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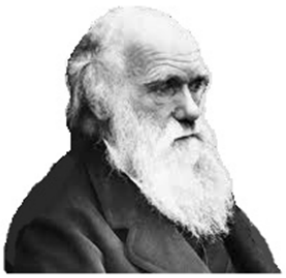

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Science and policy in the coastal zone management

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ABSTRACT

The relationships among science, scientist, policy, and policy-makers are extremely complex and variable. Each issue or problem; each mix of constituencies to that problem or issue; each 'venue', local, state, regional, national, international, lends a different character to these relationships and their processes and products. At its base, however, coastal management is a social process. It is defined by the belief, perceptions, and 'cultures' of its various participants. At the very heart of the issue of the interaction between science and policy is the fact that science is concerned with description and explanation, while policy is concerned with governance of human behaviour. Science is not normative, while policy is normative by definition. In this paper, the different dimensions of the relationship between science and policy as a social process are explored. The relationship among them will be better understood, and will contribute more fully to the coastal policy-making process if the characteristics, limitations, and potential contributions of each one are clearly recognized.

***Keywords*:** coastal management, policy, science, cultural ecology

1. INTRODUCTION

The relationships among science, scientists, policy and policy-makers are extremely complex and variable (OECD, 2015). Each issue or problem; each mix of constituencies to that problem or issue; each 'venue', local state, regional, national, international, lends a different character to these relationships and their processes and products. At its base, however, "coastal management is a social process" (Cooke and Cowx, 2004; Rizal, 2018).

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In this paper, we explore the different dimensions of the relationship between science and policy as a social process.

At the very heart of the issue of the interaction between science and policy is the fact that science is concerned with description and explanation, while policy is concerned with governance of human behaviour. Science is not normative, while policy is normative by definition. Although it is clear that there is no value-free science, every attempt is made by responsible scientists to identify their assumptions and biases and try to minimize the latter.

The policy-making integrating them into policy (Hammond and Adelman, 1976). Science should hold to the standards of objectivity, reliability and validity. Policy-making should reflect human values, advocacy and leadership. In this sense, scientific results can only answer policy questions of the form, 'What will happen to (X) if human behaviour is changed in the manner (Y)'. Science can never answer policy questions of the form, 'If we wish to have (X), what different forms of (Y) will yield (X)', but only after applications of the theories, methodologies, resources, time frames and analytical capabilities available to the scientist for the particular question at hand (Steel *et al*.,2001). Social science can help us to understand the distribution of beliefs, perceptions and norms among a constituency against which various objectives and alternative and their impact can be measured, but even social science cannot be normative in and of itself (Berggren, 2012).

So, for example, in the case of coastal environmental mitigation strategies a scientist may tell us what mitigation techniques will lead to a certain outcome, but not whether or how much of that mitigation or particular outcome is appropriate. A scientist may identify an effective, cost-efficient indicator of a certain condition in the environment, but not whether or not the condition so identified is acceptable (Allan *et al*., 2005). A scientist can describe the relationship between coastal development and closed shellfish waters, but not how much development or shellfish closure is appropriate.

These questions that science cannot answer fall into the category of policy-making, or governance. Policy-making is the process of identifying objectives, alternative for achieving those objectives and their relative costs and benefits, and measuring these relative costs and benefits against a backdrop of human values (Allan, 2004; Berggren, 2012). Policy-making answer questions of the form, 'Given that we have objective (O) and we know that the costs and benefits of alternative (A) will be (X) and the costs and benefits of alternative (B) will be (Y), should we do (A) or (B)?' It is the governance process, with all of its requirements for planning, analysis and public input, through which public policy decisions are made (Steel *et al*., 2009; Cooke *et al*., 2012; Syaifuddin and Rizal, 2018).

So, for example, in the case of mitigation strategies if the scientist tells us what strategies are available and their relative costs and benefits, the policy-making process may then proceed to elicit the human values against which the alternatives and their various costs and benefits may be judged (Rizal and Nurruhwati, 2018). In the case of an environment indicator, if a scientist identifies a condition in the environment from a given indicator, then the policy-making process may proceed to a decision as to whether the condition indicated is desirable or undesirable, if it should be changed, and in what manner (Rizal *et al*., 2018). If a scientist can tell us which land and water uses result in shellfish closures, the policy-making process can then proceed to a decision concerning how much development, and how much shellfish closure is acceptable (Steel *et al*., 2004).

The difference between science and policy, or governance, is extremely important, and is often ignored or confused (Steel *et al*., 2009). Scientists often feel so strongly about a particular

normative position that they allow themselves to claim that science tells us the best way to behave, which is usually the way that particular scientists want us to behave according to the scientists' own value system. Since coastal environmental policy-making is often contentious, and occurs in the midst of a complex mixture of human values and preferences, such claims are likely to further confuse the discussion, and to lead to a diminution of the credibility of the scientist (Carson, 1962; Alesina and Perotti, 1996; Bartley *et al*., 2015).

Science and policy-making are different from one another, but complementary. The conduct of each requires different sets of expertise. The scientists must know theory, methodology, and techniques. The policy-maker must know constituencies, governance processes and value orientations expressed as legal mandates (Steel *et al*., 2001). It is, of course, useful for each to know something of the others trade as well, although we ought not as a general rule expect one to do the work of the other.

All human behaviour is a result of a complex interaction between culture and environment, where culture is defined as the beliefs, perceptions and normative rules of behaviour of a group of people, and environment is the total set of objects and process with which those people interact (Allan, 2004). Culture in this sense is shared differentially among human groups-not everyone has the same beliefs, perceives or interprets things in the same way, or has the same normative rules of behaviour. Although culture ultimately resides in each individual human, certain groups of people share more of their culture than others. Linguistic, ethnic, national, professional, community, religious, and other groups all share specific cultural attributes to various degrees (Berggren, 2004). These cultural differences contribute significantly to the development of environmental, including coastal policy (Rizal, 2018).

Most of our normative cultural rules are learned, taught to, or internalized by us in various acculturation on socialization processes. Beliefs and perceptions are formed through a combination of the above processes in additional to our individual life experiences. Through this process some of us become scientists, some of us become administrators, some of us become politicians, some of us become business persons, and some of us become advocates of various causes. We tend to live and work around those who have beliefs, perceptions and norms similar to our; hence the existence of 'subcultures'. With respect to the coastal environmental issues, all of our subcultures and behaviours fit together in a complex cultural, or human ecology that determines our societal rules of behaviour, or policies, with respect to coastal environments (Fortman, 1990; Rizal, 2018).

When we speak of the interaction between science and policy, we actually mean the interactions among a large number of different subcultures of people including scientist of many different disciplines and modes employment, elected officials, legislators, administrators, courts, businesses, coastal, and non-coastal residents, interest and advocacy groups and many others (Rizal *et al*., 2017). In any given interaction in the policy development or implementation process, individual personalities may be as significant as cultural background or 'official positions' in particular outcomes (Steel *et al*., 2006).

There are myriad sources of difference in how humans acquire their professional cultures, and we will focus here on a few examples: education and training; institutional affiliation; rewards and incentives; time frame; and product form. Further, even though many different individual and groups are involved in the cultural ecology of coastal policy, we will focus here on two 'subcultures' of that cultural ecologyscientists and public policy makers, the latter defined here as legislators or administrative agency personnel.

By 'scientist' we are referring by and large to professionals who obtained advanced degrees, most often a PhD, in a specific single or inter-disciplinary training programmes or university, thereby, acquiring scientific 'credentials'. Such people stay in school much longer than the average citizen. In an atmosphere which emphasizes the value of knowledge, objectivity, reliability and validity, and of the scientific method. Their training institutions are somewhat insulated from society through the mechanisms of the 'ivory tower' such as permanent tenure, and those employed in such institutions often instil a belief in the high status of scientists and the scientific enterprise and their ability to 'solve' environmental problems in their students. Most problem-solving, however, occurs at the level of hypothesis-testing as opposed to behavioural change (Steel *et al*., 2009; Dhahiyat *et al*., 2018).

Policy-makers, on the other hand, although they come from a variety of back-grounds and educations, often do not have the scientific disciplinary focus or time-depth of socialization in school that we see in scientists. In certain cases, such as that of attorneys, the time spent in school is of a very different character, one which does emphasise behavioural change over hypothesis-testing (Rizal *et al*., 2018). Policy-makers are people who presumably choose to work in a world of human, essentially experimental, interaction where every new law or policy has the potential to create consensus or conflict, but in any case to create behavioural change. Rational planning, public involvement, and responsiveness to constituencies and to the public trust at the same time are the hallmarks of the policy-maker (Herder and Stikkelman, 2004).

2. INSTITUTIONAL AFFILIATION

There are, of course, people trained as scientists who work as policy-makers. Over time, however, individuals who received the same scientific training, and more especially others whose background and training differed, often diverge into separate subcultures based on their institutional affiliation (Fortman, 1990).

For example, a person with scientific training who works as an administrator in a federal regulatory agency will acquire a different set of beliefs, perceptions and norms of behaviour from a research scientist at a university because of the different requirements, contexts and processes of their work. Further, individuals working in different regulatory agencies will diverge from each other for the same reasons (Dhahiyat *et al*., 2018). In the coastal area in the United State, for example, professionals in the National Marine Fisheries Service (NMFS) or the Office of Ocean and Coastal Resource Management (OCRM) in the National Oceanic and Atmospheric Administration (NOAA) under the Department of Commerce will diverge from those in the Mineral Management Service (MMS) in the Department of Interior because of the widely varying mandates, structures and processes of those agencies. The mandates of the university is to investigate and educate; the mandate of the NMFS or OCRM is to plan for the mineral resources (OECD, 2015).

3. TIME FRAME

For a scientist at a university, time frames tend to be drawn out. Most significant coastal issues require longitudinal data based and monitoring to provide data for the scientific process. Time is measured in contract and grant submission deadlines; hour-long lectures and semester-

long courses; two-year article publication schedules; and decade-long research programs. Much is accomplished, but in larger time frames.

In policy-making, on the other hand, time frames and deadlines tend to be frequent and short. Regulatory development is a constant process under any given set of legislative mandates, and those mandates themselves are constantly changing. Information, power and decision-making are much more hierarchical than at the university, and the policy-maker will most often need to obtain data and analysis in a matter of days, weeks or months rather than years. 30-day comment and response period; controlled Congressional correspondence; regulatory decisions; with the best of planning all of these are short time frame issues compared to those of the scientist.

4. PRODUCT FORM

The product of the scientist is publication, books and articles, largely directed towards other scientists. More academic scientists are required to teach and perform university service; but the premier product of the scientist is new knowledge, peer-reviewed and disseminated to colleagues (Steel *et al*., 2006). There are, of course, many scientists who care very much about 'applied' work (science with some identifiable application to a problem or issue outside of the scientific or university community). However, very few colleges or universities are noted for their emphasis on such work, although the number appears to be growing. Traditional academic scientific products do not, in the main, cause behaviour change.

Policy-making, however, is about behavioural change. If no one's behaviour needed to be changed, we would not need public policy or government regulations. It is our common cultural norms, as expressed through the representative democratic process and written down as laws, policies and regulations, that constitute public policy (Steel and Weber, 2001; Cooke *et al*., 2013; Rizal, 2018). It is the creation of such behavioural change that is the policy-maker, in the form of laws, policies, regulations and the materials, events and processes that attend the policy development and implementation process. An important part of the product for the policy-maker is that which is delivered to the private sector constituencies and the public concerning the policy and policy-making process. Public involvement, for example, is an important 'product' of the policy-making process. 'Public involvement' is not a phrase one hears often in the discussions of most scientists in their scientific work, certain social scientists accepted (Steel *et al*., 2001; OECD, 2015).

What are the results of the existence of the different cultures and subcultures of people involved in coastal policy-making? The results tend to fall into four categories.

4. 1. Lack of mutual respect

Human ego is a powerful thing, and few things offend us and make us react in negative ways as much as the knowledge that another person does not value or respect what we are as individuals, or what we do professionally. Whether it is an interaction between a fishermen and a marine biologist; an oil worker and an environmentalist; a land use planner and a private property advocate; a social scientist and a natural scientist; or a scientist and a politician; if we interact with others with an attitude of superiority or even contempt, things will likely not go well (Steel *et al*., 2004). In the sense I am using the term, 'respect' does not have to mean admiration or agreement, but simply the acceptance of the fact that the other party has a

legitimate status and role in the human ecology of the policy-making process, and views which must be understood in the context of that status and role.

4. 2. Lack of communication

Cultural differences, whether they stem from language, occupation, or advocacy position tend to make communication more difficult. Not only are we less likely to communicate at all with different cultural or subcultures, but communications which do occur tend to be fraught with misinterpretation or lack of understanding. The use of scientific jargon in a public presentation is one such example of this problem. A scientist and a fisherman interpreting the results of a trend or cycle in fish landings differently is another. A shellfisher and a marina owner discussing water quality is a third. Sometimes the message is not picked up at all; sometimes it is perceived or interpreted differently (OECD, 2015). It is difficult, but possible and certainly desirable, to spend the effort to first open a line of communication and, second, to at least be aware of the different possibilities for perception and interpretation.

4. 3. Lack of use, or misuse of each other's products

It is often the case that an administrator will not know what use to make of a scientific report. It is often the case that a scientist will not understand the genesis or rationale for a particular public policy-making process. Private citizens will often be confused by both, a scientific report and a policy process.

The unfortunate response is to disengage, that is, to withdraw from the interaction or process. Citizens stop going to public meeting or hearings. Scientists stop seeking funding from applied research programmes. Policy-makers go on with their process as best they can, interpreting the 'best scientific information available' as that which they can interpret and use, which may be very little of that which the scientists have produced (Steel *et al*., 2009). The alternative is to take the product and use it inappropriately.

A scientist advocates a value position rather than simply presenting the science. A policy-maker lists a report in the bibliography, and uses it by reference to justify a predetermined course of action. A citizen uses a public meeting to advance a particular private advocacy agenda in the name of 'the public'.

4. 4. Conflict and competition instead of cooperation

All of the above lead to conflict and competition in the place of cooperation. They are all dimensions of the potentially negative public policy outcomes resulting from cultural differences, when those differences are not recognized, understood and addressed.

5. CONCLUSION

Coastal management is a social process. It is defined by the belief, perceptions and 'cultures' of its various participants. Science and scientists, policy and policy-makers are components of this complex and variable social process. The relationships among them will be better understood, and will contribute more fully to the coastal policy-making process, if the characteristics, limitations and potential contributions of each are clearly recognized.

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