EXPLORING THE POTENTIAL FOR PERFORMANCE ZONING WITHIN THE PRACTICE OF MARINE SPATIAL PLANNING

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ABSTRACT

The practice of zoning, long employed on land, has more recently been applied to the marine environment to regulate where and when human activities can and cannot occur. Zoning is employed to minimize conflicts between human and natural 'users' of ocean spaces. This paper identifies key benefits and limitations of conventional zoning practices that affect planning and management outcomes in a marine context and reveals urgencies and opportunities for a wider suite of objectives-based or standards-based marine spatial planning tools. This paper argues that one such planning instrument, performance zoning better fulfills the objectives of ecosystem-based marine spatial planning (EBMSP) than conventional, use-based marine zoning practices widely used today. The compatibility between EBMSP and marine performance zoning (MPZ) occurs in a common ability to: 1) focus compatible uses; 2) reduce conflicting uses; 3) protect ecosystem function; and 4) promote resilience in marine spaces.

Keywords: ocean zoning; place-based management; performance zoning; marine spatial planning; marine performance zoning.

LIST OF ABBREVIATIONS USED

AWDT	Average Weekday Daily Traffic
COZ	Comprehensive Ocean Zoning
EBM	Ecosystem-Based Management
EBSA	Ecologically & Biologically Significant Area
ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
LGDS	Land Development Guidance System
MFZ	Marine Functional Zoning
MPA	Marine Protected Area
MSP	Marine Spatial Planning
PUD	Planned Unit Development
RAP	Representative Areas Program

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INTRODUCTION

In 1961, Jane Jacobs published the book, *The Death and Life of Great American Cities*, which presented a revolutionary critique of urban planning practices at that time. The book took direct aim at the discipline of land planning, claiming its practices to be stagnant, simplistic and even destructive (Jacobs, 1961; Allen, 2011). Jacobs was transparent in her position by stating in the opening line of the book that her views were, 'an attack on current city planning and rebuilding' (Jacobs, 1961). As such, the work of Jacobs prompted a great deal of controversy among planners, architects, policy makers, politicians, and citizens who until that time, believed conventional planning practice to be the means to achieve quality-of-life standards for the majority of people across America. For the most part, the discipline of planning responded to these criticisms by rethinking the application of planning instruments such as land-use plans, zoning ordinances (or bylaws, as they are referred-to in Canada), and building standards. Planners began evolving and innovating alternative approaches to land-use planning. These included: multi-use development (Whitherspoon et al, 1976); performance zoning (Kendig, 1980); and incentive zoning (Axelrod, 1971; Morris, 2000) to achieve more functional and desirable communities.

What makes *The Death and Life of Great American Cities* particularly interesting critique for marine planners and managers is the book's critical appraisal of zoning. For marine environment, zoning is widely believed by scientists, conservationists, resource managers and scientific organizations to be an effective way to plan ocean space and to deal with issues of multiple use conflict and conservation (Doherty, 2006, Dayton et al. 2002,

Norse 2002, Pew Oceans Commission 2003). Zoning is thought to be one of the most powerful management tools available marine managers to allocate and protect critical habitat while accommodating appropriate (human) uses in ocean places (Agardy, 2010).

More specifically, Jacobs conveyed that planners at that time saw the complexities of cities as, "mere disorder" that could be resolved through planning instruments such as zoning. She further claimed that zoning had failed to cultivate a higher quality of life for citizens because it oversimplified the arrangements of communities (Allen, 2011) resulting in a state of 'monotony' (Jacobs, 1961). She also suggested that the intellectual and social basis for carving-up cities into single-use districts was nonsense, and dangerous nonsense at that (Allen, 2011).

The impetus for this research described herein was based on three initial curiosities that developed in reflecting on *The Death and Life of American Cities* relative to contemporary approaches of marine planning and zoning. The first of these curiosities questioned why a conventional approach to zoning had gained such favor with marine planners and policy makers, despite overwhelming criticisms associated with the practice in planning and law journals (Kendig, 1980). Considering one of the earliest publicized applications of conventional marine zoning (1975), the Great Barrier Reef Marine Park, post-dated *The Death and Life of American Cities* (1961), why hadn't criticisms of conventional land use zoning compelled marine planners to employ more evolved or innovative planning practices? Were the criticisms of zoning on land simply not relevant in a marine context or had the benefits of conventional zoning practices simply outweigh

any apparent costs up to this point? Or, had an insufficient amount of time passed to adequately assess the effects of conventional marine zoning practices on the ecological and socio-economic functions of marine spaces?

The second curiosity pertained to why marine zoning has seemingly avoided the need to institute alternatives or major variations to conventional zoning practices compared to those that have occurred in land planning (e.g. performance zoning, incentive zoning, etc.). Marine zoning literature will often refer to zoning approaches such as multi-use zoning and comprehensive zoning but these techniques are only variations on what is still considered by land planners to be conventional zoning. This paper considers these variations of conventional zoning because they still work under a certain degree of separation or exclusion by 'uses'. Thus, had marine planners failed to equip themselves with the array of zoning instruments available to land planners by failing to consider the array of zoning alternatives that came after the Jacobs critique? Or has the role served by these alternatives been displaced to other marine planning instruments or principles that work to support of conventional zoning in a marine context?

The third curiosity prompting an exploration of alternative marine zoning approaches goes back to Jacobs, where she underlines the impact that planning techniques (particularly zoning) can have on the resulting form and function of land spaces. To use a simple example, an apple can be processed into smaller parts using a range of tools; however the outcome will be very different when one uses a knife versus a blender. The

example highlights the need to consider the direct effects a tool can have on an outcome but also highlights the often irreversible effects a tool can have on this same outcome.

When describing conventional zoning techniques of the time, Jacobs's used words such as, 'oversimplification', and 'monotony'. Such claims stimulated the idea that the practice of zoning may not be dissimilar to that of a monoculture, which promotes the cultivation or growth of a single crop or organism especially on agricultural or forest land. Thus, could conventional zoning be likened to a monoculture as both attempt to concentrate particular uses and exclude an overwhelming majority of others to meet economic, health, safety, or conservation objectives? What is disconcerting about this similarity is that monoculture has come under much scrutiny in the scientific community for its inability to resist disturbances (e.g. disease, pests, fires, etc.) or achieve greater 'resilience' to these disturbances. Thus, if zoning can equate to a 'monoculture of uses', then how in a marine context might conventional zoning support themes of flexibility, adaptability, and durability that are prominent in recent (marine) planning and management literature?

This paper does not intend to prove that a complete departure from conventional marine zoning is required. This research paper aims to demonstrate the potential for performance zoning in a marine context, in an effort to highlight one of the many alternatives to conventional (use-based) zoning approaches that have succeeded on land. Land planning approaches have inspired many techniques, which are currently employed by marine planners and managers. This paper operates under the premise that a wider

suite of marine zoning techniques can provide marine planners and managers greater flexibility to achieve a wider range of marine planning objectives.

APPROACH

The approach taken in this research paper first uses a range of literature sources to describe the evolution of zoning on land by describing the challenges that compelled planners to innovate alternative forms of zoning, including features, benefits, and limitations of those alternatives. The paper then presents two different examples of how one of these alternative approaches -- performance zoning -- was applied. The paper goes on to use literature sources to explain the inherent characteristics of the marine environment that vary from the terrestrial environment, and complicate direct translation of land planning techniques. From there, the paper discusses the principles and practices associated with contemporary marine planning and ocean zoning and lays out the argument that performance zoning is a viable alternative to contemporary ocean zoning practices. Finally, the paper discusses two examples of marine zoning that come close to exemplifying a marine performance zoning approach and concludes by suggesting elements that could be incorporated into a marine performance zoning scheme.

BACKGROUND

INFLUENCES OF LAND PLANNING

For thousands of years, human settlements have required purposeful planning and organization to achieve standards for health, safety, security, and prosperity. Even some of the more primitive settlements displayed forethought into physical-spatial design,

selection of the site, determination of the general layout of the settlement, and precise arrangement of structures and open spaces (Branch, 1985). As human populations grew and concentrated, so did issues associated with overcrowding, health and safety (e.g. sanitation) and conflicts resulting from incompatible activities coexisting in common spaces (i.e. residential and industrial uses). (Morris, 1994).

Since humankind began designing and planning spaces, six important issues have been main considerations for planners:

1) *The selection of the site;*
2) *The function (or purpose) of the community;*
3) *The allocation of land uses;*
4) *Accommodating growth or change;*
5) *The need for connection and circulation of people, goods and services;*
6) *The form of the community (Hodge, 1986)*

Planning, in the context of this paper, refers to the process of establishing goals, guides, and directions for future community development. Planning covers the physical, economic, and social aspects of community development. The basic planning process consists of:

1) *The establishment of community goals for desired future growth and development;*

2) *Data collection, research, and studies in such areas as existing land uses, basic physical features of the community, public facilities, transportation, population characteristics, housing conditions, fiscal capability and trends, economic employment structure, environmental quality and social development patterns;*

3) *The preparation of the plan or plans; and*

4) *Plan implementation* (Linowes, 1973).

LAND USE PLANNING & REGULATION

The reoccurring function of planning most pertinent to this paper, relates to the allocation and regulation of uses on land or in a marine setting. The planning of early human settlements required public authorities to ensure both private and public lands were developed and used to standards necessary or desirable in the general public interest (Branch, 1985, Hodge, 1986).

The term 'land use' can be separated into three basic – and interrelated components: 1) physical facilities, 2) activities of people that use space, and 3) the functions that the land serves. In addition, there are three main dimensions that aid in determining land-use patterns and trends: the location, the intensity, and the amount of land required (Hodge, 1986).

Land use planning is a process that grew out of a need to protect and improve the living, production and recreation environments in a community through the proper use and development of land. This process aims to match human activities to the physical environment to ensure minimum stress on other members of society and the environment and typically results in a land use plan that require regulations or controls to implement or maintain its purpose (Leung, 2003).

Land use regulations or controls establish limitations on the use and development of land. These controls include building code, health code, subdivision control, and zoning bylaws or ordinances (Branch 1985, Hodge, 1986). Zoning controls will be the primary focus of this paper.

Zoning

On land, zoning aims to separate different or incompatible land uses (Dewberry et al, 2008) by dividing a community into districts or zones in which certain land uses and associated development standards are permitted (e.g. lot size, building bulk, placement, etc.) (Meshenberg, 1976). Zoning is made law through the adoption of a zoning bylaw (ordinance) by a governing body. The zoning bylaws consist of two parts: a text and a map. (Linowes, 1973)

Efforts to control the use of land through zoning have a long history. The first use of the word "zoning" may have appeared in 593 B.C. in the prophesies of Eziekiel, in which he describes the desirable assignment of uses or zoning of land in Palestine for the city of

Jerusalem: one part sanctuary for the temple, another for the houses and suburbs, and the remainder for the prince (Branch, 1985). When zoning was first introduced (in North America), it was promoted under the auspices of the so-called 'police powers'. These called for the protection of the health, safety, convenience and welfare of the public (Goldberg et al., 1980). The need for a police power became important in the early part of the (20^{th}) century where civic improvements by public authorities could not ensure that private land, which made up the largest part of cities and towns, would be developed to high standards. Zoning powers fulfilled a need to control the land uses and physical form of development on individual parcels of privately owned land. More specifically, zoning deals with the use that may be made of a parcel of land, b) the coverage of the parcels by structures, and c) the height of buildings (Hodge, 1986).

On land, the application of zoning is generally understood to mean 'comprehensive zoning', or zoning covering the entire community, including all uses (Leung, 2003).

Conventional Zoning

The term 'conventional zoning' simply refers to zoning practices that use rigid and often simple criteria to separate land uses by a singular use category (Meshenberg, 1976). These bylaws prescribe very specific land uses and building configurations that are permitted on a parcel of ground and the standards applied to development (Dewberry et al., 2008). Three such categories that are considered to exemplify conventional zoning are: residential (usually single family), commercial, and industrial (Linowes, 1973).

Conventional zoning is often referred to as prescriptive or Euclidian zoning, which references a 1926 United States Supreme Court case involving the Village of Euclid Vs. Ambler Realty Company. This case put to rest all doubt that zoning enactments which restricted an individual's right to develop private property were a constitutional exercise of a community's police power (Kendig, 1980). This case firmly enshrined the legal status of zoning in the United States (Leung, 2003).

The definitive theory behind conventional zoning is that the separation of land into separate districts allows the sorting of land use on the basis of their compatibility. This sorting is based on the likely or predicted effect of any particular land use rather than the actual performance of any example of such a use (Kendig, 1980).

Benefits of Conventional Zoning

Goldstein (2004) provides direct summation of the benefits of conventional zoning, as follows:

> *'Zoning would not have the track record it has if not for its efficacy as a development management tool. There are numerous positive aspects to conventional zoning, but three such aspects will be considered in particular:*
>
> 1) ***Zoning allows for the separation of incompatible land uses****. The health and welfare of certain uses (i.e. residential) can be radically diminished by the impacts of other development (e.g. industrial).*

2) ***Zoning provides clear and easily understood level of security in land acquisition and development****. In particular, it allows property owners to feel secure in their investment because adjacent properties would be required to go through a formal rezoning process in order to change their intended use.*

3) ***Zoning has logical connection to the tenets of "good" planning*** *as defined by Urban Land Use Planning (Godschalk et al., 2006), in particular the sustainable balance of economy, ecology and equity. This definition of good planning holds that optimal planning outcomes stem from ensuring that development occurs in harmony with the public goods of ecology and equity. Zoning aids this balance by ensuring that economic development occurs in areas that increase equity while minimizing environmental impact. As such it is a powerful tool, and one that has for the most part justified its prolonged existence.'* (Goldstein, 2008)

Limitations of Conventional Zoning

Porter et al. (1988) provides a concise summation of the disadvantages or limitations affiliated with conventional (traditional) zoning, as follows:

1) ***'Conventional zoning is static****. Perhaps the overarching argument against zoning is that the very idea of a pre-determined, comprehensive land use pattern is at odds with the way land is usually developed…The conventional conception of zoning as a prescriptive, static mechanism fails to cope with the ever-changing world of development.*

2) ***Conventional zoning serves parochial rather than regional interests.*** *Zoning critics have long noted that local governments acting on their own behalves often subvert regional, state, and even national interests.*

3) ***Conventional zoning cannot ensure high-quality development****. At the community scale, critics have charged that overly restrictive zoning is largely responsible for suburban sprawl. Overly stringent density controls in close-in suburbs, they argue, drive up the cost for close-in land, thereby making cheaper, more distant land more attractive for development…Zoning's chronic inability to address issues of design has stimulated interest in other means of control over site and building design. This situation provides another incentive for local officials to underzone land, then require legislative or administrative action only in light of a specific proposal for rezoning…resulting in decisions (that are) often arbitrary.*

4) ***Conventional zoning can involve administration problems****. In theory, the designation of districts, each with its list of permitted and prohibited uses, should allow easy administrative decision(s). In practice, however predetermined zoning schemes seldom fit the development realities of communities, requiring zoning bylaws to be constantly amended through variances, special exceptions, or rezonings, all of which require additional administrative actions by boards, commissions, legislative bodies and staff.' (Porte et al., 1988)*

An additional disadvantage not mentioned by Porter et al. (1988):

5) ***Conventional zoning discourages diversity*** – Zoning does not encourage diversity, variety, or experimentation. The premise of zoning is to encourage the propagation of like uses and discourage uses that do not conform to the norms for a set location. However, zoning has resulted in unanticipated consequences that excluded resulted in the exclusion of certain social groups, specifically referred to as 'exclusionary zoning' (Linowes, 1973). Such exclusionary consequences of conventional zoning can promote uniformity that can detract from the variability and resilience of a community.

Alternatives to Conventional Zoning

Jane Jacob's criticisms of conventional (Euclidean) zoning in, *The Death and Life of Great American Cities* (1961) inspired the new urbanism movement and an entire body of literature suggesting solutions to suburban sprawl and its attendant problems. New urbanism reflects an American version of the European compact city, where the mixing of shops and residence in the urban center is designed to generate city life and attract pedestrians toward a higher density, less automobile-dominated community. In direct contrast to conventional zoning, the foundational planning principle of new urbanism is that relatively dense, mixed-use development is necessary for healthy community life (Hall et al., 2001). The following sections describe the planning approaches that are a direct departure from conventional zoning in an effort to combat the many negative impacts that particular planning instruments continue to have on communities. These

municipal zoning approaches have direct bearing on the potential for innovative approaches to ocean use.

Mixed-Use Zoning

The concept of a 'mixed-use' space can be traced back in history, to ancient Greek agora, the medieval market square, and the mix of residential and commercial uses found in many 19th century European cities (Witherspoon, 1976).

Mixed-use zoning permits a combination of uses within a single district or development (Meshenberg, 1976). The intent of this approach attempts to 'mix' compatible or complementary uses to create more vibrant, convenient or efficient spaces for occupants and users. The benefits of mixed-use zoning include creating 24-hour environments; cultivating a distinct community identity; minimizing vehicular traffic; preserving environmentally sensitive areas; utilizing, improving, or upgrading existing infrastructure; and effectively creating safer (in terms of security and overall environmental health) livable communities (Dewberry et al., 2008). Mixed-use zoning does this by encouraging the intermingling of complementary or synergistic uses (e.g. residential spaces and food markets). As a result, communities are made more self-contained, thus distinct, and need for travelling away from such centers for services (e.g. employment, goods & services) is less prominent.

Benefits & Limitations of Mixed-Use Zoning

Mixed use zoning was a logical outcome of the eroding boundaries between traditional residential, commercial, and industrial land use categories (Elliot, 2008) or conventional zoning. In his book titled, *Alternative Techniques For Managing Growth* (1989), planner, Irving Shiffman provides the following benefits and limitations of mixed-use zoning:

'Benefits of Mixed-Use Zoning

1. *Can aid in reducing the cost of development.*
2. *Brings needed community facilities closer together while enhancing the vitality that comes from the interplay among various activities.*
3. *Can reduce transportation needs and energy consumption.*
4. *Provides an efficient and economical use of space, possibly relieving development pressures on rural and agricultural lands.*
5. *Provides full time/joint use of some facilities such as parking and infrastructure*

Limitations of Mixed-Use Zoning

1. *Avoiding insensitive juxtaposition of different kinds of development, particularly where residential environment is involved, requires consideration and time.*
2. *Additional processing time may be required to ensure the proper implementation of necessary design and buffering standards.*

3. *Perceived nuisance factors such as noise, traffic and security associated with mixed uses may reduce their popularity with neighbors and potential residents.' (Schiffman, 1989)*

Planned Unit Development (PUD)

A planned unit development (PUD) is a land planning instrument that allows for a comprehensive mixed use development to occur in a defined space that permits variation from traditional land controls (density, land use, open space, etc.) (Mandelker & Cunningham, 1987). It is most often applied in larger tracts of land by a single land developer (Dewberry et al., 2008). An integral part of PUD is cluster development, under which housing units are designed to be more concentrated to allow for communal open space and economies in development (Schiffman, 1989). Some communities delineate PUD districts on their zoning maps. Ordinance provisions set use and intensity conditions that reflect the district's relationship to other uses. Other communities allow zones to 'float', where they only become fixed during the rezoning process, when an applicant has assembled several properties and the project takes on the general characteristics of the underlying zones (Dewberry et al., 2008).

Performance Zoning

The emergence of mixed-use zoning is evidence that conventional zoning was not able to completely solve land use planning challenges and meet objectives of communities. Moreover, conventional land planning instruments have failed to protect the environment: forests have been felled, floodplains and marshes have been filled, and

agricultural land has been destroyed. Conventional zoning also failed to account for cumulative impacts on natural, social, and economic qualities of communities. (Kendig, 1980)

Where conventional and even mixed-use zoning relies on a list of specific uses to define what activities may be permitted in the various zones, performance zoning approaches the problem of separating potentially incompatible land uses from a different angle. As the expression implies, performance zoning looks to control the effect of a use (or activity) rather than limiting the use itself. Performance-based regulation is built upon the assumption that the impacts of land use are a function of the characteristics and intensity of uses (Hodge, 1986, Leung, 2003). Thus, performance zoning is a land use regulation system that permits or prohibits land uses based on their performance on pre-set criteria (Porter et al., 1988) or performance standards (Stockham, 1974, 1974b; Porter et al., 1988). Performance zoning permits (or encourages) a wide variety of land uses within each district as long as each land use is able to meet the performance standards set for that district and use (Kendig, 1982). The principle behind performance standards is well established in the law of nuisances, which goes back beyond the advent of zoning (Stockham, 1974b).

Performance standards, instead of use categories or use-lists, are the key elements that enable performance zoning. Dennis O'Harrow, a pioneer of industrial zoning performance standards, has initially defined these standards as (O'Harrow, 1955):

'The ideal zoning performance standard will substitute a quantitative measurement of an effect for a qualitative description of that effect that we have used in the past. It will not use the terms "limited," "substantial," "objectionable," "offensive." Instead, it will establish definite measurements with standardized instruments to determine whether the effects of a particular use are within predetermined limits, and therefore permissible in a particular zone.'

The key words in this description are "quantitative" and "effect". Stockham (1974) makes a number of key contributions to the definition and application of performance zoning by first stating that, 'to qualify as a performance standard a regulation must involve measurement….what is being measured must be an effect or impact of a particular activity'.

Finally, Stockham lays out a set of categories that incorporate a wide range of performance standards. These are: environmental pollution; traffic generation; floor area ratio; landscape area ratio; aesthetics; social and economic impact; and carrying capacity. For the purpose of this paper, and potential applicability to a marine context, the following categories will be examined further (Stockham, 1974):

1) ***'Environmental Pollution*** *– 'set ceilings for different types of…nuisances for one or more zones. The types of impacts typically controlled by…performance standards include noise, particulate matter, toxic materials, and smoke…are relatively easy to measure and there is general agreement on the levels of*

degradation which can be permitted…separating industries which are pollution generators from residences or other uses is a popular and easily defensible type of regulation.'

2) ***Traffic Generation*** *– '…involves measuring the performance of fixed activities in regard to their traffic generation potentials or traffic attraction potentials (e.g. Average Weekly Traffic [AWDT]).'*

3) ***Social and Economic Impact*** *– '…socio-economic impacts can be measured and regulated by performance-based ordinances…though a discretionary approach such as…trade-offs, negotiation, (or) "conditional use" clause(s)… where discretionary power determine if certain conditions are met.*

   Points can be granted to users for meeting certain social and economic conditions. Categories for which points are given include providing low and medium income housing, providing units for elderly people, students and large families, building where utilities and public services exist or are planned, and for providing open space. A developer can acquire the requisite special permits by accumulating a certain number of points.'

4) Carrying Capacity *– 'Carrying capacity standards relate to such factors as erosion potential, soil limitations in regard to subsurface sewage disposal, protection of groundwater supplies, and flood hazards… zone may encompass a variety of environmental conditions can use performance standards (conditions) to avoid underprotection or overprotection.'* (Stockham, 1974)

Performance standards (permissible activity by condition) to reflect carrying capacity criteria also limit the need to divide spaces into districts by physical limits or conditions.

In summary, the term "performance zoning" is merely an application of performance standards to a zoning context. Performance zoning implies a continuance of districting but the criteria for establishing districts and regulating land use within districts is based on performance rather than on use or design specifications. In other words, a performance zone is defined by a list of permitted impacts as opposed to a list of permitted uses. (Stockham, 1974b)

Benefits and Limitations of Performance Zoning

As per, Schiffman, performance zoning offers the following benefits and limitations to land planner wishing to employ the technique:

'Benefits of Performance Zoning

1) *Requires minimum of zoning districts and provides increased choice within districts; among other advantages, this should reduce the need for variances and zoning changes.*

2) *Land uses are separated only to the degree that they create negative impacts on neighbors.*

3) *Takes into account the capability of land to support proposed activities and permits development to occur only to the extent that it is consistent with the defined standards.*

4) *Moves away from fixed requirements and seeks to maximize freedom and flexibility by providing the landowner with many options in developing (their) land.*

5) *Provides incentive for industries to reduce their pollution output in order to meet the performance criteria for a particular site location. (Schiffman, 1989)*

Limitations of Performance Zoning

1) *Depending on the nature of the performance standards utilized, various degrees of skill may be necessary in their administration. In general, the complexity of the standards should reflect the capabilities of the administering authorities.*

2) *Land capability standards require very specific technical information describing such things as erosion potential, protection of ground water supplies, and flood hazards. Once the standards are in place, prospective developers can be required to collect the information necessary for decision makers to assess compliance with them.*

3) *Performance zoning districts may not be appropriate in built-up residential areas where neighborhoods are stable and the only likely development is the addition of rooms or garages.'* (Schiffman, 1989)

Performance Zoning - Case Examples

The following sections provide two examples of performance zoning ordinances that have been implemented in North America over the past number of decades. Both case

examples will be presented and followed by a summary discussion that highlights the similarities, dissimilarities and features that will feed into discussion later in the paper that relate performance zoning practices to a marine planning context.

Case Example #1 – Bay City, Oregon

The town of Bay City (population 1,175) is located on the North Coast of the State of Oregon, U.S. approximately 80 miles from the City of Portland (Bay City, 2013). The town is situated on sloping hillsides directly overlooking Tillamook Bay. Since many of its residents commute daily into Tillamook, single family homes predominate, although there are some small farms in the area also.

According to one community survey that was carried out prior to the establishment of the Comprehensive Community Plan in 1978, citizens expressed an overall sentiment that Bay City should retain its quiet residential character, that development should take advantage of the natural environment and that growth should be planned and controlled (Bay City, 2007). Thus Bay City officials were drawn to the performance zoning concept because they felt it would provide administrative simplicity and enable the community to, "attain the goals of preserving open space and maintaining the character of the community and achieve other objectives, such as lower housing costs, more efficient use of public facilities, and diverse community" (Pease & Morgan, 1980).

Bay City created and adopted a performance zoning ordinance in 1978. A variety of land uses were permitted in each zone and performance standards that regulated these land

uses differed from zone to zone (Pease & Morgan, 1980). The Bay City ordinance divided the town into three zones: a high-intensity zone, a moderate-intensity zone, and a low-intensity zone (Marwedel, 1998). The zones were based on "physical characteristics, the existing land use pattern, and the presence of public facilities such as streets and sewer and water lines," with standards that dealt with "density, lot coverage, common open space, setbacks, traffic, buffers and screens, noise, emissions, water runoff and erosion, and hazards such as flooding and landslides" (Pease & Morgan, 1980).

To date, the Bay City performance zoning has grown to include the following five broad categories or zones of land and water use within the current Bay City Comprehensive Plan (2007):

1. ***High Intensity***

The purpose of the high intensity area is to provide areas of land in which intensive types of activities can take place. These include, but are not limited to, commercial, industrial, higher density residential, intensive commercial recreation, and similar types of activities with heavier impacts. These uses are also allowed in the moderate intensity area, but with more restrictive standards. (Bay City, 2008)

2. ***Moderate Intensity***

The purpose of the moderate intensity area is to provide a land area primarily for residential use, but one in which other uses may take place on a conditional use

basis. The purpose of the performance standards is to separate non-compatible uses and lessen the overall intensity of use, while allowing for flexibility of development.

3. ***Low Intensity***

The low intensity zone encompasses those areas with large, undeveloped tracts of land where full city services are not available. The area includes several active farms and forested areas. It is anticipated that these areas may become more intensively developed in the future as the City grows. At present, however, development shall be at a low intensity level, as reflected in the performance standards.

4. ***Coastal Shorelands***

The purpose of the shoreland zones is to identify and regulate uses within the City's shoreland areas in order to implement the 'Coastal Shoreland Goal' and the policies of the Bay City Comprehensive Plan. Shoreland Area has been divided into three subareas (Bay City , 2007):

1) natural subarea that extends from Larson Cove to the Main Street extension;

2) water-dependent, water-related management unit in the vicinity of the Bay City jetty; and

3) non-water dependent/related subarea in the southern portion of the town.

5. ***Estuarine Areas***

The purpose of the Estuarine zones is best described by the Estuarine Resources Goal, which is "to recognize and protect the unique environmental, economic, and

social values of each estuary and associated wetland and to protect, maintain, where appropriate develop, and where appropriate restore the long term environmental economic and social values, diversity and benefits of Oregon's estuaries" (Bay City, 2007).

Bay City's estuarine area consists of five types of management units: Estuary Development (ED); Estuary Conservation 1 (EC-1); Estuary Conservation 2 (EC-2); Estuary Conservation Aquaculture (ECA); and Estuary Natural (EN). Each of these has distinct performance and use requirements.

These zoning categories are supplemented by another type of zone referred to as a 'Hazard Overlay' zone. The Bay City Development Ordinance (2008), describes the purpose of these zones:

'to mitigate potential building hazards and threats to life and property created by flooding, landslides, weak foundation soils, and other hazards as may be identified and mapped by the City of Bay City or other agency. Building hazards exist throughout the other zones of the City, but specific parcels which lie wholly or partially in an area of identified hazards are considered to be in the Hazards Overlay Zone…These policies and standards are intended to mitigate potential building hazards by requiring the study of such areas by a qualified person prior to construction, by reducing building intensity in these areas where appropriate, and by requiring special construction techniques for ground disturbing activities'

The hazard overlay zone includes sensitive geologic and wetland spaces that require additional development as they are subject to flooding or landslides. Other features of the Bay City zoning ordinance include buffers and screens to provide necessary protections between non-residential and residential uses, restriction of certain activities that generate high traffic to sites that have adequate access to critical roads and a bonus density system to encourage certain desirable development characteristics (Schiffman, 1989).

Though the Bay City zoning ordinance is primarily performance-based, land use is considered within each intensity and management zone. The Bay City Development Ordinance maintains an element of use-based (conventional) land control through the institution of the Land Use Matrix, which describes the general land uses that are permitted in each performance zone. With Bay City, there is a fusion of two zoning approaches (though dominated by performance standards) to regulate the effects of land uses as well as the uses themselves (Bay City, 2007).

On all accounts, Bay City Ordinance continues to represent a successful land policy instrument, designed to address the impacts of land uses partially through the use of performance standards, and by the division of the City into intensity zones, where different levels of land use intensity may take place.

Case Example #2 – Fort Collins, Colorado

The City of Fort Collins, Colorado (population 146,762 [US Census Bureau, 2011]) is about sixty-five miles north of Denver and was founded in 1865. The City was originally settled as a military outpost meant to protect the Colorado frontier. In 1879, Colorado State University was founded in Fort Collins, and, in 1883, the town incorporated (Porter et al., 1988). Fort Collins spent the next seventy years as a small, sedate college town, but around 1950 it began to grow rapidly, both in population and area. In 1950, Fort Collins' population was just under 15,000 and its area was just under 2,000 acres (Acker, 1991). By 1980, the population had grown to over 65,000 and the area to over 20,000 acres (Acker, 1991).

The infrastructure and conventional zoning ordinance that were sufficient for the town in 1950 were becoming inadequate for the city by 1980 (Acker, 1991). Until, the 1950's development code prescribed a ridged pattern of land uses separated into districts that encouraged incremental development on individual parcels. Between 1967 and 1978, Fort Collins tried a variety of land use regulations and plans to cope with its growth. None were particularly successful, except for the adoption of a planned unit development (PUD) ordinance (described in an earlier section) in 1967, which demonstrated potential for providing for a more holistic development planning approach to groups of properties. However, based on the unprecedented growth and community outcry for radically different approaches (Acker, 1991; Porter et al., 1988)

In 1981, the City, represented by the Planning and Zoning Boards responded to the need for better land use control, by implementing a land use (administration) system known as the Land Development Guidance System (LDGS) (Porter et al., 1988). The Fort Collins's LDGS has been credited as ‘the closest thing to pure performance zoning yet adopted in America’ by Acker (1991).

The LDGS abandons use districts and many other aspects of conventional zoning and relies solely on performance standards. The LDGS was implemented to apply only to Planned Unit Developments (PUDs), which are allowed in all districts, which constitute over ninety (90) percent of all development. The other ten (10) percent utilizes conventional zoning approaches in which both practices are allowed to co-exist (Porter et al., 1988). Since the LDGS is based on PUDs, which is subject to an unusual, but highly efficient, review procedure (Acker, 1991). Thus, LDGS relies on the procedure by which PUD projects are processed.

It begins with a mandatory conceptual review and neighborhood meeting. This stage allows for improvements to be made and input from the community for elements of the development plan that might have, "significant neighborhood impact” (Acker, 1991). During the preliminary plan stage, the planning staff reviews the developer's plan according to two sets of criteria within the LDGS - absolute and variable.

Absolute criteria covers development standards that include: neighborhood compatibility, conformance with adopted plans, minimum requirements for engineering and public

services and compliance with standards for protecting resources, the environment, and site design. Forty-four (44) absolute criteria are contained in the LDGS provided in 'Appendix 1' of this document. (Porter et al., 1988)

Variable criteria are written for seven land use categories: all residential uses, neighborhood service centers, community/regional shopping centers, auto-related and roadside commercial uses, business service uses, industrial uses, and extraction, salvage, and junkyard uses. (Porter et al., 1988)

In order to demonstrate that each PUD plan abides by the LDGS, the developer must provide explanation justification for how they meet each of the absolute and variable criteria. The LDGS outlines a comprehensive set of considerations or questions that developers must answer in their plan applications. The following considerations provide just a sample of those outlined in the City or Fort Collins Development Manual (City of Fort Collins, 2012):

'6. Will the project's completion not generate a traffic volume that exceeds the future capacity of the external street system as defined by the city?

7. Is the development served by utilities with adequate capacity, or have arrangements been made for extension and augmentation for the following services?

- *Water supply*
- *Sanitary sewer*

- *Electricity*

- *Natural gas*

- *Storm drainage'*

The evaluation of LDGS criteria by staff involves a 'point system'. The point system of the LDGS is what makes it a performance zoning ordinance. First, the city staff evaluates development proposals (including answers to all criteria) against the list of absolute criteria (Appendix - 1), all of which must be met. Second, staff evaluate proposals against a list of variable criteria, determined by the land use. All the variable criteria need not be met, but the proposal must achieve a minimum point score. The application process also includes bonus criteria allow developers to raise scores where deficiencies may occur in variable criteria for residential uses. (Acker, 1991; Porter et al., 1988)

The Fort Collins' performance zoning system (i.e. LDGS) is largely considered a success. Before the city implemented the LDGS, building application approval could take up to a year. After the implementation of the system, approval was observed to take only seven to fourteen weeks. It has also produced a balanced ratio of housing to jobs and more efficient use of the city's infrastructure. Perhaps the biggest success of the LDGS has been its encouragement of mixed uses. Residential and industrial and/or business uses coexist with very few problems (Acker, 1991).

However, since the reporting the success of the LDGS in Fort Collins (Porter et al. 1988), Porter notes in his 1998 report that resident concerns for the quality of development resulting from the LDGS prompted of the system in favor of more conventional zoning with its greater predictability. However, the performance criteria from the LDGS were incorporated in to the City's new zoning ordinance. The performance criteria are now expressed as (zoning) requirements, whereas before they were used to assign points in the evaluation of a development proposal (Marwedel, 1998).

Marwedel (1998) provides further explanation for the reasoning to 'hybridizing' conventional and performance based zoning systems as follows:

> *'A primary function of land use control is to ensure compatible and orderly development. Yet performance zoning has been charged as being "the antithesis of 'orderly' development"…(where) different land uses can locate next or very near to each other thereby resulting in visual and functional conflicts. Most performance-based systems, however, …rely on devices to ensure more orderly development (Porter et al., 1988)…(such as) standards that guide development to preferred locations for urban growth...(or, through)…the mixing of conventional zoning and performance zoning. Certain areas are defined in which densities and some land uses are specified (conventional zoning), but flexibility is retained through the use of performance standards (Porter et al., 1988)'* (Marwedel, 1998)

Case Example - Discussion

Bay City and Fort Collins represent innovative applications of performance zoning. Both cases were purposely selected due to certain differences and similarities in the way they implemented performance-based standards.

Both systems are alike in that they attempt to recognize the need to balance conflicts between land uses and the impacts of those uses on environmental elements. The extensive set of standards employed by Fort Collins require land uses to meet natural targets such a *Resource Protection* (e.g. wildlife habitat, eco-sensitive areas, etc.) and human conflict mitigation targets such as *Site Design* (e.g. privacy, parking, open space, etc.). Bay City achieves the same balance by fusing community objectives for the location of development intensity (i.e. intensity zones) with the capacity of the land to handle disturbance (i.e. hazard overlay zones, estuary management areas). Both systems employ a certain degree of consideration for carrying capacity by setting standards that relate to a predetermined zone or by detailed plan review, carried out by qualified staff.

Additionally, both systems allow for flexibility in uses of land that utilize some form of incentive or bonus, through conditional performance standards to compensate for shortcomings in development plans by rewarding other aspects of land activities that benefit immediate and adjacent spaces (e.g. affordable housing).

However, Fort Collins and Bay City differ in the manner in which performance standards manifest spatially. The Fort Collins LDGS relies on PUDs which are not necessarily

based on pre-determined zoning districts, whereas the Bay City intensity zones are clearly delimited and require amendments to the zoning ordinance if the extent of the zones was required to change. Themes of 'flexibility' and 'simplicity' are common goals for both systems but applied differently, creating certain trade-offs. The presence of intensity zones simplifies the development process in Bay City, as developers need only consider the performance standards that apply to that zone, though their potential locations for development are more restricted. Whereas, Fort Collins PUD based approach allows for mixed development to take place in most locations, although developers must consider a full suite of absolute and variable criteria.

CHARACTERISTICS OF THE MARINE ENVIRONMENT

Thus far, this paper has illustrated how planning and use-control techniques have evolved in a land context. Although many of the practices utilized in the marine environment have been borrowed or derived from land techniques (Agardy, 2010), it is important to understand how readily the variety of land planning techniques can translate to the marine setting by first understanding the differences between both environments. The following sections describe the unique characteristics of the marine environment that must be weighed when translating land planning techniques to the marine realm.

1) Oceans Provide 'Services' to a Range of 'Users'

Planning on land generally aims to create safe, healthy, economically and environmentally sustainable, or 'liveable' communities. Earlier sections of this paper described the approaches taken by land planners to ensure growth, development, and use

of land is carried out to reflect the greater good of the community by implementing controls on property and built form.

Marine planning and management is generally not focused on 'liveability' of marine spaces for humans, simply because oceans are generally not used as living spaces. Marine space has typically been seen as ''unpeopled'', with users entering and leaving for resource extraction, recreation, or travel, but with little attachment to particular places (Crowder & Norse, 2008). This is not to say that marine planning does not account for the safety, welfare, enjoyment and overall livelihoods of humans using oceans, but there in-lies the key term, 'use'.

Oceans are heavily exploited (used) by different kinds of activities (Toonen, 2013). Because human activities have overlapping objectives, not all uses are compatible with one another and are competing for ocean space or have adverse effects on each other (user– user conflicts) (Cicin-Sain, 1998). In addition to conflicts among users, human activities can impact marine environments, creating conflicts between human uses and the marine environment (user– environment conflicts) (Douvere, 2008).

Marine ecosystems and their relevant space are not only used by humans – they are 'used' by the natural living and non-living part of the eco-system (i.e. natural use) (Zacharoula et al, 2013). Thus, correct or not, the term 'use' can be used to suggest a particular activity and associated assets, as well as part or function of a marine ecosystem.

2) Oceans are Common Property

On land, zoning bylaws enable authorities to exercise 'police powers' through legislative means in order to limit the use and development of private and public properties alike (Leung, 2003). Inversely, the ocean environment lacks a need to administer or enforce property rights and treats ocean spaces as 'common property' (Agardy, 2010). Common property or common property resources are owned collectively by members of some group , where such resources are freely open to any user (open- access) and subject to intense use, often the end result is depletion and degradation (Berkes, 1987).

In a marine environment, individual ownership is not the norm. Government ownership, public rights, and international law may usurp whatever private rights exist in the water column. Since oceans have endured as common property, the requirement to institute mechanisms to allocate and enforce rights and restrictions is much different to that on land. Land administration involves the establishment of a system that is responsible for among other things, boundary delimitation, spatial organisation, and right or title of ownership. (Ng'ang'a et al., 2004)

Land-based boundary delimitation might include determining the parcel as a basic land unit. A parcel-based system of this kind is referred to as a cadastre (Larsson, 1991; McLaughlin, 1975; National Research Council, 1980, 1983). In Canada, a land-based cadastre provides the basis for delimitation of zoning districts but the idea of a multi-purpose marine cadastre (Nichols, 1999, 2000; Ng'ang'a et al., 2004) has not been put

into practise in Canada to provide a comprehensive solution for marine planning schemes (i.e. zoning). In a marine environment, individual ownership of a 'parcel' is not the norm.

Though the oceans are a mosaic of private and public interests (Ng'ang'a et al., 2004) that require effective governance, Berkes juxtaposes the argument for administrative solutions like a marine cadastre by using Hardin's *Tragedy in the Common* to argue:

> *The classic approach to the commons problem is the replacement of open-access arrangements with private property rights, as in the privatization of the medieval English common grazing lands by enclosure (Hardin 1968). This solution may be possible for the more readily appropriated resources, but for many marine resources, including fish, this is not possible in the strict sense.* (Berkes, 1987)

Given, these compelling, yet opposing views of responding to the common property characteristic of ocean spaces, solutions marine planners and managers for remain unclear.

3) Oceans are Complex Three (and Four)-Dimensional Spaces

In addition to being a common, oceans present challenges to marine planners and managers due to complex spatial and temporal characteristics intrinsic to the marine environment. Natural processes are three dimensional (3-D)/ four dimensional (4-D) in character (Glynn et al, 2011), as are the activities of humans carried out in our oceans.

The spatial dimensions of oceans include geographic position(s), area(s), and volume(s), whereas temporal dimensions relate to point(s) in time. Zacharoula et al (2013) state that marine processes and uses (human and natural) have:

1) Spatial and temporal dimensions;
2) Overlap with other types of use(s) creating conflict dimensions; and
3) An economic dimension linked to costs, benefits and externalities. (Zacharoula et al, 2013)

Ocean spaces are inherently three-dimensional (3-D) in nature, potentially involving water surface, water column, seabed, and subsurface, though few marine activities can be said to take place (exclusively) on the ‘‘surface’’ of the water (i.e. 2-D). Nearly all marine processes take place in a volume of water. Most marine rights, such as aquaculture, mining, fishing, and mooring rights and even navigation have an inherently 3D nature, which makes a 2-D definition and planning of these of these spaces inadequate (Ng'ang'a et al, 2004). Conflicts between incompatible uses can occur when they occupy the same space (2-D/3-D).

For example, a fishing trawler may transit along the water’s surface, with a portion of the vessel within the water column, in addition to gear that may be actively fished in the water column or along the seabed. This use exemplifies an activity that has both 2-D (e.g. surface) and 3-D characteristics (e.g. water column). This fishing activity can pose

spatial conflict with the feeding activity of marine mammals if the vessel or its gear were to strike or entangle the marine mammal by occupying the same immediate space. Moreover, the noise from the vessel could discourage the animal from feeding if they occupied the same general area. This example demonstrates the subjective and complex nature of spatial conflicts as they greatly depend on the nature of use, process or activity and the spatial footprint and area of influence that each marine use poses to another.

The fourth-dimension (4-D) -- time -- adds another degree of complexity to the understanding of conflicts between users in the marine environment. Incompatible uses are only in conflict with one-another if their immediate or cumulative impacts share the same point(s) in time. Since effects or impacts of one use on another can take place at points in time or over prolonged periods, time can be described as divisions of time, or time-scales.

The earlier example of the fishing trawler and the marine mammal can demonstrates the degree to which time can contributes to further complexity when considering the dimensions of conflict in marine spaces. Time and space can be linked by a singular event, such as the time where the fishing vessel collides with a whale or as time-scale, such as the period when the fishing gear was in the water or the amount of time the whale was affected by noise being emitted from the fishing vessel. Moreover, time-scales add further complexity when considering longer-term or cumulative effects. For instance, fishing might intensify in whale feeding areas over a period of many years, gradually forcing whale populations to seek other regions.

MANAGEMENT PRINCIPLES INFLUENCING MARINE PLANNING & MANAGEMENT

The complex nature of our oceans, explained in the previous sections, requires marine planners and mangers to consider a wide range of variables when determining balanced objectives and approaches to minimize user-user and user-environment conflicts. As such, marine planning and management has evolved to encompass a variety of principles as the basis to respond to the array of social, political, economic, and environmental drivers affecting oceans. The following sections describe a number of those more prominent principles.

Precautionary Principle / Approach

The precautionary approach (Garcia, 1994) or 'precautionary principle', as formulated in the 1992 Rio Declaration on Environment and Development (Sand, 2000), holds that scientific uncertainty must not prevent taking precautionary measures in response to potential threats that are irreversible and potentially disastrous (Resnik, 2003). Harris and Holm (2002) describe that the precautionary approach means, 'action in advance of scientific certainty' and removes the 'burden of proof' (Dayton, 1998; Harris & Holm, 2002) from decision-making processes affecting the marine environment. The approach is therefore an instrument for making practical decisions under conditions of scientific uncertainty (Cranor, 2001).

This principle is holds great significance in the realm of marine planning and management, given that marine spaces are complex systems and associated interactions between humans and the ocean environment. As such, the precautionary approach or removal of the burden of proof provides greater flexibility to enable decisions makers to respond to marine issues to embody a, 'better to be safe, than sorry' view.

Adaptive Management

Adaptive management, as defined by Holling (1978) is, "a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs''. The concept is aimed at increasing our understanding of systems as a whole through active participation and learning, evolving experimentation, reviewing and responding (Walters, 1986). Since marine (natural resource) planning and management decisions are surrounded by uncertainty and complexity (Bennett, 2005), Folke et al. (2002) urges that adaptive management represents a detachment from singular fixed-goals to better promote the concept of resilience in decision-making situations.

Moreover, adaptive management is more than simply, 'learning by doing'. It provides a framework whereby past management successes and challenges can inform and improve current approaches (Gerber et al., 2007). Adaptive management is an iterative process of continuous improvement based on review, including identification of shortfalls, whereby management goals and methods will be expected to change over time as new information is obtained and new challenges develop (Walters and Hilborn, 1978). The adaptive

management cycle includes the following general steps: plan, implement, monitor, review, learn, revise, and repeat (Conservation Measures Partnership, 2007). (Ban et al., 2012)

Adaptive management can provide a systematic approach for marine planning and management to avoid paralysis when weighing responses to complex issues, and ensure consideration of lessons from successes and failures in other regions or fields of study.

Area-Based / Place-Based Management

Area-based management (Roberts et al., 2010) or place-based management specifies appropriate human uses for a particular geographic area to reduce user conflicts and protect the area temporarily or permanently from some or all preventable harm (Hildreth, 2008). Place-based management tools can have a wide variety of management objectives,' such as conservation and management of species or protection of habitats or key habitat features, and are designed to achieve these objectives by managing human activities within a spatially defined area (Roberts et al., 2010).

Young et al (2007), explain the significance that place-based management plays in the planning and management of marine spaces:

> *'By focusing on the distinctive features of individual places, tailoring management regimes to regional circumstances, and encouraging adaptive management and social learning, place-based management of marine ecosystems offers a constructive*

means for dealing with the uncertainties associated with complex, heterogeneous, and dynamic systems. By clarifying the meaning of rules as applied to specific places, enhancing monitoring, adjusting competing uses to alleviate conflicts, and reducing the incentives to cheat, a place-based approach can also make it easier to implement management procedures.' (Young et al, 2007)

Examples of place-based management, in ocean spaces, include marine protected areas (MPAs) and marine reserves (Hildreth, 2008). MPAs and marine reserves are created to restrict human activities in certain areas (e.g. 'no-take' areas) (Rassweiler, 2011). In fact, the practice of zoning, fits with the definition of place-based management as it considers spatial elements of the marine environment to control interactions of human activities with one-another and with the surrounding marine environment.

Integrated Management

In a marine context, integrated management is a continuous and dynamic process that unites government and the community, science and management, sectoral and public interests in preparing and implementing an integrated plan for the protection and development of coastal ecosystems and resources (Bastien-Daigle, 2008). Canada's Oceans Act mandates the application of integrated management, and defines it as:

"a comprehensive way of planning and managing human activities so that they do not conflict with one another and so all factors are considered for the conservation and

sustainable use of marine resources and shared use of ocean spaces. (Government of Canada, 2006)

Cicin-Sain and Knecht (1998) note that this approach involves several dimensions of integration, including:

1) Inter-sectoral integration (including agencies and groups from different sectors such as fisheries, tourism, oil and gas);

2) Intergovernmental integration (including the several levels and agencies of government with coastal and ocean jurisdictions).

3) Spatial integration (including the land-ocean interface such as watersheds and river basins, intertidal zone and nearshore).

4) Science-management integration (including the natural and social sciences).

5) International integration (including trans-boundary issues and international law).

Co-Management

Co-management connotes a collaborative institutional arrangement among diverse stakeholders for managing or using a natural resource (Castro, 2001). In many cases co-management involves state agencies sharing resource allocation or management responsibilities with communities, including indigenous ones, and other parties such as user groups, non-governmental organizations (NGOs), and corporations. Although these stakeholders may hold different interests, the fundamental assumption is that sharing

authority and decision-making will enhance the process of resource management, making it more responsive to a range of needs (McCay and Jentoft, 1998).

Participatory Governance

Participatory governance is the effort to achieve change through actions that are more effective and equitable than normally possible through representative government and bureaucratic administration by inviting citizens to a deep and sustained participation in decision making (Kearney et al., 2007). Participatory governance focuses on tangible problems, involves all the people affected by those problems, and comes up with practical solutions (Schneider, 1999; Fung & Wright, 2001)

Ecosystem-Based Management

Ecosystem-based management (EBM) is ‘‘an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive, and resilient condition so that it can provide the services humans want and need.

EBM differs from current approaches that usually focus on a single species, sector, activity, or concern; it considers the cumulative impacts of different sectors’’ (McLeod et al. 2005).

EBM represents a departure from the separate management of human activities based on singular human activity and interactions (sector-based). EBM recognizes that the closed

nature of ecosystems mean that one component or function of an ecosystem can and will affect another. If the goal of marine planning and management is to sustain the ecological, economic, and social services of the marine environment, then an interconnected and interdependent view is necessary through EBM.

This broad, holistic management view held within EBM carries into a wide range of practical tools that are applied in the marine environment. For example, in March 2005, Communication Partnership for Science and the Sea (COMPASS) released a scientific consensus statement on marine EBM. The signatories support the use of ecosystem-level planning, cross-jurisdictional management goals, zoning, habitat restoration, co-management, adaptive management, and long-term monitoring to achieve EBM (McLeod et al. 2005). Thus, EBM is purposefully intended to provide a basis for a more complete management paradigm that includes many of the other principles of marine planning and management described earlier in this section.

Perspectives on Principles Affecting Marine Planning and Management

The previous sections introduced a number of management principles that have evolved out of a need to balance the range of competing interests inherent in marine environment. The aforementioned principles exist, in theory, to ensure ecological, economic, and social objectives are weighed and achieved through mechanisms that ensure optimal outcomes. Though these principles are distinct, they often interconnect, complement or even overlap one another in practical applications of marine planning and management. For instance,

place-based management and ecosystem-based management are closely related, as is described by Douvere (2008):

> *Ecosystem-based management is place- or area-based in focusing on a specific ecosystem and the range of activities affecting it (McLeod et al., 2005; Crowder & Norse, 2008). This emphasis on managing places is a key characteristic of ecosystem-based management and is a marked departure from existing approaches that usually focus on a single species, sector, activity or concern (Crowder et al., 2006).*

Participatory governance is related and often complementary to co-management depending on the type and arrangement of stakeholders collaborating throughout the planning and management process. Both contribute to integrated management since stakeholders representing various interests are encouraged to invest in a more holistic process to reach planning or management goals. Adaptive management and the precautionary approach complement each other by providing a general basis for managing within a complex and uncertain environment.

Where these principles often overlap is when they move from a theoretical discussion into a practical application. For example, ecosystem-based management and integrated management both speak to a need for spatial management or delimitation, or spatial integration (Crowder & Norse, 2008; Cicin-Sain & Knecht , 1998). Integrated management often references participatory governance (i.e. stakeholder participation) as a core component, yet arguments could be made as to why these two principles are

theoretically different. These are examples of instances of principles that are theoretical different, but practically similar.

Finally, these principles share two common elements that relate them within the scope of marine planning and management. That is, they exist to address both uncertainty, and conflict. Uncertainty, discussed earlier, is ever-present in marine planning and management given the dynamic and complex nature of the marine setting. This is compounded by an ever-changing reliance of humans on the ocean for a range of services. Conflict, also discussed, can exist between human uses, as well as between those uses and the marine environment. These principles are all embedded in the use of zoning for planning and management, in spite of ever-present complexities.

MARINE SPATIAL PLANNING

A sign that coastal nations are increasingly committed to more strategic and integrative approaches to ocean management has been the sudden growth and popularity of Marine Spatial Planning (MSP) (Agardy, 2010). The United Nations Educational, Scientific, and Cultural Organization (UNESCO) define MSP as:

> *'the public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process'* (UNESCO, 2012)

Maes (2008) provides an alternative description, stating:

> *'MSP is a complicated, but necessary process, to establish a more rational organization of using marine space and the user interactions in order to protect the biological diversity of the marine environment, while taking into account social and economic objectives.'* (Maes, 2008)

The principal output of MSP is a comprehensive spatial management plan for a marine area or ecosystem, typically implemented through a zoning map(s) and/or a permit system (Douvere & Ehler, 2009). The plan looks to regulate, manage and protect the marine environment by allocating space to resolve actual and potential multiple conflicting uses and to facilitate sustainable management of the seas. The plan should provide a firm basis for rational and consistent decisions on permit applications and to allow users of the sea to make future decision with greater knowledge and confidence. The plans will have to be flexible to allow for adaptation as a consequence of new scientific insights regarding effects of certain activities or major changes in the natural systems of seas and Earth (biological diversity and climate change effects) and needs to be developed in consultation with stakeholders. (Maes, 2008)

As in land planning, MSP involves a number of common steps, described by Ehler & Douvere (2009) in, *Marine Spatial Planning: Step-By-Step Approach Toward Ecosystem-based Management*:

1) *Identifying need and establishing authority*

2) *Obtaining financial support*

3) *Organizing the process through pre-planning*

4) *Organizing stakeholder participation*

5) *Defining and analyzing existing conditions*

6) *Defining and analyzing future conditions*

7) *Preparing and approving the spatial management plan*

8) *Implementing and enforcing the spatial management plan*

9) *Monitoring and evaluating performance*

10) *Adapting the marine spatial management process*

The steps of MSP listed above, are strikingly similar to the steps associated with the (land) planning process (Linowes, 1973) discussed earlier in this paper. Both processes involve elements of the establishment of goals, collection of information and the preparation and implementation of a spatial plan. Moreover, many suggest that MSP is merely a new label for other similar practises that have existed for decades (Agardy, 2010). Twenty years ago, MSP might have been labelled as Integrated Coastal Management (ICM) or Integrated Coastal Zone Management (ICZM). Decades prior to this, it may have been called Regional Planning. Agardy (2010) also references James Dobbin to suggest that the principles of MSP are no different than of a practise which

emerged in the 1970's called 'bioregionalism'. The point being, that MSP is not to be treated as a revolutionary departure from prior marine planning and management practices but an evolutionary amalgam of lessons learned from prior successes and failures. MSP provides opportunities to draw from a range of planning and management principles discussed earlier in this paper. For instance, Ehler & Douvere (2009) list the following characteristics of effective marine spatial planning:

- *Ecosystem-based, balancing ecological, economic, and social goals and objectives toward sustainable development*
- *Integrated, across sectors and agencies, and among levels of government*
- *Place-based or area-based*
- *Adaptive, capable of learning from experience*
- *Strategic and anticipatory, focused on the long-term*
- *Participatory, stakeholders actively involved in the process*

Since ecosystems or components of ecosystems cannot be planned or managed, MSP focuses to reduce conflict associated with human activities in marine areas by allocating those activities to specific marine spaces by objective or interest (e.g., maritime transport, environmental protection, energy, fisheries and tourism) (Douvere & Ehler, 2009). Ocean space has been regulated or allocated in a number of different ways, but most importantly, this has been done predominantly within individual economic sectors. Obvious examples of 'sectoral zoning'' include ship channels, disposal areas, military

security zones, concession zones for mineral extraction, aquaculture sites, and most recently marine protected areas (Young et al., 2007).

At present, there are few frameworks that facilitate integrated strategic and comprehensive planning in relation to all activities taking place in marine areas (Defra, 2007). The lack of such a framework, often translates into:

1) *A spatial and temporal overlap of human activities and their objectives, causing conflicts (user–user and user–environment conflicts) in the coastal and marine environment.*
2) *A lack of connection between the various authorities responsible for individual activities or the protection and management of the environment as a whole.*
3) *A lack of connection between offshore activities and resource use and onshore communities that are dependent on them.*
4) *A lack of conservation of biologically and ecologically sensitive marine areas.*
5) *A lack of investment certainty for marine developers and users of ocean resources* (CoastNET, 2003].

MSP integrates economic and environmental decision-making to support the development of a sustainable management regime, including spatial aspects of sectoral policies in a marine space (Zacharoula, 2013). Thus, comprehensive MSP provides an integrated framework for management, but does not replace single-sector planning. MSP

can provide important contextual information for marine protected area management or for fisheries management, but does not intent to replace them. The spatial-temporal ordering of maritime activities through MSP is based on different forms and sources of information constructed by different stakeholders who deviate in the ways they access and handle information. This process works to leverage this information to include and exclude actors and their activities (Van Houtum & Van Naerssen, 2002). MSP is therefore an inherently place-based management tool aimed to achieve ecological, social and economic objectives in an integrated way (Toonen, 2013) with zoning being a fundamental component (Kenchington & Day, 2011).

Ecosystem-Based Marine Spatial Planning

Ecosystem-based MSP is an integrated planning framework that informs the spatial distribution of activities in and on the ocean in order to support current and future uses of ocean ecosystems and maintain the delivery of valuable ecosystem services for future generations in a way that meets ecological, economic, and social objectives (Douvere, 2008). Ecosystem-based MSP is a process that informs the spatial distribution of activities in the ocean so that existing and emerging uses can be maintained, use conflicts reduced, and ecosystem health and services protected and sustained for future generations. Thus, ecosystem-based MSP puts an emphasis on the maintenance and delivery of ecosystem services that humans want and need. (Foley et al. 2010)

Ecosystem-based management is place- or area-based in focusing on a specific ecosystem and the range of activities affecting it (McLeod et al. 2005; Crowder & Norse, 2008).

This emphasis on managing places is a key characteristic of ecosystem-based management and is a marked departure from existing approaches that usually focus on a single species, sector, activity or concern (Crowder et al., 2006). Where sectoral management implies that each sector regulates particular activities or projects taking place at a particular location (or site) within a certain area, the management of areas implies that, after a certain area has been defined, sustainable development and use will be established for all activities in the whole area (CoastNet, 2003).

Foley et al. (2010) outlines a number of key objectives common to ecosystem-based MSP. These objectives will be used later in this paper to discuss the opportunities for performance zoning applications in a marine context. These common objectives are as follows:

1. ***Focus complementary use(s)*** – an intent to evaluate and distribute natural and human uses based on the level of compatibility, assuring greater sustainability or protection (e.g. focusing non-extractive marine in ecologically sensitive areas) (Douvere & Ehler, 2009; Toropova, 2010)

2. ***Reduce conflicting use(s)*** **-** an aim to reduce conflicts among human uses and between human and natural uses (Douvere & Ehler, 2009) that are frequently or potentially in tension (e.g. trawlers versus static-gear fishing) (Toropova, 2010).

3. ***Protect ecosystem function*** (***services)*** – intent to distribute uses according to ecological principles that maximize the sustainable use of marine resources. For instance, habitat conservation zones that prevent benthic disturbances but allow

pelagic fishing could be designed around sensitive benthic habitats that support productive fisheries. This effort maximizes the economic benefit (e.g. fish extraction) to humans while protecting the ecology and ability of the ecosystem to continue providing the service.

4. ***Promote Resilience –*** an aim at all levels of biological organization—to maintain biodiversity and natural flexibility of the marine area (Douvere & Ehler, 2009) to resist or cope with disturbance.

OCEAN ZONING

In its simplest form, ocean zoning (sometimes referred to as marine zoning) is the delimitation of marine areas in which only certain uses are permitted. However, most contemporary texts on managing marine areas refer to the concept of ocean zoning as a means to separate conflicting uses or to keep sensitive, ecologically valuable or recovering areas free from use (Day, 2002). Ocean zoning sets regulatory measures used to implement marine spatial plans – akin to land-use plans – that specify allowable uses in all of the target ecosystem(s). Different zones accommodate different uses, or different levels of use. All zoning plans are portrayed on maps, since the regulations are always area-based (Agardy, 2010). In essence, ocean zoning means drawing lines on maps and establishing appropriate uses for the areas within these boundaries (Doherty, 2006).

The definition ocean zoning, provided by Ehler & Douvere (2009), also demonstrates a relationship with place-based planning processes such as MSP:

An important regulatory measure to implement comprehensive marine spatial management plans usually through a zoning map or maps and regulations for some or all areas of a marine region. Ocean zoning is an effective tool of MSP.

Comprehensive ocean zoning (COZ) is one tool used by marine spatial planners to integrate management of various activities (Agardy, 2010). Comprehensive ocean zoning by its very nature is cross-sectoral because the purpose is to allow activities within a zone that are compatible, i.e. do not undermine or interfere with one another. If done coherently and with a clear objective in mind for that particular zone, planning for each zone would require one to acknowledge and manage for the cumulative and interactive consequences of different activities. (Halpern et al., 2008)

Conventional Ocean Zoning

Earlier in this paper, zoning was considered to be 'conventional' when applied in a manner that separated uses by simple or singular use categories (Meshenberg, 1976). Similarly, conventional ocean zoning, comprehensive or not, would involve zoning with one marine use or objective in mind. Conventional ocean zoning is exemplified by single-sector (or use) delimitations such as fisheries management areas, or objectives such as conservation, in the form of marine protected areas (MPAs) and MPA networks (Toonen, 2013). Most often, marine spatial plans involve zoning schemes of this type, as they are simpler to implement and enforce in a marine setting. Conventional approaches

make up the vast majority of ocean zoning applications given its strength to establish clear separations between uses and simplicity to delimit, visualize and enforce.

Multi-Use Ocean Zoning

Since zoning is a tool that was developed for use on land (Agardy, 2010) and translated to the marine environment, some variations of the technique have propagated in marine spatial plans. One such variation has been multi-use zoning which is imitative of multi-use development in a land context. Multiple-use zoning approach provides high levels of protection for specific areas while allowing a range of reasonable uses, including certain extractive activities, to continue in other zones (Day, 2002). Multiple-use area management allows a range of reasonable uses to occur in a coordinated way, and provides for broad-area integrated management.

CASE STUDIES – ECOSYSTEM-BASED MSP AND OCEAN ZONING

The following sections describe two examples of marine spatial planning approaches that demonstrate unique characteristics of ecosystem-based management that lend to potential for performance zoning in a marine context. The case examples will be presented and discussed

CASE STUDY #1 - MULTI-USE ZONING - GREAT BARRIER REEF MARINE PARK

The best known example of large-scale ocean zoning, is in fact, a multi-use ocean zoning scheme for the Great Barrier Reef Marine Park (GBRMP) of Australia (Agardy, 2010). Kenchington & Day (2011) provide the following concise description of the GBRMP:

> *The Great Barrier Reef Marine Park was established to provide for conservation and ecologically sustainable multiple use of 344,400 km2 of a large marine ecosystem…the Great Barrier Reef Marine Park Act 1975 (GBRMP Act) provides for a specific regime of conservation and reasonable multiple use of the Great Barrier Reef Region. This includes spatial management of a large marine ecosystem through zoning with powers to deny, or impose limiting conditions on, use of or entry to all or part of the marine commons within the Marine Park. (Kenchington & Day, 2011).*

The multiple-use zoning system in the GBRMP governs all human activities, providing high levels of protection for specific areas, while allowing a variety of other uses elsewhere. This form of zoning ensures an overriding conservation rationale for the entire area, minimises impacts and conflicts, and provides for high levels of protection for specific representative areas, while allowing a variety of other uses to continue in other zones (Day, 2008). The GBR zoning plans are required by the Act to define the purposes for which areas of the Marine Park may be used or entered. They allow reasonable activities, such as tourism, fishing, boating, diving and research to occur in

specific areas, but also separate conflicting uses by the various zones and determined the appropriateness of various extractive activities (Day, 2002).

What makes the GBRMP a fine example of ecosystem-based MSP, is the most recent effort to carry out a comprehensive and systematic rezoning of the entire GBRMP, otherwise known as the Representative Areas Program (RAP) (Kenchington & Day, 2011). Between 1999 and 2004, the GBRMP Authority (GBRMPA) undertook a complex planning and consultative program to develop the new zoning for the Marine Park. The primary aim of the program was to better protect the range of biodiversity in the Great Barrier Reef, by increasing the extent of no-take areas, ensuring they included 'representative' examples of all the different habitat types (hence the name, the Representative Areas Program or RAP). Whilst increasing the protection of biodiversity, a further aim was to minimise negative and maximise positive impacts on the existing users of the Marine Park. Both these aims were achieved by a comprehensive program of scientific input, community involvement and innovation (GBRMPA, 2006). Key products included a zoning plan that identified 70 bioregions as well as a set of operational principles developed by the Authority agency assisted by committees of external scientific, socio-economic, and cultural advisers (Fernandes et al. 2005). Delimitation of spatial management boundaries was guided by 11 biophysical operational principles and four socio-economic operational principles to ensure balance of interests between marine users (Kenchington & Day, 2011).

Furthermore, the RAP involved the most comprehensive process of community involvement and participatory planning for any environmental issue in Australia's history (GBRMPA, 2006). The operational guidelines were initially presented for public input before any new zones were proposed. The RAP developed a draft zoning plan considering all the operational planning principles. This provided a robust basis for public consultation as required by the GBRMP Act. More than 31,500 written representations were provided in two formal phases of public participation (Day et al. 2000; Day et al. 2005; Fernandes et al. 2005). The revised zoning was markedly different from the draft plan due to the public comments and came into effect in July 2004 (Kenchington & Day, 2011)

CASE STUDY #2 – MARINE FUNCTIONAL ZONING - CHINA

In January 2002, the Law on the Management of Sea Use came into force, establishing an initial regional planning system and an integrated management framework for marine development and conservation in China. The new legislation has established three principles, including (Douvere, 2008):

- The ***right to the sea-use authorization system***: stipulates that the seas are owned by the State and any entity or individual who intends to use the sea must apply in advance and obtain the right to use the sea. They are authorized only after the approval of the national government.

- A ***marine functional zoning system***: stipulates that any use of the sea areas must comply with the marine functional zoning scheme established by the State. The scheme is the foundation for marine management, under which the sea is divided

into different types of functional zones (according to the criteria related to ecological functions and priority use), to regulate and guide rational use of the sea area.

- A ***user-fee system***: requires that any entity or individual who uses the sea must pay a fee in accordance with the regulations of the State council.

Marine functional zoning (MFZ) has been characterized as a practice of MSP (Douvere 2008; Fang et al., 2011). Marine functional zoning refers to dividing sea space areas (inclusive of islands) into different functional zones. A functional zone is a designated sea area for human activities based on its geographical and ecological features, natural resources, current usage and socioeconomic development needs. It is the smallest spatial unit of marine functional zoning (Dong, Zhang, and Yang 2006).

Fang et al. (2011) explain how the MFZ scheme has evolved in structure to its present form:

> *So far the classification of marine functional zones has experienced much modification and development, going from five to ten main categories because the five categories functional zones cannot satisfy the emerging marine industries; in fact, this classification does not directly refer to the sea uses. Detailed classification for each type of zones is explained in the Technology Directive in 1997 and its revision in 2006, respectively. The five main functional zones were: Exploitation Zone, Remediation Zone, Marine Protected Zone, and Special Function Zone (for*

research, military use, disposal, dumping), and Reserved Zone. Each type can be further divided into more specific sub-zones at three levels.

The 10 recent functional zones proposed by the Technical Directives revised in 2006 are: Port and Shipping Zone, Fishing and its Resource Conservation Zone, Mining Zone, Tourism and Recreation Zone, Water Use Zone, Ocean Energy Use Zone, Construction Use Zone (the subzone for submerged pipeline, reclamation, shore protection, bridge, and others), Marine Protected Area, Special Use Zone, and Reserved Area. Each type can also be divided into sub-zones. Different human activities will be allocated in corresponding functional zones. A series of indexes and criteria have been established to determine the function of sea area. These indexes and criteria are also grouped into 10 categories correspondent to 10 main functional zones.

The following specific operating principles are found in the Technical Directives for Marine Functional Zoning (Dong, Zhang, and Yang 2006):

1. *Consider both natural characteristics (natural resources, environmental quality, and geographical location) and social attributes (current marine uses, national or regional economic, and social needs for sea space);*
2. *Make overall arrangements of the industries involved in the use of sea areas, coordinate between exploitation and protection, balance short-term and long-term interests as well as interests of stakeholders; guarantee marine traffic safety and other special needs such as national security and the needs of military use.*

3. *Make trade-offs between economic development and environmental protection. MFZ shall promote the sustainable development of the marine economy and safeguard the health of marine ecosystem, achieving sustainable use of sea areas and the islands;*
4. *Provide a forward-looking framework for all exploitation and protection activities of the sea, taking account of economic, social, scientific and technological development; and*
5. *Give priority to those sea uses dependent on marine resources and environment.*

Fang at al. (2011) also write that, MFZ in China, as a multi-use zoning tool of sea use management, has helped to resolve the conflicts among various human uses to a certain degree, but recommends the following four measures must be taken for Chinas MFZ scheme to realize greater success as a MSP approach (Fang et al., 2011):

1. ***Coordinate the zoning schemes of both sea area and the coastal land area****. The increasing land-based pollution load is one of the main reasons that have led to the degradation of marine environmental quality (in China)…land-based pollution (especially nitrogen and phosphorus) contributes to more than 70% of the pollutant loads in the coastal seas (Chen et al. 2008). Therefore effects of human activities in adjacent land areas must be considered in the MFZ process, and because of this concern, there are more and more calling to expand MFZ to Coastal and Marine Functional Zoning, which looks at the coastal land and sea as a whole system.*

2. ***Put more efforts to address the conflicts between human uses and marine environmental protection***. *Current MFZ mainly focuses on resolving user–user conflicts and usually neglects the user–environment conflicts although it has been stated that protection of marine ecosystem and the marine environment is one of its objectives. For this reason, the zoning process commonly emphasizes the exploitation of marine resources, and then the marine functional zoning scheme is usually formulated based on the use-planning of various sea use departments that do not sufficiently consider the latter conflict between human uses and marine environmental protection.*

3. ***Revise MFZ scheme with the prerequisite of monitoring and evaluation***. *MFZ is essentially a long-term arrangement of ocean space to different human uses according to the natural attributes of the ocean. Corresponding sea use planning is also needed to guide the temporal distribution and development intensity of human activities. Therefore, the timeframe of MFZ scheme is relatively long and in theory it should not be revised very often. On the other hand, because of the uncertainty inherent in MSP, as well as the dynamic nature of marine and human ecosystems, management must be adaptive over time (Ehler, 2008). Since monitoring and evaluation of the performance is the basis of adaptive management in MSP process, they can help to illustrate how human activities affect ecosystem structure and processes as well as help to improve future planning.*

4. ***Enlarge the scope of involvement of stakeholders in the zoning process.*** *Since MSP was recognized as a public process (Douvere & Ehler, 2009), this*

characteristic requires that stakeholder engagement be considered an inherent component of MSP. The level of stakeholder engagement is an important factor in achieving the success of MSP (Gilliland 2008). However, first, the involvement of stakeholders in the MFZ process is limited to the sea use departments and related government departments; and the public including local communities has not been fully involved; second, stakeholders especially the public usually are only informed after the MFZ scheme has been completed rather than being involved at the earlier stage. Lack of stakeholder involvement affects its effectiveness in implementation.

CASE DISCUSSION – ECOSYSTEM-BASED MSP AND OCEAN ZONING

The previous case examples demonstrate place-based marine management schemes that were guided by ecosystem-based principles. This section uses the four objectives of ecosystem-based MSP outlined in Foley et al. (2011)

*1) **Focus complementary use(s)***

Zoning is about managing conflict by grouping compatible activities. In the case of the GBRMP, the multi-use zoning scheme is a better-known example of evaluating and allocating spaces for different uses to co-exist. Multi-use zoning schemes are about encouraging a variety of uses to cohabit designated areas. Thus, the zoning scheme, promotes the concentration of compatible uses. The Chinese MFZ scheme also promotes a similar concentration of like uses by establishing zones based on the purpose or

function of the space. A variety of uses are permitted or licensed by the state provided the activities meet the functional categories.

2) ***Reduce conflicting use(s)***

The RAP instituted by the GBRMP ensures that use zones are delimited by ecological, cultural, and social characteristics that would otherwise pose conflicts with certain human uses if otherwise not considered. The RAP is great example of an MSP process that engaged various stakeholders representing ecological and socio-economic interests to rezone the GBRMP to optimize the protection and benefits for marine users while mitigating immediate and cumulative conflicts that could arise had the GBRMPA not instituted the RAP process. In the case of the Chinese MFZ system, uses grouped by a similar function ensure users of a defined area have like interests or requirements. Separating unlike interests reduce the potential for conflict.

3) ***Protect ecosystem function (services)***

The GBRMP RAP utilized an ecosystems-based approach to determine the 70 RAP sites by evaluating the wide geographic and lifecycle characteristics of local ecologies that represent the GBRMP, and formulated zones that based on requirements of these representative areas. To a lesser extent, the MFZ system encourages a management structure to support ecosystem function by instituting set of management principles and processes that leveraged spatial information (through GIS) to support decisions related to sensitive and valuable habitat areas, in addition to spaces more ideally suited to support resource extraction.

4) ***Promote Resilience***

The GBRMP RAP is a fine example of a management measure intent on maintaining and promoting an acceptable level of diversity in support of healthy, resilient ecosystems but has gone further to involve elements of economic and cultural diversity. The combination of the RAP and the multi-use zoning scheme protect a natural and socio-economic variability of the park and promote less intensive uses in areas more susceptible to stress. More representative, undisturbed and healthier marine spaces will without a doubt lead to greater resilience in those systems.

OPPORTUNITIES FOR MARINE PERFORMANCE ZONING

In recent years, discussions around contemporary MSP and ocean zoning practices have demonstrated a willingness to move beyond use-based regulation and leverage marine planning principles to evolve flexible, more objectives-based approaches to place-based marine planning and management. The following statement by Ehler (2008) indicates the growing interest in performance-based planning instruments:

> *'…MSP is only one part of the tool box for ecosystem-based, sea use management—plans for sea use management should include a mix of many management measures including input, process, and output measures that can be used to influence the performance of human activities.'*

More recently, a 2011 Regional Workshop on Marine Spatial Planning, facilitated by the World Wildlife Fund (WWF) and Fisheries and Oceans Canada (DFO), suggested that a regional direction for MSP should (DFO, 2011):

> *'…include performance-based measures and thresholds in zoning plans, rather than a strictly no-use zone(s)…the potential for performance-based zoning exists.'*

Since performance zoning is implemented by a list of permitted impacts or target-outcomes as opposed to a list of permitted uses (Schiffman, 1989), the regulatory scheme more closely resembles the interests or objectives of marine users. Thus, performance zoning in a marine context bears a striking resemblance to an objectives-based approach to place-based management, described by Hall et al. (2011), who write:

> *'The objectives-based approach seeks to ensure that interrelationships among ecosystem and human use objectives are recognized and reflected in the identification of management strategies and supporting actions.'*

Where conventional, use-based regulatory instruments require a process to translate objectives or standards into use-based controls (i.e. use-zones); performance zoning would more directly accept objectives and interests in a regulatory framework that could be applied to desired spaces.

The earlier case examples of the GBRMP (RAP) and China's MFZ scheme demonstrate intent to use more flexible zoning instruments such as multi-use zoning or mixed zones where uses are permitted based on similar function. Such case examples demonstrate that regulation promoting plurality-of-use and place-based management by functional objectives prove a potential for performance zoning. Both of these qualities are distinguishing characteristics performance zoning.

The following sections will draw from earlier material as a means of contextualizing the potential for performance zoning in a marine environment.

PERFORMANCE ZONING AND ECOSYSTEM-BASED MSP

This paper argues that performance zoning belongs in the suite of instruments available to marine planners and managers because its characteristics correlate to the objectives cited by Foley et al. (2010) relating to Ecosystem-based MSP. The following sections discuss the specific aspects of performance zoning that allow performance zoning to be a candidate to address the objectives of ecosystem-based MSP.

Focus Complementary Uses

In its truest form, performance zoning does not discriminate by use. In an extreme view, marine performance zoning could consider all marine uses to be complementary. However, the reality is that certain uses cannot help to oppose or negatively affect another use demonstrates that performance standards may be required to be so stringent that they provide no other alternative but to be a use-based regulation. Such a situation is

evident in the earlier case examples of, Bay City, Oregon and Fort Collins, Colorado that presently use 'hybrid' performance / conventional zoning schemes for certain situations.

The challenge with use-based zoning schemes is that uses do not encompass a stakeholder's complete interest or value of the marine environment. For instance, two activities that seemingly oppose one another (e.g. conservation and resource extraction) may share the same overarching goal (i.e. sustainability), whether for ecological or monetary purposes.

Performance zoning can provide opportunities to reduce conflict by institutionalizing the goals of stakeholders into a more objectives-based regulatory form. Common ground can be found in more holistic and inclusive performance standards and implemented in an enforceable zoning scheme.

Reduce Conflicting Uses

Performance zoning would aim to reduce the conflict between marine uses, not through use specifications but through performance standards based on scientific input and stakeholder engagement. Marine performance zoning would separate activities to mitigate conflict, but only on the basis of their inability to meet performance thresholds.

Protect Ecosystem Function

The protection or sustainability of ecosystem function has been actively promoted by the establishment of conservation areas and networks (MPAs) using strict 'no-use' or

'limited-use' zones throughout the world. Though use-based controls are arguably the best method to ensure degradation does not occur in sensitive marine space, a prohibition on use cannot be the only regulatory measure at the disposal of good marine planners and managers. The idea of performance standards allows for a measurable set of ecological indicators to be built directly into policy that regulates activity, providing a great deal of power to marine governance frameworks to weigh factors contributing to ecosystem function. In many ways, performance standards are comparable to environmental performance indicators (EPIs) or targets.

Promote Resilience

The sustainability of any system, marine or otherwise, is strongly tied to its ability to endure pressures or disturbances. The marine environment is a dynamic, ever-changing space that provides a range of services to its users, albeit finite in its capacity. As such, the wider the diversity of those marine services means a far greater chance the needs of more users could be met if parts of the space were no longer able to provide them.

Conventional zoning advocates placing similar uses in the same or neighboring districts, while placing substantially different uses in separated districts (Acker, 1991) to prevent conflict. However, this principle comes with a significant flaw when one considers the nature of extractive activities (i.e. fishing) within a common property resource area. In the case of extractive marine activities, like-uses are not complementary (i.e. single-family residential uses), but competitive. As was learned by Hardin's, *The Tragedy of the Commons,* competition for resources within a common property, left unchecked, will

lead to the inevitable degradation of the common and its resources. Thus, the ordering of marine activities based on use (conventional zoning) may lead to unanticipated immediate and cumulative impacts in marine spaces. It is within these inter-sectoral conflicts that use-based spatial management can prove unsuccessful. Therefore, use-based conflict management instruments like conventional zoning may not be appropriate in all situations.

Where conventional zoning looks to reduce the plurality of uses in marine spaces to reduce potential conflict, this results in displacement of certain uses or a reduction in the available space to sustain that use, and greater competition or intensification in the remaining or allotted space. This reductionist philosophy of managing conflict by reducing activities in a space presents a risk of creating a 'monoculture of uses'. Since a monoculture in an agricultural or horticultural sense has come under much scrutiny over the past century for its susceptibility to external disturbances (e.g. disease, pests), one can argue that a monoculture of uses would do little to promote the ecological, social, and economic resilience of a marine space. The promotion of multiple uses, inherent in performance zoning and the control of impacts through performance standards positions it as an alternative to conventional ocean zoning practices to achieve resilient marine spaces.

BENEFITS & LIMITATIONS OF CONVENTIONAL ZONING IN A MARINE CONTEXT

Previously, this paper established that ocean zoning most often takes a conventional zoning approach that establishes spatially-based legislation to separate incompatible activities by use categories. The following sections use arguments presented earlier, debating the benefits and limitations of conventional zoning on land to discuss the applicability of those same arguments in a marine context.

Benefits of Conventional Zoning in a Marine Context

1) Conventional marine zoning allows for the separation of incompatible uses.

Although there are differences between zoning on land and in the ocean, ocean zoning can help to identify all uses and the way in which these uses can or cannot be harmonized (Doherty, 2006). Because of overlapping objectives, not all uses are compatible with one another and are competing for ocean space or have adverse effects on each other (Cicin-Sain et al., 1998) and marine ecosystems, which have an inherent need to function sustainably (Douvere, 2008). In a marine context, zoning has been employed to separate conflicting uses or to keep sensitive, ecologically valuable or recovering areas free from use (Day, 2002). Therefore, zoning serves a dual purpose to mitigate user-user conflicts and user-environment conflicts by regulating the spatial allocation of such uses.

2) The 'static' nature of conventional marine zoning provides greater certainty.

A certain amount of rigidity is necessary in marine planning and management to account for the variety of lifecycles of uses and natural systems intrinsic to the marine setting.

Although ocean spaces are dynamic, planning and management actions require fixed targets to base processes and achieve desired outcomes. As such, zoning can provide ridged structure of spatial and temporal use allocations that accounts for timescales needed to achieve desired outcomes (e.g. development of new industries, or regeneration of damaged habitat).

Developers desire certainty or predictability to land or marine spaces to justify investment and return on investment. For example, a developer would not want to purchase land for a residential development only to have adjacent land used for a pig farm. In a marine context, human activities can be 'fixed' to a location such as wind and wave energy, cables and pipelines, coastal defence, port infrastructures, aquaculture, land extension, and potentially in the future, carbon sequestration and storage or 'mobile' such as fisheries, shipping, air transport, military use, water recreation, sand and gravel extraction and dredging activities and in some cases both (Maes, 2008).

Development of resource-based sectors requires the investment of time and resources to determine output potential, select location(s) and establish market and distribution networks. Such investment would be wasted if the space became unavailable or unsuitable due to reactive planning or management decisions. Thus, zoning provides greater certainty for long-term investment decisions (Ehler, 2008) and achieves security to ecologically and biologically significant areas by considering space (e.g. buffers) and time (e.g. lifecycle) variables in fixed zones.

3) Conventional zoning can have logical connection to the tenets of 'good' planning.

Earlier, this paper described that conventional zoning can help to institute the tenets of good planning described in Godschalk et al. (2006), particularly the sustainable balance of economy, ecology and equity. No more is this apparent in the emergence of comprehensive ocean zoning. Comprehensive ocean zoning, by its very nature, attempts to account for 'the whole', of marine spaces by instituting spatial plans that represent the balance of interests in the marine environment. Simply put, comprehensive zoning would address whole ecosystems. It would also improve public understanding and reduce conflicts, by displaying in a clear, graphic way which human actions are appropriate where (Agardy, 2009). It is through this balance of interests representing human and natural systems that comprehensive forms of conventional zoning approaches meet the tenets of 'good' planning.

Limitations of Conventional Zoning in a Marine Context

1) The 'static' nature of conventional zoning does not adapt to changing uses.

In the previous section, one benefit of conventional ocean zoning is that it provided certainty to users by being static, allowing planning and management objectives to be implemented through a zoning plan. However, depending on the point of view, this very benefit can also be a limitation.

The issue with that premise is that human and natural systems are adaptive and ever-changing. Earlier sections described marine uses as being categorically fixed or mobile, and some sometimes both. For example, areas designated for certain types of fishing are

fixed, but the vessels and gear themselves may be considered mobile. The complexity of these time and space factors do not readily lend to ridged zoning structures, that are purposefully meant to regulate uses based on time and space.

Furthermore, this paper previously highlighted conventional zoning approaches are based on assumptions that certain uses can or may impact another. These assumptions are based on the nature of these uses at a certain point in time. Thus, conventional zoning does not readily accommodate positive or negative changes in particular uses on one another. For example, extractive industries may use certain technologies or practices to explore resource potential in certain areas (e.g. seismic surveying). These specific activities, at a point in time may have proven effects on other activities (e.g. fishing) or natural systems (e.g. marine mammals). However, these technologies and practices can be advanced to mitigate or eliminate effects on surrounding marine uses. Inversely, such industries may introduce new practices and techniques whose impacts are not accounted for in zoning regulations, leading to conflicts that could not be accounted for through used-based regulations. In short, static used-based (zoning) regulations are not designed to account for an ever evolving ocean. Conventional zoning approaches are purposely designed to be static, and can limit capacity to promote greater performance of marine uses.

2) Conventional zoning serves parochial rather than regional interests.

On land, the power to carry out community planning and regulate land use is mostly conducted within the structure or authority of local (municipal) government (Hodge,

1986). As such, the focus of land-based zoning schemes is often carried out to serve a local outlook. Zoning schemes therefore, follow boundaries that match jurisdictional authority and are found to be driven by local objectives within those confines (Porter et al., 1988).

In a marine context, governance of ocean spaces typically falls on the jurisdiction of the coastal nation. The 1982 UN Convention on the Law of the Sea (UNCLOS) defines the extent of coastal nation-state and jurisdiction in offshore waters. Thus, the regulation of ocean spaces by MSP and ocean zoning are typically facilitated by national and sub-national (e.g. state or provincial) government organizations. As such, planning outlook is subject to a wider mandate. The dimensions of scale and scope, described earlier complicate outcomes and the ability for a zoning scheme to represent national, subnational and local interests in a common zoning structure.

Conventional zoning exercised as sector-based approaches present greater potential for parochial or narrow objectives, such as the establishment of MPAs or MPA networks. However, zoning that aims to embrace contemporary marine planning and management principles such as EBM, ICZM, ICOM, or MSP set precedents to consider scale and scope, which extend beyond the boundaries delimiting the immediate zoned space. So generally there is much less opportunity for conventional zoning to take on parochial focus in a marine context.

3) Conventional zoning cannot ensure high-quality development.

Oceans offer very different services to humans than those on land. Planning on land focuses on human interaction between one another and between the built and natural environment. Though many of these same factors are present in marine planning, there are stark differences between the requirements for built-form, where the vast majorities of human population need not frequent the ocean. Oceans are becoming the domain of the elite whose access to boats, fuel and other technologies permit them to access and carry out a range of activities (T. Agardy, personal communication, Aug 2, 2013). Thus, development and quality of development in the marine environment require less emphasis on development control of the built environment and more emphasis on focus on the 'quality' of activities and interactions between those activities, or uses. Planning of human activities need not consider quality-of-life characteristics as in the context of a 'living-space' but instead consider quality-development for the sustainability of a 'resource base'.

On land, conventional zoning has been attributed with a number of failings, including problems of built form such as urban blight and suburban sprawl. Additionally, zoning has had a documented history of excluding certain socio-economic groups in cases of exclusionary zoning. However, there is nothing inherently different in how conventional zoning functions on land or in marine spaces, that would prevent these known failings. The issue of sprawl is caused by a 'leapfrogging' effect that spreads land or marine uses to more permissive or less resistive areas. Simply put, sprawl is caused by the sorting and separation of uses, in turn leading to displacement and potential intensification in other areas due to reductions in potential space. Homogeneous zones implemented to

support singular, or near singular uses can contribute to low density, inefficient use of marine spaces.

This is not to say that certain uses are better served by eliminating conflict through complete separation such as, conservation areas (e.g. MPAs, EBSAs, etc.), culturally significant areas (aboriginal sites, marine parks, historical wreck sites, etc.), or hazardous zones (e.g. military munitions disposal sites, submarine cable corridors, etc.). Such separations embody the precautionary approach by not forcing the idea that these marine uses can coexist with others.

4) Conventional zoning can involve administration problems.

The administration of contemporary zoning practices is burdened by frequent variances, special exceptions, and rezonings, all of which require additional administrative actions by boards, commissions, legislative bodies and staff (Porter et al., 1988). Administrative issues associated with zoning on land occur within governance structures and authoritative process that are often well defined by an act of legislation involving one authority to administer land control. With the exception of examples such as the GBRMP, which established a central authority to administer zoning plans and enabling legislation, zoning processes often involve multiple authoritative organizations that share in responsibilities to plan, implement and manage zoning schemes. This can complicates jurisdictional scope associated with the establishment and enforcement of ocean zones.

However, as was denoted earlier, land-based zoning uses a well-established system of delimited property boundaries (i.e. cadastre) to which, zoning districts apply. Ocean spaces, based on common property, do not typically based zoning boundaries on established property boundaries (aside from the rare instance of water lots) and therefore delimitation and maintenance of zoning extents makes up an added administrative duty for ocean zoning. On land zoning districts group individual properties by a common use, and as such zoning districts can be made up of thousands of individual property boundaries. This is an important detail when considering differences between administrative differences between land and sea. The potential numbers of individual properties that make land-based zoning districts increase the likelihood that changes to zoning districts will occur.

The GBRMP example demonstrates that administration of ocean zoning districts need not occur in piecemeal fashion, but can be coordinated in comprehensive, phased approaches, leading to fewer burdens on the day-to-day management of such schemes. Though the earliest sections of the GBRMP zoning plan were implemented in 1981 (Day, 2002) subsequent decades saw further spaces added (Day & Dobbs, 2013) to the zoning plan until such time that a comprehensive and systematic rezoning of the entire GBRMP was required and undertaken between 1999 and 2003. The rezoning was known as the Representative Areas Program (RAP) because the principal strategic approach was the protection of representative examples of the entire range of biodiversity (Kenchington & Day, 2011). Key products included a bioregionalisation that identified 70 bioregions and

a set of operational principles developed by the Authority agency assisted by committees of external scientific, socio-economic, and cultural advisers (Fernandes et al. 2005).

5) *Conventional zoning discourages diversity.*

Since, ocean zoning regulates marine activities to certain spaces based on strict use categories, the practice influences homogeneity or uniformity within delimited zones. The variety of uses permitted these districts directly relate to the range of activities permitted by use categories in the zoning scheme. Conventional zoning discourages diversity by encouraging homogeneous use categories to be the basis for conflict resolution. Where ocean zoning improves capacity for diversity is in the application of multiple-use or mixed-use zoning structures, like that of the GBRMP. The multiple-use zoning approach provides for the separation of conflicting uses while allowing a wide range of commercial and recreational activities, some of which are further managed through a permit system (Day & Dobbs, 2013).

6) Conventional zoning is two-dimensional whereas marine uses are three and four-dimensional

Zoning bylaws (ordinances) consist of two parts: a text and a map (Linowes, 1973). Specifically, the zoning map describes the spatial extent of each zoning district. However, maps are inherently two-dimensional whereas ocean uses can exemplify three and four- dimensional characters. This fundamental aspect of zoning does not typically affect land planning and management because land-use control relates to 'fixed' development and built-form that can be represented as a 'footprint' or 'envelope' that in

turn occupies an area or property. Land-use on land can be considered 2-dimensionally because most human activity is predominantly considered in relation to the plane of the earth's surface.

Where land planning is not as greatly affected by the limitations of two-dimensional zoning-map instruments, the inherent three and four-dimensional nature of marine spaces may prove ocean zoning instruments to be less effective in demonstrating or mitigating conflict. The wider disconnect that exists between ocean zoning maps and the dynamic reality it represents may limit the effectiveness of zoning as a tool for planning and management processes.

Potential Benefits of Marine Performance Zoning in a Marine Context

Marine planning and management based on the confines of conventional zoning do not deal with the dynamic nature of 3-D marine spaces nor does it institute mechanisms to control cumulative or external influences. The following sections provide a number of key indications that marine performance zoning approaches may lend to more effective planning and management of marine spaces. The following sections use earlier literature sources to discuss the characteristics of land-based performance zoning in order to contextualize the potential in a marine context.

1) *Requires minimum of zoning districts and provides increased choice within districts; among other advantages, this should reduce the need for variances and zoning changes.*

Given the complex multi-dimensional characteristics of marine spaces, there are a wider number of possibilities for marine uses to co-exist. For example, human activities can take place on the water-surface and not affect ecological uses of the sea-bottom on what would appear on a 2-D map to be the same space. Since certain marine uses do not mutually exclude others, there is a potential for a version of multi-use zoning, not limited by use-based regulations. Performance zoning can help to institute regulations to control potential impacts or effects of activities in the multi-use environment without having to form complex use-based regulations that can unnecessarily exclude activities that might not impact other uses. As such, regulatory frameworks may not need to rely on fine-scale segregation or distinct singular-use zones. Performance zoning encourages a variety of uses in each district, requiring fewer zones, thus less complexity on zoning maps or schemes. This leads to easier interpretation of fixed zones and more effective compliance and enforcement, as well as less need to change spatial boundaries or characteristics permitted within each zone.

2) Uses are separated only to the degree that they create negative impacts on neighbors. The flexibility of performance zoning in a marine context would not discriminate uses based on their understood impacts at a particular point in time and may in fact promote more intensive uses to seek innovative ways to meet performance standards or targets. For example, conventional zoning approaches might preclude shipping activities from taking place in an area if they are felt to be in conflict with certain ecological uses. Performance zoning can provide the shipping stakeholders with a set of tangible targets

to meet so that shipping could occur in areas not otherwise available to the industry, providing opportunities to lessen costs or risk to cargo and seagoing persons.

Additionally, marine performance zoning standards can go further to provide planners and managers opportunities to tie incentives or externalities into zoning regulations. For instance, performance regulations may help to support accreditation for sustainable fishing practices (i.e. Marine Stewardship Council) if performance targets are reached in a particular zone. Moreover, socio-economic performance standards linked zoned areas can provide incentives to industry provide more indirect investment in marine spaces and associated communities. For example, an industry may be permitted to carry out certain activities if they carry out research and development and provide information to local communities, or reach education or job creation targets. Since spaces being zoned can have effects on external or adjacent stakeholders (i.e. land-based communities), performance standards can transcend use-based regulations confined to physical spaces by involving standards that are not directly linked to marine geographies being zoned.

3) *Takes into account the capability of the marine environment to support proposed activities and permits development to occur only to the extent that it is consistent with the defined standards.*

Being somewhat newer than its land-based counterpart, ocean zoning has benefitted from the evolution of zoning practices on land. The land planning process saw significant paradigm shifts to be more aware of the effects of human development on nature and visa-versa. The consideration of natural systems in modern planning practices can be

attributed to a wide range of literature such as Ian McHarg's, *Design with Nature* (1969) or Rachel Carson's, *Silent Spring* (1962). The emergence of performance zoning is evidence that planning practices evolved to consider the impacts of human development, and these effects can be managed through area-based regulations. Since performance standards are meant to be a more direct means of managing within the requirements or tolerances of a space, it seems apparent that it is a more direct regulatory instrument to account for the capabilities of the marine environment. Contemporary marine planning practices like ICZM and MSP have helped to institute processes that require consideration of ecological principles in marine planning situations, but the instrument of performance zoning can allow for a more direct translation of objectives-based planning into regulatory frameworks.

Potential Limitations of Performance Zoning in a Marine Context

The following sections provide a number of key limitations that marine performance zoning approaches that may challenge the effective planning and management of marine spaces.

1) Performance (capability) standards require very specific technical information.

The basis of performance zoning is the establishment of quantifiable targets that must be met by marine users in a defined space. Such 'hard' targets would often require the generation of specific forms of information for the planning (modelling, siting, etc.) and management (monitoring, evaluation, and enforcement) techniques for marine activity characteristics such as noise, pollutant levels, shipping frequency. In order for

performance standards to be effective, they must suit the ecological and socio-economic setting to which they apply. Where use-based zoning controls are easier to enforce since human activities can be observed or recorded through visual means, performance zoning standards may need to rely on technical instruments or processes to determine compliance.

2) *Various degrees of skill may be necessary for the administration of marine performance zoning.*

Since performance zoning demands specific forms of information for the institution and enforcement of ecological and socio-economic standards, a wide range of subject experts may be required to support or defend the regulatory or use decisions for a particular marine space. Since performance zoning aims to more directly account for the range of potential impacts on users (human and natural), the potential exists for certain effects to be missed, and an inefficient amount of time being spent to measure impacts of uses that may be more or less significant in the greater ecological sphere.

FUTURE CONSIDERATIONS FOR MARINE PERFORMANCE ZONING

A marine performance zoning scheme would require the consideration of user-user and user-environment conflicts (Douvere, 2008) by allocating specific performance standards for both categories. Opportunities for performance standards discussed earlier in this paper, specifically those cited by Stockham (1974) might include:

Environmental Pollution

Setting thresholds for levels of pollution that can be tolerated by other human and environmental uses would more directly aid in the control of immediate and cumulative effects on marine systems. Examples of such standards might include: fossil fuel emissions, solid waste, grey-water, ballast-water (exchange), spills of hazardous materials, military and explosives of concern (MEC), and excess light or noise levels.

Traffic Generation

Though often linked to more consequential impacts such as noise, emissions, and light pollutants, vessel traffic, by its stationary or transient presence can impact human and environmental uses. Moreover, frequency and quantity of vessels occupying or transiting marine spaces is a quantifiable characteristic that can be observed directly or remotely-sensed, in order to evaluate from a performance perspective (e.g. Average Weekday Daily Traffic [AWDT]).

Social and Economic Impact(s)

As was discussed earlier, marine spaces are a common property resource that provides a range of ecological and socio-economic services. The geographic limitations and finite resources that make up marine spaces present challenges for marine managers to balance the sustainable delivery of ecosystem and socio-economic services. Performance standards representing socio-economic, cultural, and political interests are necessary to represent the pressures of economic and cultural sustainability with ecological sustainability in the marine environment. The establishment of performance indicators

relating to socio-economic services are often more difficult to quantify but might include social performance standards such as: level of access (public or otherwise), level of participation (type, frequency), education programs, and community-based research outcomes. Economic performance standards may also focus on number of jobs created or retained, employment rate, and revenues shared.

As with land-based examples, socio-economic standards can provide marine planners and managers with opportunities to negotiate for shortcomings in conditional standards (or uses) cannot be met. For example, if a marine use involved the regular operation of supply vessels, performance standards may demand the provided users contribute to a community-based scientific research program to monitor the effects of noise or excess wake on local marine life. The use of flexible 'scoring' systems discussed earlier limit the rigidity that can come with conventional zoning schemes, thus missing out on innovative, adaptive management measures that can meet overarching management goals.

Carrying Capacity

Performance standards relating to carrying capacity can directly translate empirical targets, requirements or limitations into actionable zoning regulations. This is essence of where performance zoning differs from use-based approaches in that it directly limits the impact on other human and natural users by setting clear measures of those impacts. Such factors may include site conditions such as bottom type or profile (e.g. substrate,

vegetation, slope, etc.), or limits of a resource that may be targeted for extraction or displacement (e.g. biomass, fossil fuel, mineral deposits, sand, etc.).

CONCLUSION

Many contemporary marine planning and area-management practices are generally accepted as being inherited from land planning approaches. Though successful in a marine context, only a subset of the planning instruments known to land planners are readily applied in a marine context or discussed in marine planning literature. Land planning approaches that have made their way into marine planning practice include conventional (Euclidean) zoning, and mixed/multi-use zoning. Both regulatory instruments display similar benefits and limitations in a marine context as they do on land, where they have arguably failed to solve for all issues facing planners or land-based communities.

In both terrestrial and marine environments, conventional zoning and multi-use zoning aim to mitigate conflict between human and natural 'users', by limiting uses to select districts or zones. Therefore, both approaches must maintain explicit lists of what marine uses are permitted and maps to delimit the spatial extent of each zone. The issues with use-based regulation is that they exclude a vast majority of potential marine uses in particular zones and advocate the concentration or intensification of uses into smaller spaces within a finite ocean. On land, these displacement and intensification effects have had ecological, social and economic consequences that are just as possible in a marine setting.

The shortcomings of use-based zoning on land have prompted the innovation of land control techniques such as performance zoning. Performance zoning looks to control the effect of a use (or activity) rather limiting by use itself. This is done by establishing explicit performance standards for each zone, thereby setting measureable thresholds for allowable impacts or desirable outcomes. Performance zoning in a marine context demonstrates a number of the same traits embodied by ecosystem-based MSP and therefore has a place in the suite of tools that are available to marine planners and managers.

The opportunity for performance-based standards to serve more holistic management objectives lies in its ability to set planning and management targets that transcend physical use of the marine space and incorporate externalities such as social, economic, and cultural interests. Performance zoning may allow for easier comprehensive zoning of the oceans because it is less restrictive on where activities can/cannot occur, allowing users greater access to a wider ocean provided they meet performance (not use) targets. Performance zoning may also provide MSP with an alternative zoning instrument to better implement or action EBM since tangible ecological targets (criteria) are formalized into legislation instead of enacting use-based specifications, which only indirectly address ecological function. The objectives of ecosystem-based MSP and marine performance zoning overlap in that both approaches aim to focus complementary uses, reduce conflict, encourage ecosystem function, and promote resilience in marine systems. However the issues associated conventional marine zoning approaches limit the ability of

ecosystem-based MSP to realize all of these goals unless marine planners incorporate more flexible, inclusive and objective-based regulatory schemes.

This paper does not advocate that performance zoning is the next evolution of ocean zoning nor must it replace the more conventional practice. However, this paper aims to draw attention to a wider range of regulatory place-based planning and management instruments. As was demonstrated in the earlier case studies for Bay City, Oregon and Fort Collins Colorado, performance zoning can exist as an independent regulatory scheme or be combined with more conventional approaches. Where an instance of performance zoning has yet to be applied in a marine setting, the Chinese MFZ system provides an indication that coastal states see benefit to considering the purpose, intent or function of marine spaces and that regulatory frameworks must involve objectives-based models for marine management. The rezoning of the GBRMP utilizing the Representative Areas Program indicates a demand for a multi-use zoning scheme that demands greater 'performance' objectives of an ecological, social and economic nature.

To conclude, a return to the initial curiosities that prompted investigation of this topic is useful. First, the question of, "why hadn't criticisms of conventional land use zoning compelled marine planners to employ alternatives practices", can be addressed by stating that many of the shortcomings of conventional zoning can and do exist in marine planning applications. However, due to the elitist nature of human activities in our oceans, requiring specialized or costly equipment, exclusion is occurring whether through zoning or not. The common property nature of ocean spaces also eliminates any

argument based on individual property rights that had been the focus of land-based examples. These norms may cause planners and managers to dismiss the shortcomings of conventional approaches especially given the ease in which use-based zoning allows decision makers to analyze, and administer the allocation of marine activities through (2-D) zoning maps.

The second curiosity, relating to "why marine zoning has seemingly avoided a need to institute alternatives or major variations to conventional zoning practices compared to those that have occurred in land planning (e.g. performance zoning, incentive zoning, etc.)", remains unanswered. With ocean zoning lacking the maturity of its terrestrial cousin, opportunities still exist for marine planners and managers to explore alternative place-based management techniques, performance zoning being one.

The third curiosity promoting exploration of performance zoning in a marine context may in fact form the basis for further study. The question of the degree to which a planning instrument, itself can affect the function of land or marine spaces, inspired from *The Death and Life of Great American Cities* cannot be answered based on this work alone. However, this paper has introduced the idea that there is an alternative to use-based ocean zoning practices and a number of compelling arguments that suggest that conventional ocean zoning approaches do not solve for all marine planning and management issues, and may in fact create new ones.

It is suggested that further consideration of a marine performance zoning approach investigate the wider costs and benefits associated with the development, implementation and enforcement of such a concept. Additionally, the lack of practical applications of the technique limits its study -- but perhaps further investigation into this topic might reveal one or multiple zoning ordinance models for a particular marine location.

Finally, considering the interconnectedness between marine management issues and stressors that originate from the terrestrial environment, there will be an increasing demand to bridge the objectives of land and marine planning initiatives within a comprehensive form. Given the stark differences between uses and use categories, performance zoning may provide the integrated management through the establishment of performance standards that transcend physical use.

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APPENDIX 1 – CITY OF FORT COLLINS, ABSOLUTE CRITERIA - LGDS

ALL DEVELOPMENT: NUMBERED CRITERIA CHART							
ALL CRITERIA					APPLICABLE CRITERIA ONLY		
CRITERION	Is the criterion applicable?				Will the criterion be satisfied? Yes	Will the criterion be satisfied? No	If no, please explain
NEIGHBORHOOD COMPATIBILITY							
1. Social Compatibility							
2. Neighborhood Character							
3. Land Use Conflicts							
4. Adverse Traffic Impact							
PLANS AND POLICIES							
5. Comprehensive Plan							
PUBLIC FACILITIES & SAFETY							
6. Street Capacity							
7. Utility Capacity							
8. Design Standards							
9. Emergency Access							
10. Security Lighting							
11. Water Hazards							
RESOURCE PROTECTION							
12. Soils & Slope Hazard							
13. Significant Vegetation							
14. Wildlife Habitat							
15. Historical Landmark							
16. Mineral Deposit							
17. Eco-Sensitive Areas							
18. Agricultural Lands							
ENVIRONMENTAL STANDARDS							
19. Air Quality							
20. Water Quality							
21. Noise							
22. Glare & Heat							
23. Vibrations							
24. Exterior Lighting							
25. Sewage & Wastes							
SITE DESIGN							
26. Community Organization							
27. Site Organization							
28. Natural Features							
29. Energy Conservation							
30. Privacy							
31. Open Space Arrangement							
32. Building Height							
33. Vehicular Movement							
34. Vehicular Design							
35. Parking							
36. Active Recreational Areas							
37. Private Outdoor Areas							
38. Pedestrian Convenience							
39. Pedestrian Conflicts							
40. Landscaping/Open Areas							
41. Landscaping/Buildings							
42. Landscaping/Screening							
43. Public Access							
44. Signs							

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(Porter et al., 1988)