with general public health, has also been tied to beach litter and marine debris (Gregory, 1999; Ivar do Sul and Costa, 2007). These matters affect both tourists and locals.

Recreational boaters, like local fishermen, are affected by marine debris when it clogs boat's water intakes, blocks pumping systems, or fouls boat propellers (Topping, 2000).

Recreational fishers, also like local fishermen, are affected when fish stocks suffer due to marine debris (Ofiara and Brown, 1999). Fewer fish in the water means fewer fish caught per hour or per trip, greatly reducing the pleasure of fishing (Ofiara and Brown, 1999). Faced with this situation, some recreational fishermen either reduce the number of trips they take, or stop fishing in the affected location (Ofiara and Brown, 1999). If they choose to fish in alternate locations, they may face increased travel costs (Ofiara and Brown, 1999). Recreational fishermen will also reduce the number of fishing trips they take if the quality and safety of fish are negatively impacted (Ofiara and Brown, 1999).

3.3 What characteristics of a specific beach affect beach pollution?

A number of factors modify the amount of litter found on a beach. As mentioned earlier, the distance to urban centers is a major factor in beach litter amount. The distance of a beach from a population center is a major factor influencing the quantity of litter on a beach (Wlloughby *et al*., 1997; Cho, 2005; Oigman-Pszczol, 2007; Martinez Ribes *et al*., 2007). The distance to a tourist center is also a major factor (Santos, 2005). In Brazil as well as the UK, most beach litter derives from beachgoer activities and recreational boats (Willoughby *et al*., 1997; Oigman-Pszczol and Creed, 2007). Which of these factors influences a particular beach more is generally dependent on the specific properties of the beach in question.

The relative abundance and origin of beach litter can change seasonally. In fact, in Brazil, beach litter in the summer is entirely tourist derived, whereas in the winter, when there are no tourists, beach litter is fishing derived (Santos, 2005).

The volume of people using beach resources and the intensity of this use is often a key determinant of litter volume (Backhurst and Cole, 2000; Sun and Walsh, 1998).

In Brazil, it was found that the amount of litter generated in all areas increased with the number of tourists and litter generation was highest on the weekends (Santos, 2005; Oigman-Pszczol and Creed, 2007). In the Balearic Islands, beach litter abundance was shown to parallel hotel occupation, a measure of tourist activity and beach usage (Martinez-Ribes *et al*., 2007).

Beach litter composition depends greatly on the habits of locals and tourists. Social attitudes and behaviors of beach users are a predominant influence on the composition of beach litter (Oigman-Pszczol and Creed, 2007). The level of education also influences beach litter generation. In the UK, litter generation per person was much lower than in Indonesia because of local knowledge of the effects of litter (Willoughby *et al*., 1997). There is also a socioeconomic component to the type of beach litter (Oigman-Pszczol and Creed, 2007; Santos *et al*., 2005). Between two adjacent beaches studied, litter generation was higher at the beach with lower income and education for any density of people (Santos *et al*., 2005).

Beach litter is also a function of physical factors such as "beach dynamics, oceanic circulation patterns, weather, and debris characteristics" (Oigman-Pszczol and Creed, 2007). Currents strongly affect the deposition of marine debris on beaches. In Japan, marine debris is more dense in southern Japan than in the north, due to differences in the current patterns (Shiomoto and Kameda, 2005). The windward shores of beaches generally have higher levels of marine debris pollution than the leeward side (Gregory, 1999). The effects of El Nino have been found to also greatly increase marine debris accumulation patterns (Morishige, 2007). Additionally, larger beach widths and dense vegetation retain beach litter more effectively, which results in higher densities (de Araujo and da Costa, 2007). Beaches that are composed of pebbles as opposed to sand are more likely to accumulate small litter as it can easily fall deep into the substrate, and these beaches are also impossible to clean mechanically (Martinez-Ribes *et al*., 2007).

3.4 What actions have been proposed to mediate the relationship between brokers, tourists, and locals and the environment?

The consequences of beach litter on brokers, locals, and tourists alike will provoke action on behalf of each of the groups which will impact the others. Beach litter and marine debris reduction requires three steps: "first to identify the sources of waste, second to identify practical alternatives, then third to implement them" (Topping, 2000). However, because there are so many possible courses of action, only a few of the most commonly recommended ones are described here, along with the 'typical' relationship between brokers, locals, and tourists that the method represents. It is important to remember that there is no panacea; although each planning or policy process has been found to work in some locations, the specific conditions and institutions of a region will determine the end result (Hall, 2001).

3.4.1 Clean-up initiatives (often broker or local organized, all can participate)

Beach clean-up programs are often used to improve the aesthetic appearance of beaches. However, although necessary, simply collecting litter is not only expensive, but ineffective and only a stop-gap reactive measure (Santos *et al*., 2005; Oigman-Pszczol and Clark, 2007). Community led beach clean ups focus only on larger more visible debris and do not always produce statistically significant declines in beach litter (Oigman-Pszczol and Clark, 2007). Repeated intensive beach cleanings are necessary to maintain acceptable aesthetic standards, and even these measures will not remove small litter particles (Somerville *et al*., 2003). Furthermore, cleared beaches regain beach litter at an alarming rate, even if the only source is from ocean transport. A beach in Panama took only three months to regain 50% of the original beach litter load (Derraik, 2002). The disposal on land of litter removed from beaches is also a consideration, as it can be hard to incinerate and quite heavy (Cho, 2005).

3.4.2 Educational mitigation (brokers → locals and tourists)

Because of the inefficiency and the high cost of beach cleaning, measures that prevent litter are likely to be more effective in the long run. Locals, in conjunction with private and public brokers as well as tourists, should instead work to reduce the amount of litter entering the beach ecosystem (Oigman_Pszcol and Clark, 2007). That is not to say that beach and marine debris removal programs are not necessary. These measures are useful in removing waste that has already accumulated, or that accumulates as a result of outside forces.

To progress beach litter and marine debris control policy it is necessary to identify the main sources of pollution (Williams *et al*., 2002. With the source of pollution identified, those actors contributing to beach litter and marine debris can be identified and targeted with education (Williams *et al*., 2002). Beach and port authorities could also use this information to create legislation and action plans to prevent pollution in their jurisdictions (Williams *et al*., 2002).

Tourist education has been proposed by many researchers as a method to reduce litter generation, and some even suggest that it should form the basis of a beach litter and marine debris management program (Priskin, 2003; Santos *et al*., 2005). It is argued that education will have long-term effects, especially if children are targeted in volunteer beach clean-ups to encourage life-long litter responsibility through education (Santos *et al*., 2005; Derraik, 2002). Most importantly, education needs to address the 'throw away' mentality of today's society (Ballance, 2000).

Tourists, especially those who feel that they are part of the problem, or have lower levels of environmental education, are often very receptive to beach litter and marine debris education (Priskin, 2003). Education should also be targeted at socio-economic groups that

are more likely to pollute, such as those with lower incomes and education levels (Santos *et al*., 2005).Those tourists who are most interested in learning about beach litter and marine debris problems likely are already knowledgeable about environmental problems (Priskin, 201, 2003). However, they may not know exactly how their actions are impacting the environment they are visiting and improvements to their behavior could certainly be made (Priskin, 2003).

Littering is acceptable behavior in many communities, and since these activities are a major source of marine debris, these attitudes need to be changed (Topping, 2000). Communities could develop programs that work with people's natural tendencies in order to manipulate and change them for the better (Topping, 2000). Most locals and tourists will resist solutions that require extra effort; therefore it is imperative that solutions be tailored with convenience in mind. Incentives, financial or otherwise, will also influence people to act in a manner that reduces marine debris (Topping, 2000). Beachgoers may contribute to marine litter mainly because there are poor disposal practices, and recommend that communities act to enforce environmental protection and management policies (Oigman-Pszczol and Creed, 2007). These actions would require public brokers, in conjunction with locals and private brokers, to institute guidelines suggesting the placement of garbage cans, signs or programs explaining the importance of preventing litter to tourists.

Distributing plastic bags for waste collection or pamphlets that describe the detrimental effects of littering, however, have been found to be counterproductive. These items which are meant to prevent litter often become litter themselves, only increasing litter generation by beachgoers (Santos *et al*., 2005).

3.4.3 Grading systems (public brokers/NGOs → private brokers)

In the UK, the National Aquatic Litter Group (NALG) has proposed a beach grading system, which they believe would help with public awareness and beach management (Somerville *et al*., 2003). This system would require regular surveys of beach litter, the result of which is an A-D letter grade for the beach (Somerville *et al*., 2003). The hope is that this system will be easier for the general public to understand, and therefore have more meaning and educational value (Somerville *et al*., 2003). It is also thought that having a grade posted at a beach will lead to more responsible beachgoers and less beach litter generation (Somerville *et al*., 2003). Furthermore, because of the specifics of the grading protocol, this system also has the potential to aid management in identifying the sources of beach litter and therefore targeting problem groups specifically, as well as evaluate the progress of management plans (Somerville *et al*., 2003).

3.4.4 Economic methods (public broker → brokers, locals, and tourists)

Local governments within a region will need to work with each other in order to reduce marine debris. For example, marine debris can originate on land, and wash into

the marine system. In Korea, local governments have set up a program in which marine debris generating inland communities help pay the clean-up costs for coastal communities to remove and dispose of marine debris (Cho, 2005).

Additionally, it is necessary to remove derelict fishing gear because it can entangle local fishermen's nets and compound the problem (Cho, 2005). To this end, Incheon City in Korea has implemented a program that financially rewards local fishermen who retrieve and turn in marine debris collected during fishing (Cho, 2005). Although somewhat slow to catch on, this program has resulted in reduced marine debris and cost savings for the local government, who pay the fishermen a fraction of what it would cost the government to collect the debris (Cho, 2005). Governments will also need to make sure that their waste disposal policies account for the disposal of marine debris collected by local governments and fishermen (Cho, 2005).

3.4.5 Other methods (various)

Non-Governmental Organizations (NGOs) have been found to be of varying importance in the control and amelioration of beach litter and marine debris. In Goa, India, it was found that the involvement of NGOs was crucial in guiding the socioeconomic development, and keeping the harmful effects of coastal tourism development in check (Hall, 2001). In many other locations, however, NGOs have made only a minimal contribution (Hall, 2001).

Storm water runoff, sewage overflow, and landfill run-off is another vector by which beaches are polluted. There are a few factors at work in these situations, controlled mainly by the actions of locals and public brokers. Locals (and to some extent tourists) are responsible for littering in municipal streets − in these cases, tactics similar to those used to educate tourists about beach litter should be used. Public brokers are responsible for faults in sewage systems as well as poor landfill placement, which cause waste to runoff into coastal environments. In these cases public brokers must regulate themselves to create and enforce legislation regulating the construction and maintenance of sewer systems and landfill placement.

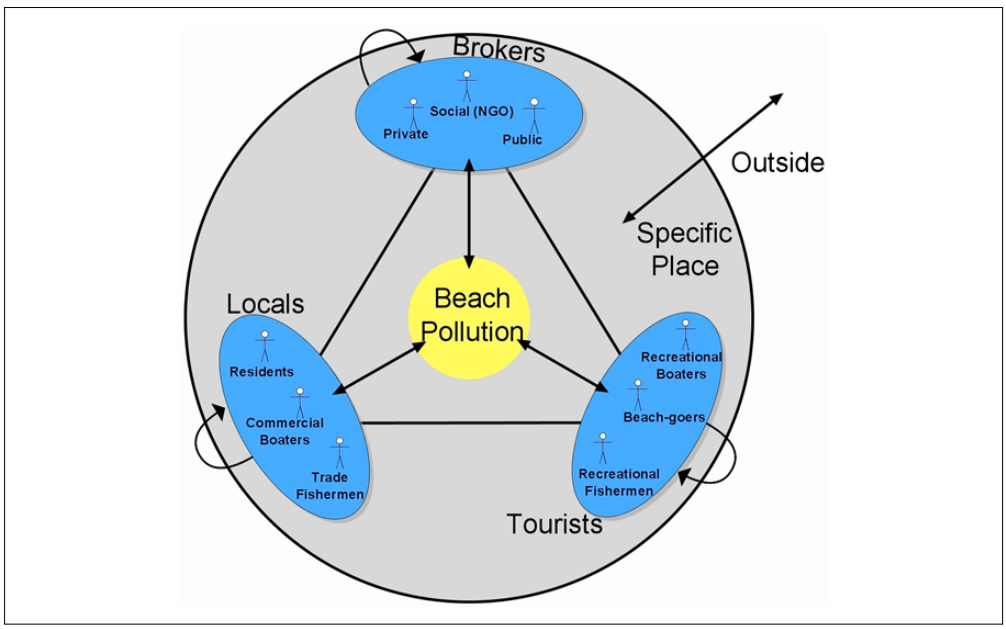
Locals and public brokers will also need to regulate or otherwise encourage private brokers to reduce their litter generation. Using marine debris source information, specific legislation could be created to attempt to address the specific actors contributing to pollution (Williams *et al*., 2002). For example, a local government may implement standards that hotels will have to abide by to reduce the amount of sewage waste they contribute, or implement fines and enforcement for tourists found discarding waste on beaches.

Because of ocean currents, there is often an international component to marine debris and beach litter (Cho, 2005). In Japan, for example, 38% of litter found on one beach originated in Korea (Cho, 2005). Although international concerns are really outside the scope of this study, they are worth mention as public brokers will have to work with

their counterparts across county and country borders to effectively target beach litter and marine debris. MARPOL Annex V, a treaty which seeks to control and reduce marine debris generated by ships, is such an example of international cooperation.

4. The conceptual model

There are three main components to the conceptual model (Figure 2). First, Miller and Auyong's Broker-Local-Tourist model provides the underlying framework of human interactions (Miller *et al*., 1999).



Notes: The place-based tourism model, which depicts the interactions between brokers, locals, tourists and the central element, here beach pollution, in the context of a specific place, in this case a beach.

Figure 2. The place-based tourism model

The broker, local, and tourist groups are shown in the blue ovals. Within each of these groups, sub-groups have been identified based upon the patterns found in the literature review. These sub-groups are represented by the labeled stick figures located within each of the blue group ovals. The broker group has been broken down into Miller and Auyong's categories of public, private, and social or NGO brokers (Miller *et al*., 1999). These sub-groups are closely tied to different aspects and interactions with beach litter and marine debris. The local group has been divided into residents, commercial boaters,

and trade fishermen (those who derive significant portions of their income from fishing) according to their different interactions with beach litter and marine debris found in the literature review. The tourist group has similarly been divided into beach-goes, recreational boaters, and recreational fishermen, again according to their different interactions with beach litter and marine debris.

The broker, local, and tourist groups interact both with each other and within the group (Miller *et al*., 1999). This is indicated by the triangular connections between each of these groups, and the u-shaped self-loops associated with each group. These interactions can take many forms. For example, within the broker category, a public sector broker (local legislature) may regulate private sector brokers (beachfront hotel owners). An example of between group interactions includes private sector brokers (hotel owners) acting to educate tourists (beach-goers). Many of these are discussed in the literature review.

The second component of the model is the central element, beach litter and marine debris, which is shown in the yellow circle. The double-headed arrows connecting the groups of the broker-local-tourist model with the central element represent both the contributions to beach litter and marine debris and the impacts that this pollution has on each of the three groups. These arrows should be seen to connect both the group as a whole and each subgroup to the central element in this way. The double-headed arrow connecting the local group is indicative of how all groups of locals contribute to beach litter and marine debris and are also affected by it.

Third, the interactions described above take place in the context of a specific place. The large grey circle represents a specific place, and encompasses all of the interactions between the components of the BLT model and the central element that happen in this specific place. Here the specific place is a beach, or a series of adjacent beaches, however other places could also be explored through this model. Factors unique to a place that affect beach pollution are described in the literature review.

Anything outside of the specific place is here referred to as the ‘outside.’ This is represented by the white space outside of the grey specific place circle. However, this outside region still influences the interactions between elements of the BLT model and the central element in the specific place, as indicated by the double-headed arrow. As an example, the state or federal government could pass laws that limit the ways in which public brokers can regulate private brokers.

This model could easily be extended to describe many other interactions types between the tourism BLT components and a place. By simply changing the specific place of study, large shifts in the pattern of interactions between components of the BLT model and the central element can occur along with shifts in the division of sub-groups in the BLT model. Furthermore, by changing the central element– perhaps instead of using beach pollution, another form of pollution or a management action such as zoning could be used – the entire context of the model changes.

5. Conclusion and future directions

Interactions between the various factors of the nature-based tourism paradox are complex. The model developed here from the literature attempts to describe the interactions in terms of the links between components of the Broker-Local-Tourist model and beach litter and marine debris.

Brokers, locals, and tourists all make significant contributions to beach litter and marine debris, either directly or indirectly. Each broker, local, and tourist type contributes in different ways and degrees. Typically private brokers contribute through construction debris, hotel sewage waste, and recreational boating waste. Public brokers are often ultimately responsible for contributions from storm water and sewage overflows, as well as waste resulting from poor planning and legislation. The effects of NGO brokers have not been adequately studied. Locals contribute to beach litter and marine debris in two main ways, first through garbage and sewage waste that washes into nearby water bodies, and second through the solid waste and fishing gear discards of local fishermen. Tourists are often a major contributor to beach litter, both through littering directly on the beaches and because of the waste that results from recreational boating and fishing. The effects of these groups on beach pollution are often mediated by beach usage, socio-economic factors, geographic proximity to urban and tourist areas, and the physical properties of the beach.

In turn, beach litter and marine debris have various effects on brokers, locals, and tourists. Although it is possible that some of these effects could be positive, the literature thus far has only detailed the negative effects on brokers, locals, and tourists. Private brokers often see reduced tourism revenue resulting from polluted beaches and marine areas, and are often forced to conduct expensive beach clean-up efforts. Public brokers also have to pay for these clean-up efforts on municipal beaches and in local waters. Again, the effect on NGO brokers has not been adequately studied. Locals are harmed by beach litter and marine debris in many ways. In locations where local economies are highly dependent on tourism revenue, depressions can occur if tourism numbers fall off due to polluted beaches. Local fishermen can be harmed when marine debris negatively impacts important fish stocks. Local fishermen and boaters are also harmed if marine debris causes damage to boat propellers or engines. Beach litter and marine debris has also been shown to negatively impact human health. Tourists who visit polluted beaches are likely to have a poor experience and reduced enjoyment, and recreational boaters and fishers face problems similar to local boaters and fishermen.

Brokers, locals, and tourists have made some attempts to ameliorate the negative impacts of beach litter and marine debris. Beach clean-ups have often been used to reduce the visibility of beach litter; however these measures are expensive, of questionable value,

and reactionary. They are, however, necessary to reduce the amount of beach litter and marine debris already present in the environment. More proactive measures that have been proposed include education and economic incentives.

This study is not exhaustive, as it does not explore all the aspects of interaction between people and place, but only those presented in the literature. However, this is the first step to understanding the linkages between beach tourists and beach pollution, and subsequently the nature-based tourism paradox. Although imperfect, the proposed model has attempted to bring together the forms of interaction described in the literature, building on Miller and Auyong's Broker-Local-Tourist model (Miller *et al*., 1999) in a straightforward and adaptive manner.

Further research into the issue of a tourism paradox should be directed at first at examining areas where interactions are largely unknown, such as with NGO brokers. This information will allow for a more complete assessment of "how the various factors [of the nature-based tourism paradox] interact with each other" (Hillery *et al*., 2001). In addition, the causality of these interactions will need to be examined. This is likely to be a difficult and elusive task.

In order to address beach litter and marine debris, studies and monitoring programs need to be implemented to determine the sources of pollution. Alongside these beach litter and marine debris studies and monitoring programs, the interaction framework detailed in this paper can be used to create effective preventative measures. For example, if it is found that private brokers are the main contributor to pollution, it will be understood that private brokers can implement enforcement measures to control this source of pollution, and can work with NGO brokers to educate private brokers about the consequences of their actions. This framework can also be used to allow for the mitigation of harmful impacts of beach litter and marine debris on brokers, locals, and tourists. If, for example, local fishermen are suffering significant harm from the pollution caused by private brokers, they could be required by public brokers to pay for the damages caused to local fishermen. It is in drawing these connections between brokers, locals, tourists, and their contributions to and detriments caused by beach litter and marine debris that the framework developed here is most valuable.

References

Allsopp, M., A. Walters, D. Santillo, and P. Johnston (2006) Plastic Debris in the World's Oceans. *Technical report*, Greenpeace, Amsterdam.

Backhurst, M. and R. G. Cole (2000) Subtidal benthic marine litter at Kawau Island, north-eastern New Zealand. *Journal of Environmental Management* 60, pp.227-237.

Ballance, A., P. Ryan, and J. Turpie (2000) How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula. *South Africa. South African Journal of Science* 96, pp.210-213.

Dameron, O. J., M. Parke, M. A. Albins, and R. Brainard (2007) Marine debris accumulation in the Northwestern Hawaiian Islands: An examination of rates and processes. *Marine Pollution Bulletin* 54, pp.423-433.

de Araujo, M. C. B. and M. F. da Costa (2007) Visual diagnosis of solid waste contamination of a tourist beach: Pernambuco, Brazil. *Waste Management* 27, pp.833-839.

Derraik, J. G. (2002) The pollution of the marine environment by plastic debris: a review. *Marine Pollution Bulletin* 44, pp.842-852.

Green, R. (2005) Community perceptions of environmental and social change and tourism development on the island of Koh Samui, Thailand. *Journal of Environmental Psychology* 25, pp.37-56.

Gregory, M. R. (1999) Plastics and South Pacifc Island shores: environmental implications. *Ocean & Coastal Management* 42, pp.604-615.

Hall, M. C. (2001) Trends in ocean and coastal tourism: the end of the last frontier? Ocean & Coastal Management 44, pp.601-618.

Hillery, M., B. Nancarrow, G. Gri_n, and G. Syme (2001) Tourist Perception of Environmental Impact. *Annals of Tourism Research* 28(4), pp.853-867.

Ivar do Sul, J. A. and M. F. Costa (2007) Marine debris review for Latin America and the Wider Caribbean Region: From the 1970s until now, and where do we go from here? *Marine Pollution Bulletin* 54, pp.1087-1104.

Klein, R. A. (2003) Cruising Out of Control: The Cruise Industry, The Environment, Workers, and the Maritimes. *Technical report, Canadian Centre for Policy Alternatives*, Halifax.

Martinez-Ribes, L., G. Basterretxea, M. Palmer, and J. Tintore (2007) Origin and abundance of beach debris in the Balearic Islands. *Scientia Marina* 71(2), pp.305-314.

Miller, M. L., J. Auyong, and N. P. Hadley (1999) Sustainable Coastal Tourism: Challenges or Management, Planning, and Education. In: 1999 International Symposium on Coastal and Marine Tourism.

Morishige, C., M. J. Donohue, E. Flint, C. Swenson, and C. Woolaway (2007) Factors affecting marine debris deposition at French Frigate Shoals, Northwestern Hawaiian Islands Marine National Monument, 1990-2006. *Marine Pollution Bulletin* 54,

pp.1162-1169.

Nagelkerken, I., G. Wiltjer, A. Debrot, and L. Pors (2001) Baseline Study of Submerged Marine Debris at Beachers in Curacao, West Indies. *Marine Pollution Bulletin* 42(9), pp.786-789.

National Oceanic and Atmospheric Administration. What is Marine Debris? http://marinedebris.noaa.gov/whatis/welcome.html (Last Accessed on 15 Nov. 2010)

Ofiara, D. D. and B. Brown (1999) Assessment of Economic Losses to Recreational Activities from 1988 Marine Pollution Events and Assessment of Economic Losses from Long-Term Contamination of Fish within the New York Bight to New Jersey. *Marine Pollution Bulletin* 38(11), pp.990-1004.

Cho, D. (2005) Challenges to Marine Debris Management in Korea. *Coastal Management* 33(4), pp.389-409.

Oigman-Pszczol, S. S. and J. C. Creed (2007) Quantification and Classification of Marine Litter on Beaches along Armacao dos Buzios, Rio de Janeiro, Brazil. *Journal of Coastal Research* 23(2), pp.421-428.

Priskin, J. (2003) Tourist Perceptions of Degradation Caused by Coastal Nature-Based Recreation. *Environmental Management* 32(2), pp.189-204.

Santos, I. R., A. C. Friedrich, M. Wallner-Kersanach, and G. Fillmann (2005) Influence of socio-economic characteristics of beach users on litter generation. *Ocean and Coastal Management* 48, pp.742-752.

Shiomoto, A. and T. Kameda (2005) Distribution of manufactured floating marine debris in near-shore areas around Japan. *Marine Pollution Bulletin* 50, pp.1430-1432.

Somerville, S., K. Miller, and J. Mair (2003) Assessment of the aesthetic quality of a selection of beaches in the Firth of Forth, Scotland. *Marine Pollution Bulletin* 46, pp.1184-1190.

Sun, D. and D. Walsh (1998) Review of studies on environmental impacts of recreation and tourism in Australia. *Journal of Environmental Management* 53, pp.323-338.

Topping, P. (2000) Marine Debris: A Focus for Community Agreement. In: Coastal Zone Canada Conference. Environment Canada.

Tudor, D. and A. Williams (2006) A rationale for beach selection by the public on the coast of Wales, UK. Area 38.2, pp.153-164.

Tunstall, S. M. and E. C. Penning-Rowsell (1998) The English beach: experiences and values. *The Geographical Journal* 164(3), pp.319-332.

Williams, A., D. Tudor, and R. Randerson (2003) Beach Litter Sourcing in the Bristol Channel and Wales, U.K. *Water, Air, and Soil Pollution* 143, pp.387-408.

Willoughby, N., H. Sangkoyo, and B. O. Lakaserus (1997) Beach Litter: an Increasing and Changing Problem for Indonesia. *Marine Pollution Bulletin* 34(6), pp.469-478.

The analysis of the relationship between major East Asian countries and the Arctic Council

Li Weifang* and WuDi**

Received August 6, 2010; accepted November 29, 2010

ABSTRACT

In recent years, with the debate over rights in the Arctic regions among coastal and world's major countries, the Arctic issue has rapidly become a hot spot of global concern. The East Asian countries should also give active responses towards this issue. Given that the Arctic Council, as an intergovernmental organization consisting of eight Arctic countries, plays a significant leading role in Arctic affairs, by providing an overview of the work and developing trend of the Arctic Council, this paper analyzes the necessity and feasibility for East Asian countries (mainly refer to China, South Korea and Japan) of their participation in the Council and also proposes the suggestions on this basis to promote these countries' position and their role in Arctic affairs.

Key words: East Asia countries, Arctic Council, observer status

* Corresponding Author: Professor, International Law Faculty in East China University of Politics Science and Law. E-mail: liweifang@ecupl.edu.cn

** Graduate student, International Law Faculty in East China University of Politics Science and Law. E-mail: interlaw@sina.com

This article is sponsored by the project "The analysis of the relation between China and international organizations related to the Arctic"(grant NBQY200904), China Polar Research Institute.

1. Overview of the Arctic Council

1.1 The AEPS and the Arctic Council

In 1989, Finland proposed that the eight Arctic States (Canada, Denmark, Finland, Iceland, Norway, Sweden, Union of Soviet Socialist Republics and United States of America) should adopt a regional strategy towards protecting the Arctic environment. In 1991, the Declaration on the Protection of the Arctic Environment was signed by all eight countries declaring the foundation of the Arctic Environmental Protection Strategy (AEPS).

The Declaration states that the eight signatory nations commit themselves to "a Joint Action Plan of the [AEPS]", which includes:

i) Cooperation in scientific research to specify sources, pathways, sinks, and effects of pollution, in particular, oil, acidification, persistent organic contaminants, radioactivity, noise and heavy metals as well as sharing of these data;
ii) Assessment of potential environmental impacts of development activities; and
iii) Full implementation and consideration of further measures to control pollutants and reduce their adverse effects to the Arctic environment.[1]

In order to ensure the continuity of the AEPS, all countries were committed to the regular meetings at ministerial level. The major work of AEPS was to be completed by its four working groups: Arctic Monitoring and Assessment Program (AMAP), Protection of the Marine Environment in the Arctic (PMEA), Emergency Prevention, Preparedness and Response in the Arctic (EPPR) and Conservation of Arctic Flora and Fauna (CAFF).[2]

In 1993, the Second Ministerial Conference of the AEPS was held in Nuuk, Greenland. Countries signed the Nuuk Declaration on Environment and Development in the Arctic with emphasis on the importance of sustainable development of the Arctic environmental protection. The meeting decided to create the fifth working group of the AEPS: the Task Force on Sustainable Development (TFSD).

On September 19, 1996, the eight Arctic States signed the Declaration on the Establishment of the Arctic Council in Ottawa and the AEPS was thus replaced by the Council.[3] The members of Arctic Council including the eight Arctic countries and four Arctic indigenous peoples' organizations had all permitted the participation of invited observers. The main difference between the Arctic Council and the AEPS is that the Arctic

1. Arctic Council (1999) Arctic Environmental Protection Strategy, pp.1631-1655. http://arctic-council.org/filearchive/artic_environment.pdf (last accessed 20 Feb. 2010).
2. *Ibid.* pp.1631-1664.
3. Vanderzwaag, D., R. Huebert and S. Ferrara (2002) The Arctic Environmental Protection Strategy, Arctic Council and Multilateral Environmental Initiatives: Tinkering While the Arctic Marine Environment Totters, *Denver Journal of International Law and Policy Spring* 151.

Council not only shows concern about environmental protection, but also carries out sustainable development projects and "disseminate information, encourage education and promote interest in Arctic related issues".[4]

1.2 The goal of the Arctic Council

The Arctic Council is established as a high level forum to: provide i) Means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities and other Arctic inhabitants on common Arctic issues, in particular, issues of sustainable development and environmental protection in the Arctic, ii) Supervise and coordinate the programs created under the AEPS on the Arctic Monitoring and Assessment Program (AMAP); Conservation of Arctic Flora and Fauna (CAFF); Protection of the Arctic Marine Environment (PAME); and Emergency Preparedness and Response (EPPR), iii) Organize and coordinate a sustainable development program, iv) Disseminate information, encourage education and promote interest in Arctic-related issues.[5]

The main tasks of the Arctic Council include the protection of the Arctic eco-environment and its sustainable development. To achieve these two goals, the Council has created a number of projects. The Arctic Council not only continued to complete the work under the former AEPS, but also set up two new work plans − a Sustainable Development Framework Document and the Arctic Council Action Plan to Eliminate Pollution of the Arctic (ACAP). The Council also specifically provides indigenous peoples with the opportunity of participation in the working schedule of the Council. The Council has recognized four groups working on behalf of indigenous peoples as "Permanent Participants" in every area of the Council's work.[6]

The Arctic Council is the first and "only major inter-governmental initiative for the Arctic involving all eight Arctic states".[7] The character of the Arctic Council is a unique partnership among Governments and organizations representing indigenous peoples and communities in the Arctic.[8] The Arctic Council "seeks to protect the Arctic's pristine environment through a quasi-legislative inter-governmental forum charged with recommending,

4. Arctic Council (1998) Report of the Senior Arctic Officials to the Arctic Council, Iqaluit, Canada, September 17-18, Part I(A). http://arctic-council.org/meeting/sao_meeting%2C_autumn_1998 (Last accessed on 12 Feb. 2010).
5. Declaration on the Establishment of the Arctic Council, p.1. http://arctic-council.org/filearchive/Declaration%20on%20the%20Establishment%20of%20the%20Arctic%20Council-1.pdf (Last accessed on 12 Feb. 2010).
6. Verhaag, M. A. (2003) It Is Not Too Late: The Need For A Comprehensive International Treaty To Protect The Arctic Environment. *Georgetown International Environmental Law Review* 15, p.570.
7. Bloom, E. (1999) Current Development: Establishment of the Arctic Council.93 AM. J. INT'L L. 712:1.
8. INARI DECLARATION on the occasion of the Third Ministerial Meeting, p.1. http://arctic- council.org/filearchive/inari_Declaration.pdf (Last accessed on 12 Feb. 2010).

implementing, and developing environmental policies" instead of a patchwork quilt of eight legal regimes trying to protect one extremely fragile area during the APES time.[9] Notwithstanding that the Arctic Council seems to be an important step towards a the cause of creating a sound regional legal system, its existence is only to facilitate cooperation between Arctic States in the realms of environmental protection and sustainable development, and does not require any binding commitments.[10] Was this lack-of-binding legal system capable of coordinating the different interests of multiple power entities on the Arctic issue? And will it lose its power when facing great issues in the region? All these issues need to be further addressed by the Arctic Council in the future.

2. Major concerns of the Arctic Council

In the past 10 years the Arctic Council has enhanced the common understanding and promoted cooperation in the Arctic region. It has become the most important forum in the region and has been playing a leading role for the Arctic affairs. The environmental protection and sustainable development in the Arctic is the main topics of Arctic Council, and also as key issues in the future development. These issues specifically include the following aspects.

2.1 Climate change

The Arctic Council is looking forward to an effective global response that will address the challenge of climate change, and confirm the commitment of all Arctic States to actively contribute to reaching a well-consented outcome at the UNFCCC 15th Conference of the Parties (CoP15) in Copenhagen in December 2009. The Council decided to deliver the Snow, Water, Ice, and Permafrost in the Arctic report to the UN CoP15, and looking forward to the delivery of the full results of the Arctic Cryosphere: Snow, Water, Ice, and Permafrost in the Arctic (SWIPA) project in 2011.

The Council urged Member States to perform the early actions where possible on methane and other short-lived climate forcers, and encouraged the cooperation with the Methane Marketing Program as well as with other relevant international organizations to take measures to reduce methane emission and other short-lived forcers. Meanwhile, it decided to establish a task force on short-lived climate forcers to identify existing and

9. Ansson, R. J. (1998) The North American Agreement on Environmental Protection and the Arctic Council Agreement: Will These Multinational Agreements Adequately Protect the Environment?, 29 CAL. W. INT'L L.J. 101, 103:103.
10. Vanderzwaag, D., R. Huebert and S. Ferrara, supra note 3, p.142.

new measures to reduce emissions of these forcers and also recommend further immediate actions. And all these progresses should be reported by task force at the next Ministerial meeting.

2.2 Maritime environment

The Arctic Council is now cooperating within the International Maritime Organization (IMO) on development of relevant measures to reduce the environmental impacts of shipping in Arctic waters. The Council is stepping up its update of the Guidelines for Ships Operating in Arctic Ice-Covered Waters and the mandatory application of some of its terms.

The Council carried out consultation with the IMO to make sure that the global IMO ship safety and pollution prevention conventions be augmented with specific mandatory requirements or other provisions for ship construction, design, equipment, crewing, training, and operations, aimed at safety and protection of the Arctic environment.

2.3 Energy

The Council agreed on the findings and recommendations of the assessment of oil and gas activities in the Arctic: effects and potential effects. It emphasized that while there has been significant progress in technology, management, and regulations that have greatly reduced the impact of oil and gas activities, environmental risk still remained. Recently, the Arctic Council is urging Member States to apply the precautionary approach and polluter-pays principle as reflected in Principles 15 and 16 of the Rio Declaration, respectively, and conduct risk and environmental impact assessments for the exploration, development, transport and storage of oil, and enact and/or enforce appropriate laws and controls.

2.4 Contaminants

The fifth Ministerial Meeting of the Arctic Council approved the ACAP as a formal working group. The Arctic Pollution 2009 report highlights that progress has been achieved through political actions to reduce the threats from some legacy persistent organic and radionuclide pollutants, but concerns remain regarding new chemicals occurring in the Arctic environment and their potential threat to people and wildlife.

The contaminants with persistent organic pollutant (POP) characteristics in the Arctic region are not subject to international controls. The Council is now considering the possibility of deliver it to international communities.

The Arctic Council hopes to strengthen its cooperation with UNEP Chemicals Agency (UNEP Chemicals) and United Nations Development Program (UNDP) for the ACAP projects. The Council is preparing to set up a new Project Steering Group to address contaminants in indigenous peoples' communities in remote areas of the Arctic.

2.5 Biodiversity

The Arctic Council's contribution to the United Nations International Biodiversity Year in 2010 was the Arctic Highlights Report of Arctic Biodiversity Assessment (ABA). This report can also serve as a tool to measure progress towards the United Nations 2010 biodiversity target which was set by the Convention on Biological Diversity.

The Council recognized the community-based monitoring as a valuable means of observation in the Arctic, and encouraged further development of projects with participation of local residents.

2.6 Security

The Arctic Council is preparing for establishing a search and rescue task force in the Arctic, and negotiations are expected to be completed by 2011. Besides, the sixth Ministerial Meeting accepted the Russia's initiative of 'Developing Security Systems in the Realization of Economic and Infrastructure Projects in the Arctic' which presupposes the elaboration of common approaches and mechanisms for the prevention and neutralization of various man-made disasters that may arise owing to more active economic development of the region.

Russia hopes that any likely proposals in this sphere will be regulated by mechanisms of the Arctic Council. "That's the exact decision of last year's Arctic Ocean Conference at Ilulissat".[11] However, the U.S. does not agree with the views of Russia. The new American Arctic policy which is contained in National Security / Homeland Security Presidential Directive on Arctic Region Policy specified that "the Arctic Council should remain a high-level forum devoted to issues within its current mandate and not be transformed into a formal international organization, particularly one with assessed contributions. The United States is nevertheless open to updating the structure of the Council, including consolidation of, or making operational changes to, its subsidiary bodies, to the extent such changes can clearly improve the Council's work and are consistent with the general mandate of the Council".[12]

---

11. Russian foreign minister's statement at Arctic Council meeting, April 29, 2009. http://www.regjeringen.no/en/dep/ud/Whats-new/Speeches-and-articles/speeches_foreign/2006/concluding-statement-at-the-arctic-counc.html?id=420889 (Last accessed on 12 Feb. 2010)
12. U.S. (2009) National Security / Homeland Security Presidential Directive on Arctic Region Policy. The

East Asian countries should pay close attention to the opposing stand points of the two great powers. Since this is related to the scope of discourse power of the Arctic Council on Arctic affairs, we should take further measures based on the latest change of this situation.

3. The analysis and suggestions regarding the relationship between East Asian countries and the Arctic Council

3.1 The necessity for East Asian countries to participate in the Arctic Council

The climate and environmental change in the Arctic has a significant impact on surrounding countries in East Asia and is also directly related to the sustainable development of national economy of China, Japan and South Korea due to the following reasons.

Firstly, Climate change and its effects in the Arctic may be the most serious environmental issue threatening the Arctic environment. Average annual temperatures in the Arctic have increased by approximately double the increase in global average temperatures.[13] The direct impacts of global warming include higher temperatures, sea-level rise, melting of sea ice and glaciers, increased precipitation in some areas and drought in others. Indirect social, environmental, economic and health impacts will follow, including increased death and serious illness in poor communities, decreased crop yields, heat stress in livestock and wildlife, and damage to coastal ecosystems, forests, drinking water, fisheries, buildings and other resources needed for subsistence.[14] The East Asian countries shall pay more attention to these problems and take measures to mitigate harmful influences caused by climate change in the Arctic.

Secondly, Although coastal states in the Arctic regions enjoy exclusive management authority over resources found in the continental shelf, including those parts that extend beyond 200 miles from the baselines, the resources found on the deep seabed beyond the continental shelves are defined in the United Nations Convention on the Law of the Sea (UNCLOS) as the 'common heritage of mankind' and made subject to a specific

---

directive "establishes the policy of the United States with respect to the Arctic region and directs related implementation actions. This directive supersedes Presidential Decision Directive/NSC-26 (PDD-26; issued 1994) with respect to Arctic policy but not Antarctic policy; PDD-26 remains in effect for Antarctic policy only." See http:// www.cfr.org/publication/18215/national_security_homeland_security_presidential_directive_on_arctic_region_policy.html (Last accessed on 3 Feb. 2010)

13. Union of Concerned Scientists, Fact Sheet, Early Signs of Global Warming: Arctic and Antarctic Warming. http://www.ucsusa.org/warming/gw<uscore>arctic.html.

14. Intergovernmental Panel on Global warming (2001) Global warming 2001: Impacts, Adaptation and Vulnerability, Summary for Policymakers and Technical Summary of the Working Group Two Report 26.

regime. Besides, the most significant impact of the retreat of the Arctic sea ice will be the opening of the northern sea routes, which will be further advanced by technical developments in the building of icebreakers. The opening of these sea routes have great significance for global economic development and security. It is suggested that shipping routes from the east coast of North America or from Europe to destinations in the Pacific could thus be shortened by up to 40%, but at present sea transport must be directed either through the Suez Canal in the east or the Panama Canal in the west. UNCLOS provides for freedom of navigation on the high seas and within the exclusive economic zone of coastal States, as well as for the right of innocent passage in the 12-mile territorial sea of coastal States. UNCLOS also provides for the right of transit passage through straits used for international navigation.

The economic and social development of East Asian region has also developed the demand for the natural resources and the sea route use in the Arctic region. China, Japan and South Korea shall realize that UNCLOS, which is the only comprehensive treaty concluded in this field, applies to the Arctic Ocean in general. So far, UNCLOS has been ratified by four of the five countries that border the Arctic Ocean, while the United States accepts the relevant provisions as customary international law.[15] UNCLOS contains detailed provisions on all uses of the ocean, the seabed and the air space above, and also includes provisions on, inter alia, navigation, fishing, exploitation of oil, gas and other resources of the continental shelf, maritime delimitation, prevention of marine pollution and on marine scientific research. Under the framework of UNCLOS, China, Japan and South Korea shall be responsible and capable of participating in the peaceful using sea route and common natural resources in the Arctic regions.

Thirdly, the Arctic possesses a very high scientific value, and it is an ideal place for a number of science and research activities. In this way, China, Japan and South Korea should actively carry out the cooperation in scientific research in the Arctic region and spare no effort to make their due contribution to the human understanding of nature as well as the Arctic.

The Arctic Council, as the major international organization in the Arctic region, takes the initiative in the Arctic affairs. Consequently, China, Japan and South Korea's participation in the Arctic Council will not only enable them to participate in the latest trends and focus in Arctic regional affairs, but also promote sharing of the latest technology as well as expertise by participating in the working teams and projects of the Arctic Council. In addition, the Arctic Council values regional and international cooperation. Therefore, by involving in the Arctic Council's affairs, China, Japan and South Korea could promote the cooperation and exchange with members, observers and its relevant international organizations within the Arctic Council's framework. Most importantly, the Arctic Council

15. Norway ratified in 1996, Russia ratified in 1997, Canada ratified in 2003 and Denmark ratified in 2004.

is now discussing issues regarding the reform of Arctic governance, hence, China, Japan and South Korea should seize this opportunity to reach a consensus on the Arctic issue through the negotiations, and then, hold the necessary discourse by actively participating in the relevant activities of the Council and eventually, propose programs that are beneficial to East Asia regions.

3.2 The importance of being permanent observer

"Observer" means an entity described in Article 3 of the Declaration which has been granted observer status in accordance with these Rules.[16] Observer status in the Arctic Council is open to the following entities: non-Arctic states; global, regional intergovernmental organizations and inter-parliamentary organizations; non-governmental organizations.[17]

The United Kingdom, France, New Zealand, Poland, Spain and Germany, etc. are permanent observers of the Arctic Council, in which the United Kingdom, New Zealand, Poland and Germany are the successors of their observer status in the former organization of the Arctic Council, the AEPS.[18] China, South Korea, Italy and the EU are currently ad-hoc observers. And Japan has submitted the application for observer status to the chairman on duty, Norway, in April 2009.[19]

China is the earliest to participate in the activities of the Arctic Council in East Asia and submitted the application for the permanent observer status of the Sixth Ministerial meeting in the "Senior Arctic Officials" (SAOs) held in April 2007, and the final report of that SAOs granted China ad-hoc observer status and allowed China to participate as observer in the Senior Officials Meeting and working group meetings of the Arctic Council, and meanwhile, it also claimed that, it will later consider granting China permanent observer status on the Sixth Ministerial Meeting.[20]

The Senior Arctic Officials meeting was held in Nordland, Norway from 23rd to 24th April, 2009 and Chinese delegation participated again as ad-hoc observer.[21] On 29th April, 2009, the Arctic Council Sixth Ministerial Meeting was held in Tromso, Norway, both China and South Korea participated as ad-hoc observers and had some exchanges of ideas with other participants.[22] Unfortunately, the Ministerial Meeting did not adopt China, Italy, South Korea and the EU as permanent observer, only claiming that the role

16. Arctic Council Rules of Procedure, supra note 11, p.1.
17. Declaration on the Establishment of the Arctic Council, supra note 5, p.3.
18. Annex 2 to Arctic Council Rules of Procedure, Art. 1. http://arctic-council.org/filearchive/official%20rules%20and%20procedures.pdf (Last accessed on 8 Feb. 2010)
19. Japan applies for Arctic Council observer status. http://arctic. foreignpolicyblogs.com /2009 /04/20/japan-applies-for-arctic-council-observer-status (Last accessed on 4 Jun. 2010)
20. Arctic Council Meeting of Senior Arctic Officials, FINAL MINUTES. 12-13 Apr. 2007, Norway, Item 3.
21. List of participants, SAO Meeting, Svolvær, 23-24 Apr. 2009.
22. Final List of Participants, 6th Ministerial Meeting of the Arctic Council, 29 Apr. 2009, Tromsø, Norway

of observers in the Arctic Council should be further discussed. The reason of Canada and Norway's rejection of the EU's application for observer status is mainly due to EU's ban on import of hunted seal products, which was considered as damaging the fundamental interests of Arctic countries and people.[23]

Observers shall be invited to the Ministerial meetings and/or to other meetings and activities of the Arctic Council, observer status shall continue for such time as consensus exists at the Ministerial meeting. Any observer that engages in activities which are at odds with the Council's Declaration shall have its status as an observer suspended.[24] The biggest difference between ad-hoc observer and permanent observer is that, the granted effect of an ad-hoc observer is limited to a particular meeting.[25] This means that ad-hoc observers need agreement from all council members for participation in ministerial meetings.

So far, China, Japan and South Korea still have not been recognized as permanent observer of the Arctic Council, which makes it necessary for these three countries to start ground-breaking cooperation and negotiation on this issue to take joint measures to earn this title as soon as possible.

3.3 In the name of "near-Arctic Countries" or "near-Arctic Region"

On 18th September, 2008, Russia issued "Basics of the State Policy of the Russian Federation in the Arctic for the Period till 2020 and for a Further Perspective", which determined the national interests, main objectives, strategic priorities, the basic tasks and implementation mechanisms of Russian Federation's arctic policy. Foremost among them is "to develop the Russia-owned Arctic region into the strategic resource base for ensuring the national social- economic development". On 13th May 2009, Russia again issued "Russian National Security Strategy till 2020", emphasizing that the focus of future international politics is energy competition, and the Arctic is the focus of this competition. In addition, the to-be-issued documents like "Russian Navy strategy 2009", "Development Strategy of the Railway Transportation in the Russian Federation till 2030" and "The Program of Study and Development of the Russian Continental Shelf till 2030" also express their concern about "Arctic" and intention of establishing the Arctic fleet.

The existence of Alaska entitles the U.S.' huge influence on the Arctic affairs. On 9th January, 2009, the U.S. government issued "National Security and Homeland Security Presidential Directive" to replace the Arctic policy in 1994. The new paper declared that the U.S. is an "Arctic Country" and has extensive and important national interests in the Arctic region. Among which the freedom of navigation has been placed on the "top priority"

23. Arctic Council snubs EU as observer over seal dispute. http://www.eubusiness.com/news-eu/ 124 1016421.74/ (Last accessed on 14 Sep. 2009)
24. Arctic Council Rules of Procedure, supra note 11, Art.37, Art.38.
25. *Idid*. Art.37, Item 2.

level. The U.S. insists on that both northwest and the northeast passage belong to "strait used for international navigation" and the U.S. vessels have the right to transit passage.

The enormous natural resource and sea route values also attract EU and NATO's attention. Especially, Denmark, Finland and Sweden are both Arctic and EU member states, while four of all five Arctic Circle countries (Iceland, Norway, the U.S. and Canada) belong to NATO. So once there is conflict in Arctic, neither of EU and NATO will just sit by. in November, 2008, EU issued "The European Union and the Arctic Region" policy document, declared that the EU countries have fishing, oil and gas and other interests in the Arctic region. The EU's Arctic goal is to maintain the harmonious relationship between the Arctic and human, promote sustainable use of resources, and be committed to improving the multilateral governance of the Arctic region. On 29th, January, 2009, NATO leaders and parliament members from NATO member states gathered in Reykjavik, capital of Iceland, saying that NATO may be involved in the Arctic debates due to the interests of its members, and troops should be deployed in Arctic region to eliminate the tension. The EU and NATO's attitudes lead the Nordic countries to collectively participate in Arctic affairs.

While all other countries and regions in the world have been indicating their interests in the Arctic region, the question is if East Asian countries should also speak with one voice on this issue?

First and foremost, in terms of geographical location, East Asia is located in the northern hemisphere, and is very close to the Arctic region whether from its land or sea. Secondly, the geopolitical factor plays a significant role in the national interest, national security as well as the decision of national strategies, and is deemed to be an underlying factor affecting or even determining a country's political behavior. The Eurasia is the world's largest continent and currently the political and economic center, which means that when dealing with important Arctic affairs, all eight circum-Arctic countries could by no means ignore the influence of China, Japan and South Korea in the Arctic region.

Again, from the Arctic climate, ecological environment as well as the Arctic Ocean together with their profound influence on East Asian region, for example: atmospheric changes, ocean currents and temperature, sea route, Arctic flight routes, Missile Defense, the Arctic Ocean continental shelf oil and gas resources and so on. All these are related to human and global issues.[26] At present, the global warming caused by human activities is on its way of accelerating the melting of Arctic ice cap, thus pushing the Arctic to a precarious situation. The Arctic is now under significant and rapid changes in atmosphere, oceans, land, ecology and society, and this is believed to have great impact on the climate and socio-economic development of the Northern Hemisphere and even the globe. To sum up, the natural change of the Arctic, as well as the change caused by global warming,

26. Long, C.-N. (2008) New Era of the Arctic Ocean. CITIC PACIFIC RESEARCH ADVANCE 14:23.

have been profoundly influencing the surrounding sea areas, climates including ecological environment of East Asia.

For the reasons above, China, Japan and South Korea have every reason to emphasize the nature of "Near-Arctic Region". This not only indicates the actual links with the Arctic affairs, but also justifies the action on it. The "Near the Arctic Region" will determine East Asia's right position in the Arctic affairs, and then entitle the effective participation in the activities of the Arctic Council. Therefore, China, Japan and South Korea could consider participating in the discussion of Arctic affairs in the name of "Near-Arctic Countries" or "Near-Arctic Region" to provide an objective basis for gaining possibility of discourse on the Arctic affairs.

3.4 The way to participate in the activities of the Arctic Council

For China, Japan and South Korea, the key concern is to be recognized as permanent observer as soon as possible. This requires more research on the Arctic Council and adequate understanding of its purpose of establishment, operating patterns as well as its organizational principles, meanwhile, it also requires broadening of contacts with the Arctic Council member states as well as an all-round participation in the group project of the Council to make endeavor in becoming the permanent observer in the next Ministerial Meeting.

China, Japan and South Korea should adopt several ways of participating in the activities of the Arctic Council to meet the Arctic Council's requirements on capability and experience of becoming a permanent observer:[27]

3.4.1 Continue to participate in the ministerial meeting and SAOs as ad-hoc observer

These three countries shall show a continuous concern about the Arctic environment and climate changes and express a full understanding of the Arctic Council to demonstrate the capability and an active attitude towards cooperation with the Arctic Council. What's more, particular attention should be paid so that China, Japan and South Korea could also apply for ad-hoc observer for the vice-ministerial meeting which was newly set by the Arctic Council in 2009. If China, Japan and South Korea could make constructive advices or outstanding contributions to the newly established vice-ministerial mechanism, it may be to some extent a strong plus to be accepted as permanent observer.

27. Annex 2 to Arctic Council Rules of Procedure, supra note 11, at Art.3, Art.4.

3.4.2 Participate as ad-hoc observers in the Arctic Council's work group meetings

Cooperate with respective project teams in terms of environmental protection, pollution control, climate change, energy, maritime transport, biodiversity conservation, human health and its development, etc. to obtain the latest information, technology and expertise, and to promote support and understanding of the Arctic Council. All these are helpful in applying for permanent observer status.

3.4.3 Strengthen the bilateral cooperation with the Arctic Council and its member states on climate change, marine environmental protection and other fields

The decision-making mechanism of the Arctic Council is unanimous approval of its resolutions; hence, any application for permanent observers should be approved by all eight Arctic countries. Therefore, the strengthening of communication and understanding of the Arctic environmental protection among China, Japan, South Korea and other member states is conducive to enhancement of the mutual trust and expression of East Asia's concern about the Arctic and consequently, to the final approval of permanent observer granting.

As for East Asia's application for permanent observers, Russia, Norway, Denmark and other major Arctic Council countries are in favor of it. Russian Foreign Minister said that the increasing concern from international community about Arctic issues requires seeking common interests with China and other countries to find a balance between promoting international cooperation and maintain the Council's regional profile. Denmark is currently the chairman on duty of the Arctic Council, and the map of the Arctic Council members issued by its Ministry of Foreign Affairs website has marked China as "light blue" (as the figure shows below), which represents the status of "Observer".[28] This has indicated the Council's open attitude towards the approval of observer status, and is meanwhile a good basis for China, Japan and South Korea to further strive towards the permanent observer status.

3.4.4 Actively cooperate with Italy and the EU in applying for the permanent observer

China and South Korea's application for permanent observer status had not been approved by the Arctic Council in 2009, with the former rejection of Italy and EU's application. As can be seen, the Council regards all applicants as a whole, and may resolve this issue as a whole in the future, and there seems to be no competition between applicants. Therefore, it is necessary to strengthen ties and communication with Italy and the EU, and jointly take measures to urge the Arctic Council to address this issue properly.

28. DENMARK IN THE ARCTIC. http://www.ambottawa.um.dk/enmenu/ aboutdenmark /denmarkin thearctic. (Last accessed on 28 Nov. 2009)

3.4.5 Actively take advantage of the Arctic Council to promote cooperation with "Antarctic Treaty" Consultative Parties

On 6th April, 2009, the joint meeting of the Antarctic Treaty / Arctic Council adopted "Joint Ministerial Declaration on the International Polar Year and Polar Science". The declaration agreed on the importance of achievements of the International Polar Year to the scientific research, the Arctic natives including indigenous people, and to all human beings, and meanwhile encouraged the development of collaborative research and scientific observation in the polar regions, and expressed the commitment to considering the important issues related to scientific cooperation and latest scientific discovery on the biennial Arctic Council ministerial meeting and annual Antarctic Treaty consultative meeting, and moreover, be further committed in the scientific explanation of the joint development measures regarding the threats in the polar regions. China, Japan and South Korea are all consultative parties of the "Antarctic Treaty", and should actively respond to the points in the "Declaration", and also pay attention to the next International Polar Year. All this will provide more opportunities to participate in the activities of the Arctic Council.

4. Conclusion

The Arctic and surrounding sub-Arctic regions is a key area for the study of global change because the anthropogenic impact is projected to be the largest in this area due to the complicated feedback processes of the nature. The Arctic is undergoing strong changes in the recent years during the global warming. They have a significant impact on surrounding countries in East Asia and are also directly related to the sustainable development of national economy of China, Japan and South Korea. In addition, the economic and social development of East Asian region has also raised the demand on the natural resources and sea route use in the Arctic region. As an only comprehensive treaty concluded in this field, UNCLOS applies to the Arctic Ocean in general. China, Japan and South Korea shall be responsible and capable of participating in the peaceful using sea route and common natural resources in the Arctic regions under the legal framework of UNCLOS.

Meanwhile, geopolitical concerns in the Arctic regions have been reduced after end of Cold War. New interests and debates are arising as the Arctic is becoming more accessible. That will be understood as an opportunity for entry of new actors to the Arctic regions. East Asian countries shall seize this opportunity to show their strong concerns about the Arctic environment and climate changes. The Arctic Council, as the only inter-governmental organization in the Arctic, plays undoubtedly a significant role in pushing forward the international legislation regarding the Arctic development. So far, China, Japan and South Korea still have not been recognized as permanent observer of the Arctic Council.

Therefore, East Asian countries shall express a full understanding of the Arctic Council to demonstrate the capability and an active attitude towards cooperation with the Arctic Council. We should cooperate and actively participate in the activities of the Arctic Council to strive for the observer status and promote cooperation with countries surrounding the Arctic in the fields of Arctic's nature resource exploration, sea routes use as well as eco-environmental protection to uphold the East Asian countries' interests in the Arctic region.

References

Arctic Council (1991) Arctic Environmental Protection Strategy.

Arctic Council (1996) Declaration on the Establishment of the Arctic Council.

Arctic Council (1998) The Iqaluit Declaration, on the occasion of the First Ministerial Meeting of the Arctic Council.

Arctic Council (1998) ANNEX 2 to Arctic Council Rules of Procedure.

Arctic Council (1998) Arctic Council Rules of Procedure.

Arctic Council (2000) The Barrow Declaration, on the occasion of the Second Ministerial Meeting of the Arctic Council.

Arctic Council (2001) Arctic Council Indigenous Peoples' Secretariat Terms of Reference and Procedural Guidelines.

Arctic Council (2002) The Inari Declaration, on the occasion of the Third Ministerial Meeting of the Arctic Council.

Arctic Council (2004) The REYKJAVÍK Declaration, on the occasion of the Fourth Ministerial Meeting of the Arctic Council.

Arctic Council (2005) Foreign Affairs Office of Canada: Strengthening Canada's Leadership and Influence in the Circumpolar World.

Arctic Council (2006) The SALEKHARD Declaration, on the occasion of the Fifth Ministerial Meeting of the Arctic Council.

Arctic Council (2007) Arctic Council Meeting of Senior Arctic Officials, FINAL MINUTES.

Arctic Council (2009) The TROMSØ Declaration, on the occasion of the Sixth Ministerial Meeting of the Arctic Council.

Arctic Council (2009) List of participants, SAO Meeting.

Arctic Council (2009) Senior Arctic Official (SAO) Report to Ministers, Tromso, Norway.

Arctic Council (2009) Arctic Council Meeting of Senior Arctic Officials, FINAL MINUTES.

Barents Euro-Arctic Council (2005) Working Group on Trade Barriers (WGTB) Action Plan.

Bloom, E. (1999) Current Development: Establishment of the Arctic Council. 93 AM. J. INT'L L. 712, 712.

Long, C.-N. (2008) New Era of the Arctic Ocean. *CITIC PACIFIC RESEARCH ADVANCE 14*.

Vanderzwaag, D., R. Huebert and S. Ferrara (2002) The Arctic Environmental Protection Strategy, Arctic Council and Multilateral Environmental Initiatives: Tinkering While the Arctic Marine Environment Totters, *Denver Journal of International Law and Policy Spring* 151.

International Arctic Science Committee (2005) International Study of Arctic Change.

Joint meeting of the Antarctic Treaty Parties and the Arctic Council (2009) Washington Declaration on the International Polar Year and Polar Science.

Langlais, R. (2000) Arctic co-operation organisations: A status report for the Standing

Committee of Parliamentarians of the Arctic Region. In Conference Report: *Fourth Conference of Parliamentarians of the Arctic Region*, Rovaniemi Town Hall, Rovaniemi, Finland, August 27-29, 2000, (ed.) M. Heikkilä, 85-116. Foreword by K. Kiljunen. Helsinki: Standing Committee of Parliamentarians of the Arctic Region/Edita, 2000.

Verhaag, M. A. (2003) It Is Not Too Late: The Need For A Comprehensive International Treaty To Protect The Arctic Environment, *Georgetown International Environmental Law Review* 15.

Jensen, Ø. (2007) The IMO Guidelines for Ships Operating in Arctic Ice-Covered Waters: From Voluntary to Mandatory Tool for Navigation Safety and Environmental Protection? *FNI Report* 2007(2).

Guo, P.-Q. (2006) United Nations "no right" under the jurisdiction of Antarctica. *OCEAN WORLD* 12.

Guo, P.-Q. and D. Tian (2008) Murmansk and Arctic speech: Arctic into the era of cooperation. *OCEAN WORLD* 5.

Polar Research Institute of China (2005) *Polar Science & Technology* 1.

Polar Research Institute of China (2008) *Polar Science & Technology* 2.

Polar Research Institute of China (2009) *Polar Science & Technology* 6.

Ansson, R. J. (1998) The North American Agreement on Environmental Protection and the Arctic Council Agreement: Will These Multinational Agreements Adequately Protect the Environment? 29 CAL. W. INT'L L.J. 101, 103.2.

Rothwell and Donald R. (2008) The Arctic in International Law: Time for a New Regime? *ANU College of Law Research Paper* 08.

Russia (2008) Basics of the State Policy of the Russian Federation in the Arctic for the Period till 2020 and for a Further Perspective.

U.S. (2009) National Security / Homeland Security Presidential Directive on Arctic Region Policy.

United Nations (1945) United Nations Charter.

<Website>

http://arctic-council.org

http://www.eubusiness.com/

http://www.arcticportal.org/iasc/

http://www.ambottawa.um.dk

http://www.imo.org/

http://www.un.org/

http://www.unep.org/

http://www.wwf.org/

http://news.xinhuanet.com

Notes to Contributors

Manuscript. Submissions should be clear and concise. Manuscripts will be accepted with the understanding that their content is unpublished and not being submitted for publication elsewhere. All parts of the manuscript, including the title page, abstract, tables and legends should be typed in English. Allow margins of at least 3cm on all sides of typed pages. Pages must be numbered consecutively throughout the paper.

Title. Must be as brief as possible and consistent with clarity (6 to 12 words). Authors should also supply a shortened version of the title suitable for the running head, not to exceed 50 character spaces.

Author Affiliation. Include the full names of authors, academic and/or professional affiliations and the complete mailing address of the author to whom proofs and correspondence should be sent.

Abstract. Each paper should be summarized in an abstract of not more than 150 words. Avoid abbreviations, diagrams and reference to the text.

Key words. Authors must supply three to five keywords or phrases which identify the most important subjects covered by the paper.

Mathematical Notation. Use only essential mathematical notation as it is coastly to typeset and may limit readership. Where mathematical notation is essential, keep it simple and in conformance with conventions of the profession.

References. Citations within the text must include author name(s) and the data in parentheses [i.e., Smith, Jones, and Cutler (1993)]. Use *et al*. in the text only when four or more authors are cited. Do not use *et al*. in the references. Alphabetize the reference section and include all text citations. For more information, consult the *Chicago Manual of Style*. Follow these examples:

Journal Koenig, E. F. (1984) Fisheries Regulation Under Uncertainty: A Dynamic Analysis. *Marine Resource Economics* 1(2):193-208.

Book Heaps, T., and J. F. Helliwll (1985) *The Taxation of Natural Resources. Handbook of Public Economics*, Vol. I, A. J. Auerback and M. Feldstein (eds.), pp.421-72. Amsterdam : North-Holland.

Data and Documentation. Data sources, models and estimation procedures are expected to be documented to permit replication by other researchers. Data used in the analyses should be made available to other researchers for replication purposes. Submission of appendices, model documentation and other supporting materials is encouraged to facilitate the review process.