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Abstract
This paper examines how US and proposed international law relate to the recovery of archaeological data from historic shipwrecks. It argues that US federal admiralty law of salvage gives far less protection to historic submerged sites than do US laws protecting archaeological sites on US federal and Indian lands. The paper offers a simple model in which the net present value of the salvage and archaeological investigation of an historic shipwreck is maximized. It is suggested that salvage law gives insufficient protection to archaeological data, but that UNESCO’s Convention on the Protection of the Underwater Cultural Heritage goes too far in the other direction. It is also suggested that a move towards maximizing the net present value of a wreck would be promoted if the US admiralty courts explicitly tied the size of salvage awards to the quality of the archaeology performed.

Journal of Economic Literature Classification: K1

Keywords: admiralty law of salvage, historic shipwreck, value of archaeology, UNESCO.
HISTORIC SHIPWRECKS

This paper examines how US and proposed international law relate to the recovery of archaeological data from historic shipwrecks. It argues that US federal admiralty law of salvage gives far less protection to historic submerged sites than do US laws protecting archaeological sites on US federal and Indian lands. The paper offers a simple model in which the net present value of the salvage and archaeological investigation of an historic shipwreck is maximized. It is suggested that salvage law gives insufficient protection to archaeological data, but that UNESCO's Convention on the Protection of the Underwater Cultural Heritage goes too far in the other direction. It is also suggested that a move towards maximizing the net present value of a wreck would be promoted if the US admiralty courts explicitly tied the size of salvage awards to the quality of the archaeology performed.

The excavation of shipwrecks in US waters is a matter of hot dispute between archaeologists - who value wrecks largely for the historical archaeological records that they might yield - and salvagers, who seek to extract their monetary values. Unfortunately, absent a theory of the valuation of wrecks it is difficult to make judgements about the rationality of US law as it relates to them. Working on the presumption that the law of property should properly aim to maximize the value of a property, laws governing shipwrecks should at least attempt to take into consideration the economic value - as opposed to the monetary value - of wrecks. It is acknowledged that there is some evidence that US admiralty law courts are aware of the distinction between salvage value and archaeological value. However, it is argued here that they have not yet devised a suitable standard either for encouraging the collection of archaeological data by bona fide professional archaeologists, or, for maximizing the total economic value of a wreck.

1 I would like to thank Dr. Toni Carrel for helpful her comments.
Also disputed by salvagers and the underwater archaeological profession is the rationality of UNESCO's *Convention on the Protection of the Underwater Cultural Heritage*. If ratified and accepted by the US (which at this time appears to be unlikely), would replace admiralty law outside of US territorial waters. With this prospective international law, the positions of the salvagers and the archaeologists are reversed. It is the salvagers who complain about the *Protocol's* intent of seemingly maximizing archaeological value (under the rubric of 'protecting the common heritage of mankind'), but at the expense of salvage value.

It is the purpose here to examine the economic rationality of both US admiralty law and UNESCO's *Protocol*. To do this in section 1 a simple economic model is constructed that indicates how in principle the economic value of a shipwreck can be maximized. In section 2 relevant aspects of US law as it relates to archaeology is briefly reviewed. In section 3 US admiralty law is confronted with this economic model. The conclusion is drawn that it is likely that the admiralty courts have not yet done enough to encourage the collection of highest quality archaeological data nor, therefore, to maximize the economic value of shipwrecks in US waters. In section 4 UNESCO's *Protocol* is subjected to similar scrutiny. It is suggested that perhaps the *Protocol* goes too far in the other direction. That is, of over-protecting archaeological value at the expense of salvage value.

**1: The economic values of shipwrecks**

Shipwrecks in general supply various kinds of economic values. These are, first, salvage value - as when cargoes of high monetary value are recovered, so returning them to the
'stream of commerce'. Secondly, archaeological value - as when the careful investigation of a wreck uncovers interesting historical information. Thirdly, Recreation value - as for hobbyist divers. Finally, reef value - as when a wreck creates an artificial reef as a habitat for fish that may be of value to recreational anglers.

Of most interest to us are salvage and archaeological values. There are five main reasons for narrowing the focus in this way. First, because these two values will often be the largest of the four values; secondly, individual wrecks will quite frequently combine them; thirdly, there is a tradeoff between them in the sense that maximizing salvage value may minimize archaeological value. Fourthly, recreation value may be enjoyed even after the forgoing values have been extracted. Finally, as it is becoming a common practice to deliberately sink hulks to create artificial reefs, reef value is perhaps best left to a discussion separate from that of old wrecks.

As there are a finite number of shipwrecks - perhaps about 50,000 off the US coast, and one million worldwide - they are a depleteable (non-natural) resource in the sense that salvage removes them from the stock of wrecks still available for exploitation. However, shipwrecks are not an open access resource as they are governed by state and federal admiralty law. Moreover, salvage rights over historic wrecks, such as the Titanic, lying under the high seas may be established through the courts of a nearby country - the USA in the case of the Titanic. In addition, ratification of UNESCO's Protocol would create an international law over wrecks.
There are four characteristics of salvage and archaeological value that are of interest.

First, salvage creates a monetary value. That is, when the salvaged goods are sold they create a flow of revenue to the salvage company. A salvage company is assumed to aim to maximize the net present value of profits derivable from the salvage of a wreck - where $\text{NPV} = \text{PV}_{\text{benefit}} - \text{PV}_{\text{cost}}$.

Secondly, archaeological value is measured as the utility of the knowledge gathered through careful archaeological work. However, it is assumed that a money value can be placed on the utility of new knowledge. Admittedly, in practice this is a difficult, but it is in fact done on a routine basis. For example, governments have to decide how much to spend supporting pure research in state universities. Similarly with private sector companies performing pure research in, for example, pharmaceuticals. One attempt to place a value on archaeological knowledge is that of Throckmorton (1990) who measured value using the measured increase in visitors to a museum in, Kyrenia, Cyprus, after the artifacts and archaeological records of a 4th century BC ship had been placed there for public inspection. More generally, the monetary value of utility is measured in terms of what somebody is willing to pay (WTP) for the thing that offers that level of utility - what a museum is WTP for archaeological records and artifacts, or a TV station for the filmed record of a dive. As archaeological knowledge once collected continues to exist through time, it has a present value, and after deducting the present value of the costs of collection, a NPV.

We can write:
Total net present value of a wreck = Salvage value + Archaeological value

Or,

\[ TNPV = NPV_{salvage} + NPV_{archaeology} \]  \hspace{1cm} (1)

Thirdly, it is assumed that pure salvage operations (i.e. operations unencumbered by the collection of archaeological data) can occur rapidly so that stretching out the period of time over which salvage occurs reduces the \( NPV_{salvage} \).

The final assumption is that recovery of archaeological data and artifacts is time consuming. Opinion among practitioners is that fourteen days would be an unusually long time for pure salvage operations over a wreck. However, the thorough collection of archaeological knowledge is far more time consuming - for example, about 300 dive days were spent over the wreck of the \textit{La Salle} off the coast of Texas in 199X. Clearly, increased time diving over a wreck is required if more data is to be collected. We will assume that present value and NPV of archaeological knowledge increases with time spent over a wreck - at least for a period much more prolonged than is needed for salvage. Relevant to the length of this period of time is for how many days the value of the knowledge collected exceeds the (marginal) cost of collection. When this falls to zero it is time to end an investigation.

\textbf{Collecting economic value}

As archaeological value is expensive to collect and difficult to monetize salvage companies will not want to collect it. Sometimes salvagers claim that they do keep
archaeological records, possibly because by showing themselves before the courts as responsible citizens they hope to obtain larger salvage rewards. However, the value of 'archaeological records' collected by salvagers has been questioned on the grounds that their findings are insufficient to appear in peer reviewed archaeology journals. Siding with latter view it is assumed that salvage companies will have little interest in maximizing equation 1.2

The objective of a society is assumed to be to maximize the TNPV of a wreck, where net present value is defined in equation 1. To illustrate the maximization problem, observe the two NPV functions - both as a function of time - drawn in figure 1. The negative sloped function is marked $\text{PV}_{\text{salvage}}$ showing how delay affects the profits of salvage companies. The other function is marked $\text{PV}_{\text{archaeology}}$. This is positively sloped indicating - as argued above - that the NPV of archaeological work increases with the time spent over a wreck. Adding these two NPV functions together yields the TNPV. This function has a humped-back shape that turns out to be of special importance. We will return to discuss this in a moment.

Before doing so it should be emphasized that the TNPV function may take on two other shapes of a general characteristic. First, when a wreck has high salvage value but low archaeological value the TNPV function may be negatively sloped throughout. See figure 2. This is the case where TNPV is maximized by a rapid salvage operation that may

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2 There is a parallel between salvage companies and oil companies. When oil companies produce oil from a well they also produce some gas. When the value of the gas is large enough to monetize, oil companies collect the gas and sell it. However, when they cannot
collect little or no archaeological data. For example, the wreck may be of a world war one vintage war ship containing many crates of high quality champagne worth $2,000 per bottle at auction; but with little archaeological value because all or most that there is to know about this particular ship is already known.

At the other extreme is a wreck that is of high archaeological value - perhaps because it can add a lot to a sketchily known period of history - such as might be revealed by the wrecks of ancient Greek or Egyptian crafts. Alternatively, the wrecks of US Civil War war ships might be of high archaeological value because the recovery of even small details makes more vivid the history of a particularly interesting period of history. While artifacts recovered from wrecks such as these might also have a high salvage value, assuming that archaeological value dominates, the TNPV function may be positively sloped throughout. Such a function favors a drawn-out archaeological dive with salvage companies being kept away.

However, as figure 1 illustrates, the TNPV function may be neither negatively nor positively sloped throughout its length. As such, it is not clear whether the salvagers or the archaeologists should have it. In fact, in figure 1, TNPV is maximized at D_i dive-days, yielding NPV^{salvage}_i and NPV^{archaeology}_i. In other words, salvage and archaeology should share the wreck.

monetize the value of the gas they flare it off and it goes to waste. Similarly with salvage companies - unless they can monetize archaeological value they flare it off.
The relevance of the choice of discount rate to the NPV and TNPV function is worth considering. A high discount rate reduces the present value of expected future benefits compared with a low discount rate. Thus, high discount rates discriminate in favor of projects with quick payback periods. A high discount rate therefore would tend to favor salvage over archaeological value. This is because salvage value can be realized quite quickly (when and if the goods are put up for auction); and though archaeological value may not deplete over time, the present values of future years will be heavily discounted.

The effect of a high discount rate is then to tilt the TNPV to slope negatively, so favoring salvage over archaeology. The opposite is the case with a low discount rate. The TNPV function may be tilted to slope positively, so favoring archaeology over salvage.

The discount rate aside, how does US law discriminate between salvage and archaeological value? The answer depends in large part upon whether an archaeological site is on dry or submerged lands.

2: Archaeology and the Law

Archaeological resources on US federal lands, including submerged lands, are by no means treated equally under US law. Land-based sites are granted much the greater protection through quite recently passed laws than are historic shipwrecks - which still are largely governed by the ancient law of salvage.
Thus, US law as expressed in the *Archaeological Resources Protection Act* (1979, amended 1988) gives extensive protection to archaeological sites found on land. The Act states that "archaeological resources on public lands and Indian lands are an accessible and irreplaceable part of the Nation's heritage", but that "these resources are increasingly endangered because of their commercial attractiveness". Moreover, "existing Federal laws do not provide adequate protection to prevent the loss and destruction of these archaeological resources and sites resulting from uncontrolled excavations and pillage". Thus, "the purpose of the Act is to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands".

Under the ARPA permits are issued for the investigation of archaeological sites on the understanding that intended activity is "undertaken for the purpose of furthering archaeological knowledge in the public interest". And that "the archaeological resources that are excavated or removed from public lands will remain the property of the United States, and such resources and copies of associated archaeological records and data will be preserved by a suitable university, museum, or other scientific or educational institution". Penalties for violating the Act can be severe. The maximum sentence for a first offence being a $10,000 fine and imprisonment for up to one year, and twice these amounts for a second offence. The severity of the punishment is related to the archaeological and commercial value of the archaeological resources involved and the cost of restoration and repair of the site.
Which law applies to the establishment of property rights in historic shipwrecks depends in large part on the location of the wreck. Relevant laws are salvage law, the law of finds, the Marine Protection, Research and Sanctuaries Act (1972), the Abandoned Shipwreck Act (1987), related state legislation implementing the latter Act in state waters, and in non-navigable state waters various laws may apply including common law, and state statutory or regulatory laws. However, none of these laws protects archaeological value to the extent implied by the ARPA. For example, there is no requirement that artifacts will remain the property of the US, or that archaeological records will be preserved by a suitable university or museum.

Table 1 lists the jurisdiction of the various laws relating to historic shipwrecks.

<table>
<thead>
<tr>
<th>TABLE 1: US LAWS RELATING TO HISTORIC SHIPWRECKS</th>
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<tbody>
<tr>
<td>LAW OF SALVAGE</td>
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<tr>
<td>1. Federal submerged lands - 3-12 miles from the coast</td>
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<tr>
<td>2. Outer-continental shelf - 12-200 miles from the coast</td>
</tr>
<tr>
<td>4. State navigable submerged lands - 0-3 miles from the coast. If the wreck is not abandoned - law of salvage. If abandoned, law of finds.</td>
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</table>

[1] Admiralty courts are reluctant to apply the common law of finds to shipwrecks, preferring instead to apply salvage law. The reasoning is based on interpretation of the word "abandoned". Even a shipwreck hundreds of years old is not abandoned unless the owner - shipping or insurance company - has made an affirmative statement to that effect.

[2] Following the Brother Jonathan case before the Supreme Court in 1998 salvagers are successful in having salvage law rather than the ASA applied. The Supreme Court had ruled that the 11th Amendment protecting states from federal court lawsuits did not apply to shipwrecks in state navigable submerged lands.
Clearly, salvage law predominates in all US navigable waters. However, salvage law was initially developed for the purpose of governing the salvaging ships and their cargoes in immediate marine peril, and not for the recovery of archaeological knowledge and artifacts using modern archaeological methods from historic shipwrecks. Under the law of salvage the original owner retains ownership of the goods lost at sea but shares the value of recovered goods with the salvager. The salvage award is intended not only to compensate the salvager but also to reward 'meritorious services' and to act as an inducement to others to perform such services. The admiralty courts, in an effort to promote the recovery of archaeological data also reward archaeological work done by salvagers. However, as is discussed below, professional archaeologists are often highly critical of the scientific quality of such work.

The unsuitability of salvage law as it relates to the protection of abandoned historic shipwrecks is implicit in the Abandoned Shipwreck Act of 1987. The Act recognizes the multi-use values of historic shipwrecks. Thus, it says, "that shipwrecks offer recreational and educational opportunities to sport divers and other interested groups, as well as irreplaceable State resources for tourism, biological sanctuaries, and historical research". The states are charged with the protection of natural resources and habitat areas, guaranteeing recreational exploration of shipwreck sites; and allowing for appropriate public and private sector recovery of shipwrecks consistent with the protection of historical values and environmental integrity of the shipwrecks and the sites.

3 According to Collins (1999), the size of a salvage award depends upon two factors relating to the wreck: the degree of marine peril, the value of property recovered; as well as four factors relating to the salvagers: the risks incurred, their promptitude and skill, the value of the equipment used, and the amount of labor expended.
However, following the *Brother Jonathan* case in 1998, expert legal opinion is that admiralty law of salvage supercedes the ASA. The Supreme Court of the US said that states could not use the 11th Amendment for protection against law suits brought in relation to salvage law. The effect is that salvagers are able to choose to have their salvage rights recognized under federal salvage law rather than the ASA.

The legal demise of the ASA leaves the *Marine Protection, Research and Sanctuaries Act* (1972) as offering most protection to historic shipwrecks. Under the MPRSA it is unlawful to cause loss or injure any sanctuary resource, including historic shipwrecks. Fines can be substantial, amounting to $100,000 per day for willful misconduct. Such misconduct includes violation of archaeological sites. However, the area of jurisdiction of this Act is, as its name implies, restricted to just 12 marine sanctuaries which are of limited area.

3: Admiralty courts and the protection of archaeological value

Suppose that there are two types of companies: salvage companies and archaeological companies, but that there are relatively few of the latter type. Supposing too that the source of value of a wreck can be identified in advance, then it would be natural for salvagers and archaeologists to partition the recovery of the value of wrecks according to their special competencies. Simply, salvage companies should specialize in shipwrecks with high salvage value but low archaeological value, while archaeologists specialize in recovering the value of wrecks with the reverse characteristics.
However, it is more complicated in the intermediate case illustrated in figure 1. Here both types of value contribute to TNPV in somewhat similar proportions. There may be many cases like this as, at the outset of salvage or archaeological work, it may not be possible to make any other assumption than the proportions might be quite balanced. This could be because the discoverers of a wreck have only a very general idea as to its age, or origin. In this type of case, it would seem to be advisable to proceed with excavations slowly as if the wreck could yield significant archaeological value as well as salvage value.

Admiralty law courts have begun to fashion rules rewarding salvagers' efforts to preserve archaeological data and artifacts. Thus, awards are larger for better work done in this regard. To illustrate, in 1996 the exclusive salvage rights to the *Titanic* were challenged in court. But the court held that "the preservation of the archaeological integrity of the wreck as well as the preservation of the retrieved artifacts was evidence that the operation had been undertaken with due diligence" (Christie *et. al*, 1999, page 160).

Also, the salvagers of "*The Nashville*" where refused by a Federal District Court any salvage award because their handling of the property had increased the likelihood of the deterioration of the goods salvaged. In addition, in 1982 a Federal Court ruled that in order to state a claim for a salvage award on ancient vessels of archaeological value, it is an essential element that the salvager documents to the admiralty court's satisfaction that it has preserved the archaeological value of the wreck.
It is therefore apparent that US courts recognize the different values that may be contained by a shipwreck and that they have devised incentives for salvagers to gather archaeological data that they may well have otherwise destroyed.

However, an important proviso concerns the type of archaeological data gathered by salvage companies. Is it of high archaeological value? There can be a vast difference between data gathered by non-specialist and specialist archaeologists. The latter most often will be concerned with gathering an interpreting data suitable for publication in peer-review archaeology journals. In other words, a specialist's archaeology can normally be expected to be of the highest quality. According to Robert Neyland, Chairman of the *Advisory Council for Underwater Archaeology*, no archaeological report written by a salvage company that he knows of has ever appeared in a peer-reviewed archaeology journal. For example, the salvagers of the *Central America* sunken in 1857, carrying 21 tones of gold, and salvaged in 1987, were awarded 90% of the gold bullion and coins recovered even though no archaeological reports were published.

Thus, if it is an objective of the courts to induce salvage companies to be concerned with preserving the archaeological record they are probably failing because salvage companies produce archaeological records of less than scientific standard. While it might be said that some record is better than no record, such a situation may be far from TNPV maximizing behavior.

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4 Private letter to author dated November 18th, 2002.
One way to deal with this problem would be to require salvage companies to produce archaeological data suitable for processing into papers publishable in peer-review journals. This ought to induce the salvage companies to employ professional archaeologists devoted to collection of such data. Since such professionals would need to have some say as to the number of days needed for a dive, a move toward the TNPV maximizing number of dive days would be expected. In other words, the courts could introduce standards that in effect uses salvage companies as agents concerned with collecting high quality archaeological data.

3: Developing international law on historic shipwrecks

At the other extreme of the law of salvage as currently applied would be laws that promoted archaeological value over salvage value. Such a law if it were ever instituted could be based on the United Nations Educational, Scientific and Cultural Organization's Convention on the Protection of the Underwater Cultural Heritage - adopted in November 2001. The Convention if ratified, and assuming that a country does not take a reservation (i.e. says that it will not be bound by the Convention), will apply outside its territorial waters, i.e. in its EEZ and contiguous continental shelf (as well as on the high seas beyond).

The Convention heavily favors archaeological values and appears to discount salvage value completely. This is evident from the first two rules abstracted from the annex to the document concerning activities directed at underwater cultural heritage. "Rule 1. The protection of underwater cultural heritage through in situ preservation shall be considered
as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage, and subject to that requirement may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage. And "Rule 2. The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods"

It is clear that this *Convention* favors archaeological value to the virtual exclusion of salvage value. The value of salvage in returning goods to the circulation of commerce (such circulation presumably being the original intent when the goods were first shipped) is entirely discounted. This would appear to be the meaning of the last sentence of paragraph 2: "Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods". Rather, as the opening sentence of the quotation says "the protection of underwater cultural heritage through in situ preservation shall be considered as the first option". This seems to imply that the *Convention* would rather leave goods untouched on a wreck site than have them recovered. Such a policy is extreme to say the least given the very high salvage values that are possible. For example, the gold recovered from the steamship *Central America*, sunken in 1857 in 2,500 meters of water is valued at up to $400 million.
Given its apparently extreme nature in favoring archaeological over salvage value what kind of rational might explain the *Convention on the Protection of the Underwater Cultural Heritage*. There would seem to be two candidates. First, in any project appraisal the choice of discount rate may be crucial. Lower discount rates increase the PV of expected future benefits. If it is supposed that the utility of the archaeological knowledge once collected from a wreck does not decline over time, the use of a very low, or, even, zero discount rate could yield a high NPV for archaeological knowledge. In this scenario, with a high archaeological value, the TNPV function of figure 1 could be upward sloping throughout its length - so favoring archaeological value over salvage value.

How credible is it that the countries voting for the *Convention* rationally and consistently favor a low discount rate in their resource allocation decisions? In fact, most of the 87 countries voting for the Convention are low-income countries. (Most of the 19 countries either abstaining or voting against it are high-income countries) Given that low income is usually associated with higher rates of time preference (a determinant of the discount rate), and that these countries often have poor records of conserving their terrestrial environmental assets, a credible 'low discount rate' explanation for Rules 1 and 2 of the *Convention* is questionable.

Secondly, the *Convention* is politically motivated and is aimed at promoting the interests of Third World countries even at the expense of developed countries. The general voting pattern of Third World largely 'for' and developed countries largely 'not for' the *Convention* is consistent with this interpretation. The *Convention* might therefore be seen
as a sort of holdover from the New International Economic Order motivation of the 1970s that was pressed by Third World countries to institute certain policies that would have favored them. For example, The NIEO promoted the idea of managing worldwide raw material trade aimed at stabilizing and raising the prices of certain raw materials exported by Third World countries. Relevant to this line of argument is the fact that the new underwater exploration technologies are the property of a few developed countries. Thus, it is these countries that perhaps stand to profit most from the commercial exploitation of shipwrecks lying outside of their territorial waters, rather than Third World countries as a whole. If this argument is correct then the Convention in promoting archaeological value over salvage value is a sort of beggar-thy-neighbor policy on the part of Third World countries - 'if we can't benefit neither shall you'.

However, as both of these possible explanations for apparent bias of the Convention are themselves somewhat speculative, it remains an open question as to why it discounts salvage value so heavily.

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