EXECUTIVE SUMMARY

Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms

A TECHNICAL ANALYSIS TO INFORM STATE POLICY

CALIFORNIA OST Ocean Science Trust

CONNECTING SCIENCE TO OCEAN MANAGEMENT

About the OST

The California Ocean Science Trust (OST) is a nonprofit 501(c)(3) public benefit corporation established pursuant to the California Ocean Resources Stewardship Act of 2000 to encourage coordinated, multi-agency, multi-institution approaches to translating ocean science to management and policy. In order to achieve its mission of ensuring that the best available science is applied to California ocean policies and management, the OST has established two programs:

- *Science Integration to the State:* OST provides integration of a scientific perspective, data synthesis, and information for decision-making processes of California state agencies and coordinating bodies, such as the California Ocean Protection Council (OPC). The OST serves the state by coordinating expert advice and acting as liaison and bridging institution.
- *Piloting, Developing, and Incubating New Ventures*: This program focuses on developing and institutionalizing new and innovative approaches for improved linking of science with policy and management. As its first such project, the OST is incubating the Marine Protected Areas (MPA) Monitoring Enterprise.

More information about the OST is available at http://www.calost.org.

COVER PHOTOS

Platform Irene, North of Point Arguello: Linda Snook

Conducting Platform Surveys, Lovelab, Platform Gina: James Forte

Juvenile Vermillion Rockfish (*Sebastes miniatus*). Bottom of Platform Grace: Donna Schroeder

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Executive Summary

Submitted to the California Ocean Science Trust

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Preface

About the Study:

In 2007, the California Natural Resources Agency began investigating issues surrounding alternatives for decommissioning of the 27 oil and gas platforms in California's State Tidelands and off the Outer Continental Shelf. The Natural Resources Agency established a three-phase process to formulate and inform policy options (further described in Section 1 of this report).

For Phase II ("Conduct Comprehensive Investigation") of this process, in October 2008 the Natural Resources Agency partnered with the California Ocean Science Trust (OST) – a 501(c)(3) nonprofit public benefit corporation – to release a Request for Proposals (RFP) for a "Study to Provide Information Related to Oil and Gas Platform Decommissioning Alternatives in California." As described in the RFP, the purpose of this study was "to assemble and examine scientific and legal information that will frame future state policy discussion on the alternatives for decommissioned platforms." This report and the accompanying PLATFORM decision model are the final products of the study.

Study Funders:

This study was funded jointly by the following entities:

California Ocean Protection Council
Chevron Corporation
Ocean Conservancy
Sportfishing Conservancy
United Anglers

Study Process:

In accordance with its mission of supplying California decision makers with rigorous and objective technical information, the OST was tasked by the Natural Resources Agency with coordinating all aspects of the study. Drawing from respected and venerable models such as the National Academies, the OST designed a comprehensive, deliberative study process with the goal of ensuring a thorough, balanced, and unbiased final report that would be a useful reference for decision-makers. OST's process encompassed extensive expert technical review of the RFP, revision and release of the RFP, and selection and oversight of a qualified project team. Furthermore, through a public nomination process the OST convened an Expert Advisory Committee (EAC) (see Appendix 6 for more information). This multidisciplinary, 15-member body included academics, industry experts, and agency representatives. The EAC's charge was to work with the OST and the project team to guarantee that the state received authoritative and credible advice on this important issue. The EAC informed the selection of the project team by providing comments on the proposals, reviewed and submitted detailed comments to the OST on the team's interim products and report drafts, provided general advice on the study process and approach, and deepened the expertise that shaped project findings. In addition to the guidance provided by the EAC, the California Attorney General's Office advised the OST, the project team, and the EAC on issues regarding the legal components of the study.

For more information about the RFP, the study process, and the Expert Advisory Committee please visit **http://www.calost.org/Oil_gas.html.**

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List of Acronyms

ACOE	United States Army Corps of Engineers
AHP	Analytica Hierarchy Process
CARE	California Artificial Reef Enhancement Program
CARP	California Artificial Reef Program
CCC	California Coastal Commission
CCMP	California Coastal Management Program
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CIAP	Coastal Impact Assessment Program
CINMS	Channel Islands National Marine Sanctuary
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CRANE	Cooperative Research and Assessment of Nearshore Ecosystems
CREF	Coastal Resources Enhancement Fund
CSTR	California Ships to Reefs Program
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DCOR	Dos Cuadras Offshore, LLC
DPP	Development and Production Proposal
EA	Environmental Impact Analysis
EAC	Expert Advisory Committee
ECA	Emissions Control Area
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCF	Fishermen's Contingency Fund
FEF	Fisheries Enhancement Fund
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FWS	United States Fish and Wildlife Service
GOM	Gulf of Mexico
HLV	Heavy Lift Vessel
HSWRI	Hubbs Sea World Research Institute
LFCF	Local Fishermen's Contingency Fund
LLC	Limited Liability Company
LFCF	Local Fishermen's Contingency Fund
LNG	Liquefied natural gas
MAUT	Multi-Attribute Utility Theory
MSFCMA	Magnuson-Stevens Fisheries Conservation and Management Act
MLPA	Marine Life Protection Act

MOU	Memorandum of Understanding
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MPA	Marine Protected Area
NAA	National Aquaculture Act
NFEA	National Fishing Enhancement Act
NMFS	National Marine Fisheries Service
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Organization
NOAAct	National Offshore Aquaculture Act
NPDES	National Pollutant Discharge Elimination System
OCS	Outer Continental Shelf
OPA	Oil Pollution Act
OPR	Office of Planning and Research
OCSLA	Outer Continental Shelf Lands Act
OSPR	Office of Spill Prevention and Response
OST	California Ocean Science Trust
PAH	Polycyclic aromatic hydrocarbons
PERL	Pacific Energy Resources, Ltd.
POCS	Pacific Outer Continental Shelf
POOL	Pacific Operators Offshore, Ltd.
PXP	Plains Exploration and Production Company
ROMS	Regional Oceanic Modeling System
ROV	Remotely Operated Vehicle
SCB	Southern California Bight
SCH	State Clearinghouse
SLC	State Lands Commission
USCG	United States Coast Guard
USDA	United State Department of Agriculture

Executive Summary

Decommissioning of the 27 oil and gas platforms offshore southern California (Figure ES.1) is an unavoidable issue that will face California's ocean managers at some point in the future as the platforms reach the end of their useful production lifetimes (predicted for the 23 platforms in federal waters to occur sometime between 2015 and 2030; no such estimates are available for platforms in state waters). A number of different decommissioning options exist and each will result in an array of environmental and socioeconomic impacts, some positive and some negative. These impacts, and their costs and benefits, will be perceived and valued differently by stakeholders with differing perspectives. For example, some will see the need to decommission platforms that have reached the end of their useful production lifetime as an opportunity to fulfill operators' original lease obligations and remove these large structures from the ocean, thereby restoring the seabed to its original, natural state. Decommissioning can also be viewed as an opportunity to derive a greater return on the investment represented by the platforms by converting them to other potentially valuable uses with economic and/or scientific benefits. Yet another perspective is that decommissioning provides a chance to preserve a large part of the biological communities that inhabit offshore platforms, thus conserving an ecological resource that contributes to biological production locally and perhaps regionally. Finally, decommissioning may be an opportunity for the state to achieve financial benefit through its share of avoided decommissioning costs, thus increasing resources available to support efforts that produce environmental and socioeconomic benefits.

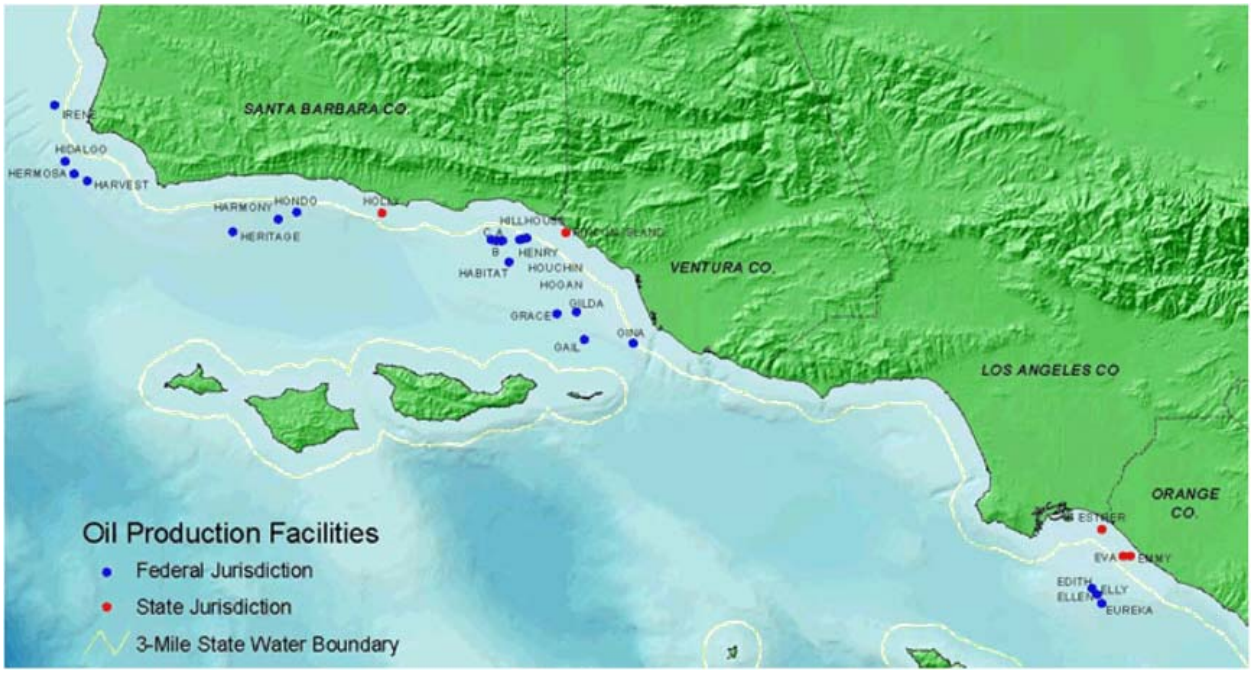

Figure ES.1. Locations of offshore platforms in the southern California region (source: Earthguide.ucsd.edu/fuels/images/platforms.jpg).

Each of these outcomes could potentially be achieved by implementing one or another of a range of possible decommissioning options. The challenge for decision makers is therefore to evaluate available information to determine whether and how these various outcomes could be achieved and the mix of costs and benefits associated with each. Making such judgments is not an easy process because decommissioning is a complex and costly engineering undertaking that involves an extremely wide range of legal, environmental, socioeconomic, and policy issues. For example, almost 30% of the California platforms are in water depths exceeding 400 feet, with the deepest at 1198 feet (taller than the Empire State Building) (Figure ES.2). As a result they are of such large dimension and mass that their removal would exceed any platform decommissioning project ever performed.

Figure ES.2. A segment of one of the larger California platforms onshore prior to its installation. For scale, a large red crane is in the foreground and a number of trucks and other vehicles are on the shoreline behind the platform at the right edge of the picture (courtesy of Proserv Offshore, Inc.)

Thus, the core objective of this study was to create an analysis and a decision framework that will assist decision makers and other interested parties in understanding and investigating the implications of different decommissioning options and making a choice among these. We addressed this objective by accomplishing three goals:

- Prioritize potential decommissioning options and identify the most viable for more detailed analysis
- Summarize available information on these options to present a comparative analysis of impacts, costs, and benefits across a wide range of issues, focusing on those aspects of decommissioning that will contribute most to a choice among options (e.g., the analysis excludes or minimizes those aspects that are the same across options)
- Examine the existing legal / regulatory framework to identify mechanisms that would aid in implementing decommissioning options

The remainder of this Executive Summary presents key findings and conclusions related to each of these three goals. We emphasize this study was not intended to provide recommendations on the choice among decommissioning options. Rather, it organizes and presents detailed information on the key aspects of decommissioning, identifying tradeoffs among these various aspects, and rigorously examining the implications of these tradeoffs in a structured evaluation framework.

Prioritize decommissioning options

In addition to their complete removal, a number of different possible uses for decommissioned offshore oil and gas platforms have been proposed over the past several decades (Figure ES.3). It is important to understand that, except for the partial removal and artificial reefing option, all other uses merely postpone, but do not do away with, the need to eventually remove platforms when they reach the end of their structural lifetimes.

Not all of the alternative uses or disposal options are equally viable technically, economically, or politically. Our evaluation showed that only a subset were likely to be seriously considered for the majority of the southern California platforms and could potentially be implemented. These options included two use options (complete removal and partial removal as part of conversion to an artificial reef) and one disposal option (onshore dismantling). Partial removal is defined as removal of the platform deck and jacket down to a depth of 85 feet below the sea surface. Table ES.1 summarizes the results of this evaluation.

It is important to note that the partial removal option, which involves conversion of the decommissioned platform to an artificial reef, is feasible for only one (Platform Holly) of the four platforms is state waters. This is because the partial removal option involves removal of the platform structure to 85 feet below the water line to reduce the risk of ship strikes and to minimize the need for surface buoys or other markings. The other three state platforms are in water depths too shallow to implement this option.

Section 4 of the report includes descriptions of these options and provides detailed engineering descriptions of the complete and partial removal options.

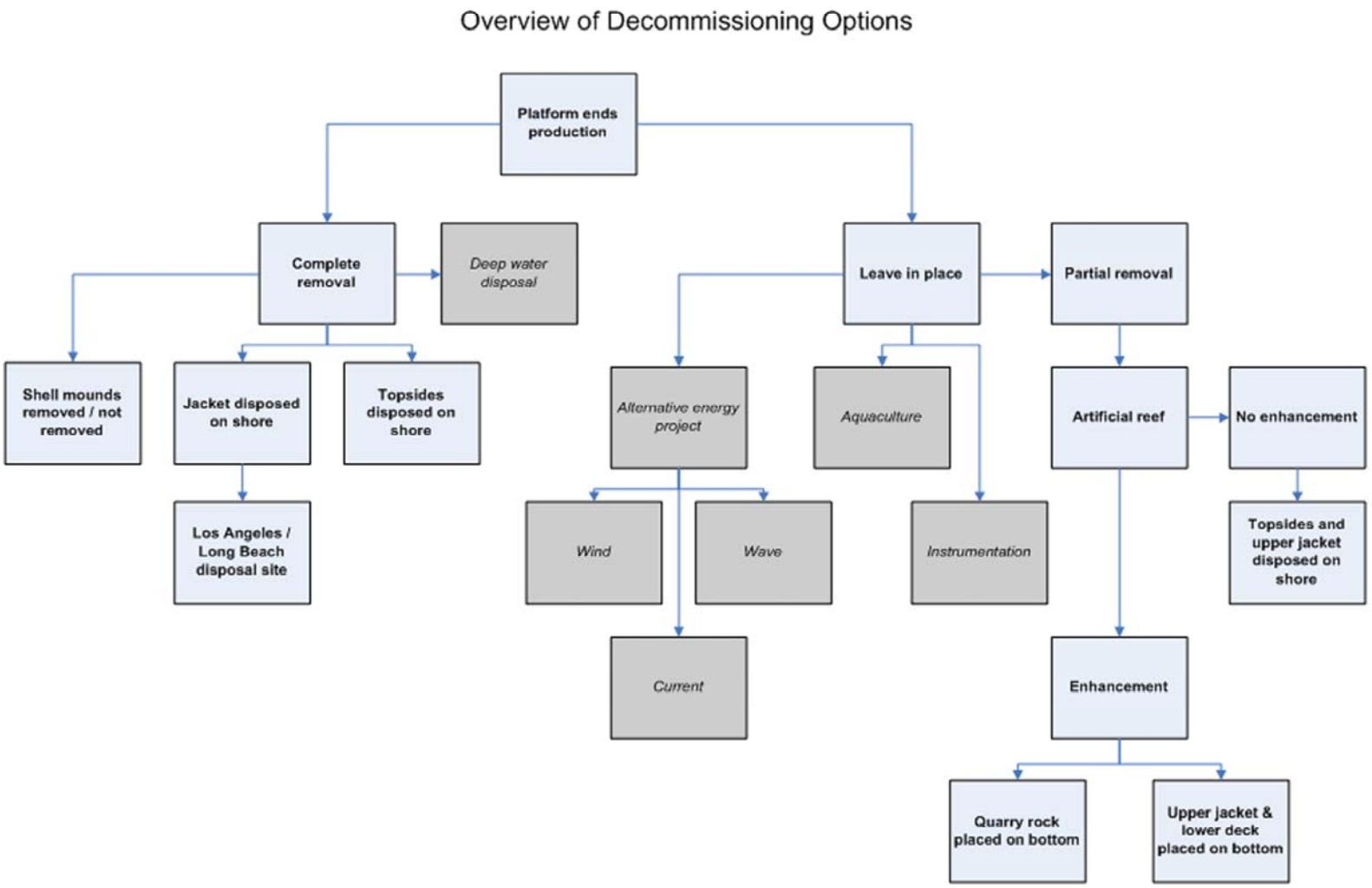

Figure ES.3. Summary of the decommissioning options considered. Complete removal and partial removal were analyzed in greater detail and are shown in bold type. Options in italics in the gray boxes were not considered in detail in the analysis. Rationale for prioritizing options is summarized in Table ES.1 and explained in more detail in Section 4.0.

Table ES.1. Summary of alternative use and disposal options considered in this report. The complete removal and partial removal / artificial reefing use options, along with the onshore dismantling and disposal option, are considered in detail. Other use and disposal options are described and evaluated in summary form. All options shown, with one exception, are legally allowable under existing law. Transfer of ownership of platforms in the OCS to the state, while allowed under federal law, would require new state enabling legislation.

Option	Prioritization	Rationale
Alternate uses		
Complete removal	Evaluated in detail	• Required in leases • Highly valued by key stakeholders • Technically feasible for all platforms • Costed out in detail by MMS
Partial removal / artificial reefing	Evaluated in detail	• Highly valued by key stakeholders • Abundant precedent in Gulf of Mexico • Fiscal incentive for both operators and state • Technically feasible for all but 3 state platforms • Detailed costs based on MMS estimates for complete removal
Artificial reefing using entire platform	Evaluated briefly	• Highly valued by key stakeholders • Fiscal incentive for both operators and state • Increased liability due to retention of surface structure makes this of much less interest to state
Alternative energy	Evaluated briefly	• Some interest here and in Gulf of Mexico • No projects implemented on platforms • Current technology does not require platforms • Not technically feasible at large majority of platforms • No current interest by project proponents • Economic viability not demonstrated
Aquaculture	Evaluated briefly	• Some interest here and in Gulf of Mexico • No projects implemented on decommissioned platforms • Economic viability not fully demonstrated
Disposal		
Onshore dismantling	Evaluated in detail	• Required for deck structures containing hydrocarbons and other pollutants • Required for complete removal option (assuming no deep water disposal) • Technically feasible • Costed out in detail by MMS

Table ES.1. Continued.

Option	Prioritization	Rationale
Disposal		
Placement of upper portion on bottom	Evaluated in partial detail	• Useful as reef enhancement under the partial removal option • Valued by key stakeholders • No objection from state or federal managers
Deep water disposal	Evaluated briefly	• Potential fiscal incentive for operators • Little interest among state and federal managers

Comparative analysis

The comparative analysis even of just the two decommissioning options selected is complicated not only by the number of possible suboptions available (i.e., the unshaded boxes in Figure ES.3) but also by the wide range of issues that could affect the choice among options. These issues include marine resources, air emissions, socioeconomic impacts, access to ocean resources, marine mammals and birds, water quality, direct decommissioning costs (and avoided costs), and longer-term program costs. We therefore bounded the analysis by excluding aspects of decommissioning that are identical across both options or that are data poor, difficult to quantify, or likely to be very small. Such aspects included, for example, employment and broader (regional, statewide) socioeconomic impacts, and tax consequences of platform donation under the partial removal and reefing option. We then used a combination of evaluation and synthesis of existing information together with analyses performed specifically for this project to conduct a systematic analysis of likely impacts on each issue listed above. Because of the number of issues and the complexity of potential impacts, we present only the most significant findings and conclusions of the analysis here.

We found that not all impacts were equally likely or significant. Impacts on benthic communities, birds, marine mammals, and water quality are likely to be localized and short term, and/or well managed. In all cases, the potential for impact is somewhat greater under the complete removal option because larger equipment will be on site for a longer period of time. In contrast, impacts on ocean access, and the socioeconomic costs and benefits of changes in access to platform locations, included a mix of positive and negative effects that could be important to some parties at some locations. Potentially interested user groups include recreational and commercial fishermen, nonconsumptive boaters and SCUBA divers, and commercial shipping. While we quantified the amount of area opened or closed to each use type for each decommissioning option, we were able to conduct only a qualitative analysis of potential socioeconomic impacts. There are large data gaps for this issue, along with uncertainties about how some user groups will respond to changes in access to the area around platforms.

In contrast, air emissions are likely to be an important issue, especially for complete removal of larger platforms. While data gaps prevented estimations of air emissions for all platforms and all decommissioning options, we did conduct a worst case analysis, represented by the complete removal of Platform Harmony, the largest and deepest platform offshore southern California. This analysis showed that the large diesel engines on the Heavy Lift Vessels (Figure ES.4) and other support vessels, on station for extended periods of time, will produce large amounts of emissions. Our analysis was not definitive and should be considered as a rough estimate; we were not able to obtain emissions factors for all equipment that would be involved in decommissioning and we could not predict the outcome of negotiations with regulatory agencies that could reduce emissions somewhat. Nevertheless, it appears that air emissions will be an important concern, especially for the larger projects, and the data gaps we encountered would most likely be filled as part of the engineering design and environmental review phases of any decommissioning project.

Figure ES.4. The Heavy Lift Vessel Hermod is in the 4000 ton lift category that would be required to decommission the larger California platforms (source: Scheepvaartnieuws, scheepvaartnieuws.punt.nl/upload/mot_1496.jpg, accessed January 28, 2010).

The nature of potential effects on marine resources currently inhabiting platforms is an area of significant concern to managers and resource users. Some outcomes were relatively clear. For example, complete platform removal will result in the death of all attached organisms and the

dispersal of fish to other reefs, where they may be subject to the high fishing mortality prevalent throughout the Southern California Bight. The use of explosives, though not likely, will most probably result in the loss of all fish inhabiting the platform. The ultimate outcome of the partial removal option is less certain. Monitoring data at many of the platforms show that fish communities on the platforms, particularly of rockfish, are at higher densities and contain larger individuals than seen on natural reefs. In addition, studies have shown that young-of-the-year rockfish are also present in much higher densities on some platforms than on natural reefs. Partial removal will leave intact much of the fish community, particularly rockfish, although organisms attached to the upper portion of the platform would be lost. Recent data also show that young-of-the-year rockfish recruit almost exclusively below the 85 foot cutoff depth envisioned for the partial removal option. As a result, this option would most likely not eliminate platforms' function as a nursery area for juvenile fishes, particularly rockfish.

Platforms converted to artificial reefs could be subject to fishing pressure that would reduce the fish populations remaining after decommissioning. While the California Department of Fish and Game could restrict fishing by California registered vessels on state-owned reefs in federal waters, it is likely that such restrictions would not apply to out of state vessels. In addition, any such restrictions must not conflict with provisions of the federal Magnuson-Stevens Fishery Conservation and Management Act or regulations established by the Pacific Fisheries Management Council. However, the Council has not designated platforms as essential fish habitat or focused fishery regulations specifically on platforms. Restrictions on fishing activity on the artificial reefs might be seen to conflict with the intent of the National Fishing Enhancement Act, which provides the legal mechanism for transferring platform ownership to the state (or other entities) for the purposes of creating artificial reefs to improve fishing. Despite these potential legal issues, sportfishing groups in southern California have publicly confirmed on several occasions their willingness to accept certain fishing restrictions that would maintain the biological productivity of the platforms and protect populations of overfished species. (This discussion pertains almost exclusively to platforms in federal waters because only one state platform (Platform Holly) is suitable for the partial removal option.)

Another major question related to the partial removal option is the amount of biological production associated with platform communities. Using data from platform monitoring surveys, we conducted population dynamics modeling of fish communities on eight platforms with data adequate for the modeling analysis. While this analysis resulted in quantitative estimates of production, data gaps prevented quantitative comparisons of platform production to that in other communities and ecosystems in southern California, or any rigorous estimate of the overall contribution of platform communities to the regional ecosystem. We also conducted modeling of larval dispersal patterns that suggested platforms can function both as sources and as sinks, or recruitment locations, for fish larvae in the region.

We also conducted a detailed analysis of decommissioning costs, using recently updated cost estimates from the Minerals Management Service (MMS). These estimates pertained only to complete platform removal and we worked with MMS and their contractor to develop detailed cost estimates for partial removal for each platform. The complete removal of all 27 offshore platforms, grouped into the seven decommissioning projects defined by MMS, would cost an estimated $1.09 billion, while partial removal of these platforms, grouped into the same set of

projects, would cost $478 million, with avoided costs of $616 million (with minor rounding). Avoided costs are costs that are saved by conducting the less extensive partial removal option.

Decision model

These findings and conclusions provide useful insights into the expected effects of the two main decommissioning options. However, the analysis in this report suffers, as is the case for all such assessments, from two important limitations. First, there is an extremely large number of possible combinations of platforms that could be selected for decommissioning, decommissioning options and suboptions, separate sources and types of impact, and approaches to valuing important costs and benefits. The report cannot investigate each of these in detail. Second, different parties will have different perspectives or preferences that will lead them to value impacts or outcomes differently. For example, one person might value preservation of biological production most highly and another following through on lease requirements to completely remove platforms at the end of their useful production lifetimes.

We have therefore developed a supporting tool for this report, the PLATFORM decision model (Figure ES.5), that provides an interactive environment in which users can investigate the cost and other implications of specific decommissioning projects in more detail. The decision model enables users to thoroughly investigate how different decommissioning choices and evaluation methods affect the relative desirability of different potential decisions. In addition, PLATFORM enables users to assess platforms individually or as part of larger, multi-platform projects, and similarly to examine individual impact categories (attributes) or integrate over all impacts to develop a global comparison between different possible decommissioning projects. The decision model also allows users to weight issues to reflect their own preferences and to investigate how different preferences affect the choice among decommissioning options, features that can prove useful in evaluating sources of conflict or disagreement. PLATFORM has been loaded with quantitative data on decommissioning costs, biological production estimates, and changes to ocean access, as well as with qualitative assessment frameworks for all other issues addressed in the report. The model thus provides a structured means of working more directly with the key data and information developed for this analysis.

Partial removal: institutional and legal issues

The partial removal option would necessarily trigger a complex legal and regulatory process that would require new state legislation and decisions about how to deal with ownership transfers, liability, and the use of the state's share of cost savings from foregoing complete platform removal. These issues required thorough description and analysis in order to define constraints, opportunities, and decision options for the state. The report therefore responds directly to requests from state managers in agencies that would be directly involved in platform decommissioning to examine a range of possible legal and management approaches for resolving the still undefined aspects of the partial removal option. As one manager stated it, "We'd like to know what would happen 'after' [the transfer of ownership] in the partial removal option." We emphasize that the extensive discussion of this topic is not intended to imply that partial removal and artificial reefing is the preferred option. It is instead intended to address what would be involved if this option were selected.

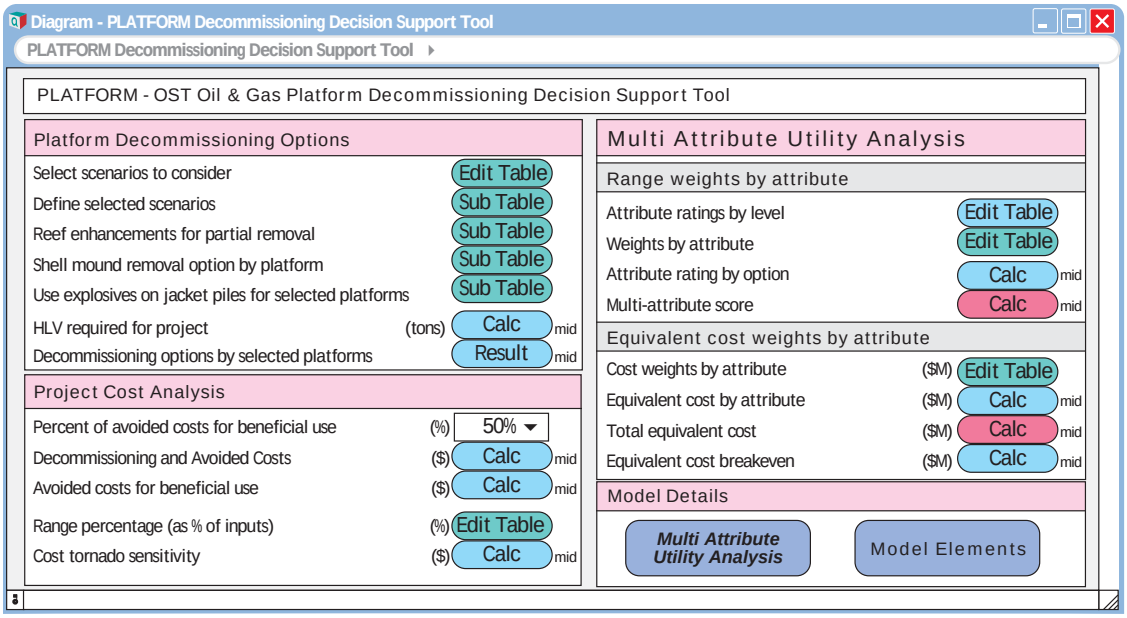

Figure ES.5. The top-level user interface for the PLATFORM decision model, illustrating the four major types of functions (see text in Section 5.4 and Appendices 4 and 5 for more detail).

While the mechanism for transferring ownership of a platform converted to an artificial reef is clearly described in federal law, California currently cannot accept ownership of an artificial reef located in federal waters. The partial removal and artificial reefing option (Figure ES.6) would therefore require new state enabling legislation, the requirements for which are clear and described in detail in Section 6 of the report. Potential liability associated with a large artificial reef has been a consistent concern whenever a rigs-to-reefs program is discussed. We identify and discuss several well-developed mechanisms for dealing with liability concerns, as well as legal precedents, in California and in other states.

Under the partial removal option, there would be significant funds available to the state, although the exact distribution of avoided costs between the state and the operator remains to be negotiated, since there is no requirement for any specific percentage share either party would receive. There are well-established mechanisms for receiving these funds, retaining them for specific uses, and then allocating and managing them. While the state would need to implement a more robust artificial reef program in order to manage these platform reefs, the scope of the program would depend on decisions about how to manage the reefs and for what purposes. While there are a number of significant legal and institutional issues involved implementing a partial removal and reefing option, there are useful precedents for all of these issues that could readily be applied in California.

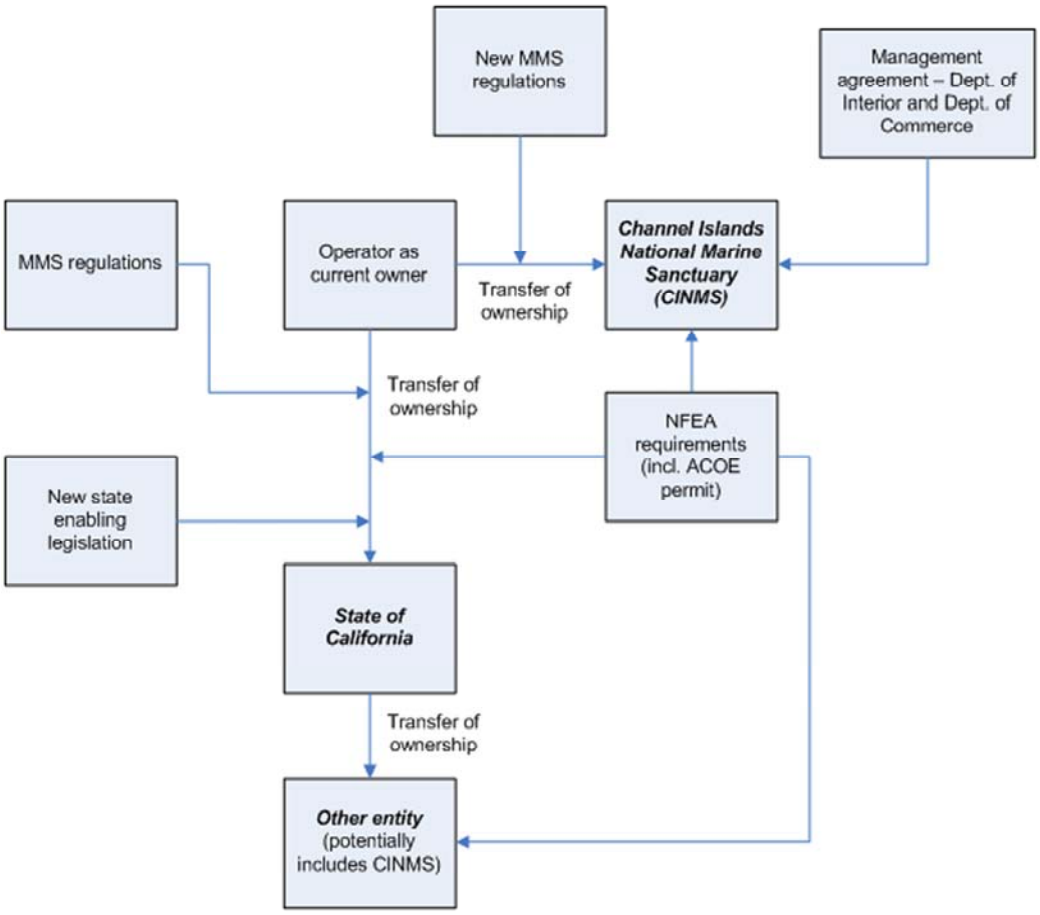

Figure ES.6. Depiction of the pathways for transferring ownership of a decommissioned platform.

Summary

There are a number of potential decommissioning options that could be implemented when the offshore platforms reach the end of their useful lifetimes, but only two of them are likely to be feasible: complete removal and partial removal to 85 feet with the remainder of the platform converted to an artificial reef. The legal and regulatory frameworks for both options are clearly defined, although the partial removal option would require new state legislation to allow the state to accept ownership of platforms in federal waters. The full range of impacts to be expected as a result of both options can be described qualitatively and some can be quantified to varying degrees. However, significant data gaps prevent the full quantification of all potential impacts. Despite these limitations, the information gathered here enables an in-depth comparison of the two primary decommissioning options and the interactive decision model that accompanies the report allows users to more fully investigate the implications of the two options and of different ways of valuing or weighting the costs and benefits of the options.