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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702

August 4, 2004

Lieutenant Derek Dostie
Docket Management Facility
Docket Number USCG-2004-16860 -34
U.S. Department of Transportation, Room PL-401
400 Seventh Street SW
Washington, D.C. 20590-0001

Dear Lieutenant Dostie:

The National Marine Fisheries Service (NOAA Fisheries) has received the Draft Environmental Impact Statement (DEIS) for the Gulf Landing LLC Deepwater Port license application (USCG-2004-16860) transmitted by a letter from Mr. Alan J. Finio dated June 18, 2004. The DEIS evaluates the potential impacts associated with the construction and operation of a liquefied natural gas (LNG) deepwater port and associated anchorage in Outer Continental Shelf, West Cameron Block 213, approximately 38 miles south of Cameron, Louisiana. The project also includes the construction of 66 miles of 16- to 36-inch pipelines that would direct natural gas from storage tanks at the deepwater terminal to existing gas supply systems in the Gulf of Mexico. The purpose of this letter is to notify the U.S. Coast Guard (USCG) and the Maritime Administration (MARAD) that NOAA Fisheries believes the proposed Gulf Landing deepwater port would have significant direct and cumulative impacts on marine fishery resources. Pursuant to §1504.3(a)(2) of the regulations implementing the National Environmental Policy Act (NEPA), unless there is satisfactory resolution of agency concerns as identified in this letter, NOAA Fisheries is advising the USCG and MARAD that we may refer the decision to issue a Record of Decision to the Council of Environmental Quality for their review.

NOAA Fisheries has reviewed the DEIS and has the following comments regarding information provided within the document:

General Comments

NOAA Fisheries does not believe the impacts associated with the open rack vaporizer (ORV) regasification system have been adequately analyzed from an economic or ecological perspective. The enclosed memorandum from the NOAA Fisheries Southeast Fisheries Science Center (SEFSC) details several problems with the fisheries impact analysis in the DEIS. The larval densities utilized in entrainment calculations and age-1 equivalency models are uncharacteristically low and are not congruent with the SEAMAP data. Also, the most appropriate life history information was not used in the age-1 equivalency analyses for red drum and red snapper, two commercially and recreationally important species managed by NOAA Fisheries. There was a lack of acknowledgment of the large potential for variability in the results of these analyses in the DEIS; sensitivity analyses could have been more appropriately utilized than confidence intervals to reflect this variability. The memorandum from the SEFSC concludes that the scientific data and analyses presented in the DEIS do not support the assertion that the proposed deepwater port will not have significant impacts on marine fishery resources. Based on the limited utility of the existing fisheries data and the potential for significant direct, secondary, and cumulative impacts from impingement, entrainment, thermal discharge, and anti-biofouling agents, NOAA Fisheries recommends the EIS designate the submerged combustion vaporizer (SCV), a closed-loop system as the preferred regasification alternative, unless an adequate NEPA analysis demonstrates it is not the least damaging feasible alternative.

Several sections of the DEIS (e.g., Sections 2.2.3 and 2.2.4) state the maximum seawater usage for regasification will be 126.8 million gallons per day (MGD). Other sections of the document (e.g., Sections 2.6.1 and 4.2.2.2) state the average seawater usage for regasification will be 136 MGD, with a maximum seawater usage for regasification of 152 MGD. In addition to regasification of LNG, other activities occurring at the terminal may result in the impingement and entrainment of marine fishery species, including (but not limited to) the use of seawater for cooling purposes and as ballast for off-loading LNG tankers. While the USCG and MARAD do not regulate some of these activities, the EIS should include an estimate of the total seawater usage at the proposed terminal to adequately assess the potential impacts to marine fishery species. The correct average and maximum seawater usage rates for regasification, as well as for other activities requiring seawater at the proposed terminal, should be consistently stated throughout the EIS and used in the discussion of potential environmental consequences on water quality and biological resources.

NOAA Fisheries also finds the age-1 equivalency analysis used to address the cumulative impacts associated with operation of the LNG regasification system to be inadequate. The cumulative impacts evaluation did not quantify impacts to individual species for which the SEFSC indicated there was the greatest potential adverse impacts from the operation of the Gulf Landing LNG facility (e.g. red drum and red snapper). The cumulative impacts analysis should be revised to include the appropriate egg and larval abundances and should be presented for individual species.

<u>Specific Comments</u>

2.0 DETAILED DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES
2.2 Alternatives Analysis
2.2.3 Vaporization Unit Alternatives

<u>Costs</u>
Page 2-7. Cost is the primary justification given for utilizing an open-loop versus a closed-loop regasification system. While the document states the estimated increase in cost for utilizing a closed-loop system, the document should be revised to include an itemized list of costs associated

with each regasification alternative, including marine life exclusion systems, anti-biofouling agents, and monitoring. The EIS should include a comparison of the costs associated with utilizing an open-loop regasification system with the monetary losses incurred by commercial and recreational fisheries due to entrainment and impingement of marine fishery species. Table 2-1 should be revised to include this information.

Effects on Water Quality and Marine Life

Page 2-8. The use of sodium hypochlorite as an anti-biofouling agent is presented in the alternatives analysis section of the DEIS. However, no alternative methods of preventing biofouling, including the use of a closed-loop regasification system or the use of less harmful anti-biofouling agents (such as ozone), were presented in the document. The EIS should fully evaluate alternative anti-biofouling methods.

Effects on Air Quality

Page 2-8. While the SCV would increase air emissions, information should be presented in the DEIS on dilution/dispersion rates of those emissions and on the use of scrubbers or other technology to reduce or eliminate contaminant releases. Additionally, the proposed project site has not been designated as a "non-attainment" area based on air quality. The EIS should include this information in the analysis of regasification alternatives.

2.2.5 Marine Life Exclusion System Alternatives

Wedgewire Screen Barriers (0.5-mm [0.019-in] mesh)

Page 2-14. While the document contains a cost estimate for the 6.35-mm wedgewire screen, there is no cost estimate provided for the 0.5-mm wedgewire screen. Since cost is the primary reason for selecting the 6.35-mm screen, the EIS should include the cost for utilizing the 0.5-mm screen.

Wedgewire Screen Barriers (6.35-mm [0.25-in] mesh)

Page 2-14. The document states that use of the 0.5-mm screen will increase impingement of eggs and larvae of marine fishery species. However, the DEIS does not state that use of the 6.35-mm screen will increase entrainment of fish eggs and larvae. This section of the EIS should be revised to state that use of the 6.35-mm screen will increase entrainment of eggs and larvae of marine fishery species.

Selection of Alternative

Page 2-14. While 1.0- and 2.0-mm wedgewire screens were reported to have a 99 percent and 62 percent reduction in entrainment over 9.5-mm screens, respectively, the DEIS does not indicate the expected reduction in entrainment by utilizing the 6.35-mm screen. The EIS should indicate the expected marine life exclusion efficiency of the 6.35-mm screen and present a clear rationale for not using a smaller mesh screen (i.e., 2.0-mm or less) to minimize impacts to marine fishery species from entrainment.

2.6 Detailed Description of the Proposed Action

2.6.1 Facility Description

LNG Vaporization

Main Power Generation

Page 2-28, paragraph 2. Personnel safety concerns and increased costs associated with burning vaporized LNG at the proposed facility were used to justify using seawater in the regasification process. However, this section of the DEIS states that vaporized LNG will be used to fuel the main power generation turbines for the terminal. The EIS should quantify the amount of LNG required for terminal power generation as compared to the amount required for regasification; clarify the rationale for utilizing LNG to generate power for the terminal functions but not for regasification; and evaluate the possibility of utilizing heat already being generated by the proposed turbines to regasify LNG.

3.0 Affected Environment
3.2 Biological Resources
3.2.6 Fisheries and Essential Fish Habitat
3.2.6.7 Ichthyoplankton

Table 3-6, page 3-32. As noted in the memorandum from the SEFSC, the larval abundances reported in the table appear to be in error. They are lower than the densities reported for the Port Pelican project though they would be expected to be higher due to the closer proximity of the proposed project to the coast. An independent assessment by the SEFSC of SEAMAP samples associated with the project area found larval densities to be 5.6 larvae per cubic meter compared with the 2.87 larvae per cubic meter reported in the DEIS. All text, tables, and calculations (including the age-1 equivalency analysis) in the document should be revised using the correct larval density. These corrected numbers should be used as a basis for the discussions and conclusions provided in the remainder of the DEIS.

Table 3-7, page 3-32. Variability in the fisheries data used in entrainment calculations leads to highly variable results. For this reason, staff of the SEFSC concluded that mortality due to entrainment had been greatly underestimated. Furthermore, the memorandum states that sensitivity analyses have greater utility in describing the potential impact to marine fishery resources. NOAA Fisheries recommends that sensitivity analyses (i.e., varying the egg and larval densities, life stage duration, and life stage mortality rates within realistic ranges) be used in conjunction with the age-1 equivalency approach.

4.0 Environmental Consequences
4.2 Biological Resources
4.2.2 Proposed Action
4.2.2.2 Operational Impacts

ORV Seawater Intake

Page 4-34, paragraph 4. The document incorrectly states that prey species of fish with EFH designated in the project area are presented in Table 3-6. The EIS should be revised to state that the prey species of fish with EFH designated in the project area are presented in Table 3-8.

Page 4-34, paragraph 5. This section of the document states that approximately 1.5 million eggs and 575,000 larvae potentially could be entrained at the proposed project site based on an average seawater intake rate of 136 MGD. As discussed in our previous comments on Table 3-6 (Section 3.2.6.7), we believe that the larval densities utilized in the DEIS are incorrect (i.e., too low). In addition, entrainment estimates for the maximum seawater intake rate of 152 MGD were not included in the document. Entrainment estimates in the EIS should be calculated for both the average and maximum seawater usage rates, as well as for other activities requiring seawater at the proposed terminal (e.g. cooling water and ballast water for LNG tankers) using the correct egg and larval densities.

Page 4-35, paragraph 5. The SEAMAP samples associated with the project area identified taxa of fish that contain species, including red snapper, under formal rebuilding programs through the Reef Fish Fishery Management Plan. Furthermore, red drum is one of the 10 most abundant taxa found in the SEAMAP samples. Red drum is a stock that is overfished and there is no directed fishery allowed for this species in the Exclusive Economic Zone. This information should be included in the evaluation of the potential impacts to marine fishery species in the EIS.

Page 4-35 through 4-40. Variability in the fisheries data used in entrainment calculations leads to highly variable results. For this reason, the SEFSC concluded that mortality due to entrainment is greatly underestimated in the DEIS. Furthermore, the SEFSC states that sensitivity analyses have greater utility in describing the potential impact to marine fishery resources. Sensitivity analyses (varying the egg and larval densities, life stage duration, and life stage mortality rates within realistic ranges) should be used in conjunction with the age-1 equivalency approach. In addition, staff of the SEFSC note that life history information for Atlantic croaker and bay anchovy were inappropriately used in the age-1 equivalency analyses for red drum and red snapper, respectively, when the life history information for those species and/or more closely related species were available in the scientific literature. NOAA fisheries recommends the DEIS be revised to include the best available information in all calculations of impacts to marine fishery species.

Page 4-37, paragraph 4. This section states that one of the limitations of the SEAMAP samples is that they were collected during the summer and spring when ichthyoplankton densities are presumed to be highest. While egg and larval densities at the proposed project site may be overestimated for species which spawn between June and November (i.e., when SEAMAP samples are collected), egg and larval densities for species that spawn during the remainder of the year (e.g., menhaden) will be underestimated. The EIS should indicate the potential for underestimating ichthyoplankton abundance due to the lack of SEAMAP samples for a large portion of the year as a limitation of the data.

Page 4-40 and 4-41. The DEIS reiterates the factors influencing the efficiency of wedgewire screen barriers in excluding marine species from the regasification system. However, it does not specify how those factors will be addressed in the selection of the screen size, as well as in the orientation and operation of the barriers at the proposed deepwater port. In addition, the document does not quantify the efficiency of the proposed barriers in reducing impacts to marine fishery species from impingement and entrainment or compare the costs of the different alternatives. The EIS should quantify and evaluate the marine life exclusion efficiency of wedgewire screen barriers in association with alternative screen sizes, orientation and operation of the barriers, and efficiency in areas of highly variable current flow rates and directions. The revised document should provide a clear justification for the wedgewire screen barrier alternative selected. We also recommend that the applicant thoroughly address mechanisms to incorporate variable depth water intakes to allow the depth of water withdrawals to be modified in response to highly variable depth distribution of marine organism densities.

4.2.4 EFH Assessment

Page 4-47, paragraph 3. This section of the DEIS states that the maximum number of eggs and larvae potentially entrained by the proposed ORV operations would be 1.6 billion and 629 million, respectively. However, using the maximum seawater intake rate of 152 MGD, and the estimated upper confidence limit of egg and larval abundances (Table 3-6), the maximum number of eggs and larvae of marine fishery species potentially entrained in the ORV is approximately 3 billion and 800 million, respectively. In addition, as discussed in our comments on Table 3-6 (Section 3.2.6.7), the larval densities utilized in the DEIS may be too low. The EIS should include the correct maximum entrainment estimate for the eggs and larvae of marine fishery species.

4.2.4.2 Mitigation

Page 4-48. NOAA Fisheries will coordinate the specific details of the monitoring plan with the applicant, as required by the proposed terms of the deepwater port license. Enclosed are guidelines for monitoring impacts to EFH and marine fishery species from seawater intake systems. At a minimum, ichthyoplankton/water samples representing an entire 24-hour cycle should be collected on a monthly basis. Baseline plankton surveys of the proposed project site should be conducted in advance of construction, and monitoring of impingement and entrainment should commence upon operation of the proposed terminal. In addition, the monitoring plan should quantify impacts resulting from thermal discharge and anti-biofouling agents. The DEIS states the exclusion efficiency of the preferred wedgewire screen would be evaluated through a monitoring plan, and finer mesh screens could be employed at a later time if monitoring indicated it was warranted (page 2-15). The EIS should state that the USCG and MARAD will develop guidelines in coordination with NOAA Fisheries for adaptive management measures, including requiring the use of smaller mesh screens or other alternative marine life exclusion systems, as well as potentially utilizing less-damaging regasification methods and/or anti-biofouling agents. These adaptive management criteria should be made a condition of any deepwater port license issued for the proposed project.

5.0 Cumulative and Other Impacts

5.1 Cumulative Impacts

5.1.2 Biological Resources

Fish Resources and EFH

Page 5-5. As stated in the memorandum from the SEFSC, the proposed project, as well as several other proposed or permitted LNG terminals, are located in the "fertile fisheries crescent", the most biologically productive area in the Gulf of Mexico marine ecosystem. While this section of the DEIS includes a cursory discussion of cumulative impacts to EFH and marine fishery species from the proposed terminal in conjunction with other proposed deepwater ports, the analysis utilizes incorrect (i.e., low) densities for the Gulf Landing project, as noted in our previous comments. The SEFSC states there is no evidence supporting the assertion that entrainment would be reduced 50 percent by locating seawater intakes in the bottom half of the water column. In addition, the age-1 equivalency numbers are not presented by species. Due to the potential for direct, secondary, and cumulative impacts, this section of the DEIS should be revised to thoroughly evaluate the potential cumulative fishery losses, expressed as age-1 equivalents by species, as a result of regasification processes at all three LNG terminals proposed for siting in this area. This section of the EIS also should include a discussion of cumulative impacts to EFH and marine fishery resources resulting from thermal discharge, anti-biofouling agents, and operation of the proposed terminal, in combination with the two other LNG terminals, and the use of seawater as ballast by LNG tankers. Cumulative impact consideration also should address major estuarine water withdrawals which impact species which occur in the Gulf Landing project area and require estuarine habitats of the northwest Gulf of Mexico for growth, feeding, and refuge.

In view of the above, NOAA Fisheries recommends a license for the deepwater port, as proposed in the DEIS, not be issued. Section 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that NOAA Fisheries provide EFH conservation recommendations for any federal action that may result in adverse impacts to EFH. Therefore, NOAA Fisheries recommends the following to ensure the conservation of EFH and associated marine fishery resources:

EFH Conservation Recommendations

1. The DEIS should be revised to thoroughly evaluate all individual and cumulative impacts from the installation and operation of the Gulf Landing deepwater port. These impact analyses should include correct species-specific data, an extrapolation of those impacts to age-1 equivalents of commercially and recreationally important marine fishery species, and an evaluation of the age-1 model results using sensitivity analysis.

2. If the reevaluation of impacts shows the potential for adverse impacts to any marine fishery species, NOAA Fisheries recommends the USCG and MARAD take a conservative, risk-averse approach and not authorize the use of an open-loop regasification system for the Gulf Landing deepwater port.

3. If the USCG and MARAD determine that there is no potential for significant adverse impacts to marine fishery species from the use of an open loop regasification system, to ensure such impacts do not occur, NOAA Fisheries recommends the applicant be required to develop an adequate fishery and EFH monitoring plan for the facility. The development of this monitoring plan, with adaptive management criteria, should be required to be coordinated with NOAA Fisheries and incorporated into any license issued for the facility.

Consistent with §305(b)(4)(B) of the Magnuson-Stevens Act and NOAA Fisheries' implementing regulations at 50 CFR 600.920(k), your office is required to provide a written response to this letter within 30 days of receipt. Your response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the proposed activity. If your response is inconsistent with our EFH conservation recommendations, you must provide a substantive discussion justifying the reasons for not implementing those recommendations. If it is not possible to provide a substantive response within 30 days, your office should provide an interim response to NOAA Fisheries, to be followed by the detailed response. The detailed response should be provided in a manner to ensure that it is received by NOAA Fisheries at least 10 days prior to the issuance of the Record of Decision.

NOAA Fisheries appreciates the opportunity to provide you with comments and recommendations for the proposed Gulf Landing LNG terminal. We look forward to reviewing the final EIS. If you have any questions regarding our comments, please contact Kelly Shotts at (225) 389-0508.

Sincerely,

Miles M. Croom

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

Enclosures

c:
FWS, Lafayette
EPA, Dallas - Lawrence
LA DNR - Consistency
F/SF1 - Rogers
F/SER - Keys
F/SER3 - Bernhart
F/SER4 - Dale
F/SER43 - Ruebsamen
SEFSC - Chester, Minello
Files

MONITORING PLAN CONSIDERATIONS FOR WATER INTAKE STRUCTURES

The following list of considerations for LNG (or other water intake structure) monitoring plans was compiled from: guidance on evaluating cooling water structures (EPA 1977); case studies developed for the 316(b) Phase II regulations (EPA 2002); a 316(b) resource assessment for the Morro Bay Power Plant (Tenera 2001); research presented at an American Fisheries Society symposium on "Fisheries, Reefs, and Offshore Development" (2003); and comments provided by the Southeast Fisheries Science Center (SEFSC) on the draft fisheries monitoring plan for the proposed El Paso deepwater LNG terminal (Thompson 2004). Most of the information presented was consistent between the referenced literature. However, unless specifically cited, information can be assumed to have originated from EPA (1977).

The considerations presented in this document are intended to provide only general guidance for the establishment of a monitoring protocol and should be evaluated on a project-specific basis. While some considerations presented here may not apply to all facilities, some facilities may require consideration of issues not discussed in this document. Each monitoring plan should be tailored to the design and operation of the proposed LNG terminal or other water intake facility.

Information Needs to Determine Potential Impingement and Entrainment Impacts

- Knowledge of the relevant organisms' life cycles; different species may spend only part of their life cycle associated with habitat near an intake structure; species with pelagic early life stages (i.e., smaller individuals) present at the intake structure may be more susceptible to entrainment; later life stages (i.e., larger individuals) present at the intake structure may be more susceptible to impingement
- The relationship between loss of individuals to population effects; this includes loss of commercially and recreationally important harvested species, as well as production foregone for key forage species; impacts from impingement and entrainment should be determined using age-structured population model (e.g., virtual population analysis [VPA] or forward-projection model) estimates of recruits to age-1 and population fecundity (maturity schedule and fecundity relationship); this allows stock-level estimates of egg production (viable eggs) and overall survival from viable egg to recruitment at age-1; when feasible, results should be extrapolated to provide losses in yield separately for recreationally and commercially important fishery species under current harvesting conditions; determination of population-level effects requires the following information for *each* life stage affected by the intake structure:
    - Life stage duration
    - Fecundity
    - Size and growth rate
    - Mortality rate
    - Distribution
    - Dispersal patterns
    - Intake vulnerability
- Water circulation patterns on a local scale, as well as in relation to larger processes (e.g., upwelling events, anticyclonic and cyclonic eddies spinning off the Loop Current, etc.)

- Spatial comparisons of organism abundance; temporal comparisons of monitoring data may only reveal catastrophic impacts; impacts associated with intake structures may be better revealed through spatial data

General Monitoring Plan Design Considerations

- Sampling objectives and the sampling area should be clearly defined from the outset of plan design
- The monitoring plan should be designed and implemented such that the spatial and temporal variability of each major sector of the ecosystem that may be impacted by the intakes is represented. Those sectors may include:
    - Mesoplankton
    - Benthic fish
    - Pelagic fish
    - Benthic macroinvertebrates
    - Phytoplankton
    - Zooplankton
    - Benthic infauna
- Sampling points should be (vertically) located throughout the water in order to determine if there is depth stratification of organisms; the SEFSC recommended that, at a minimum, oblique bongo net tows which cover each third (i.e., top, middle, and bottom third) of the water column be conducted (Thompson 2004)
- In addition, research suggests it may be important to sample on all sides of the intake structure; Stanley and Wilson (2003) found that fish density significantly varied on different sides of three oil and gas platforms in the Gulf of Mexico, but were not able to correlate density with other identifiable factors, such as current direction

Data to be Collected and Recorded During Sampling

- General data
    - Date
    - Time
    - Lunar phase
    - Ambient air temperature
    - Ambient water temperature
    - Tidal stage and flow
    - Salinity
    - Dissolved oxygen
    - Chlorophyll
- Operational data
    - Intake flow rate
    - Temperature (intake and discharge)
    - Sampling start time, duration, and water intake volume

  - Biocide concentrations; assessments should be conducted seasonally on four 2-km perpendicular transects radiating from facility; during each season, samples should be collected daily for several days at 500 m intervals on each transect at surface, mid-water, and bottom depths (Thompson 2004)
  - Current velocity at intakes over the range of water volumes used in terminal operation, as well as current velocities at various distance intervals from intakes
  - Number of times screens operated between sampling intervals

- Biological data
  - Species
  - Quantity
  - Length (using a consistent method, e.g., standard vs. total length)
  - Weight
  - Age class
  - Representative samples of each species for determination of sex and breeding condition

Data Analysis

- Data collected must be conducive to biostatistical analyses; it is important to consider the means for data reduction and analysis in the early stages of plan design
- The number of sampling units necessary to achieve a specified degree of precision should be determined; the discrimination power of the survey should be adequate for the purposes for which the data are intended
- Sample replication should be sufficient to show the typical variation between tows; sufficient replication may differ widely between species and may change over the course of the day, month, or seasons; the most variable/patchy of the species being monitored will determine the desirable number of replicates
- Confidence limits for estimates of abundance should be based on variation between tows at a given sample station, as well as human error caused by subsampling and counting procedures
- Rigorous error analysis is especially important in nearshore areas and close to intakes; non-parametric statistical analyses may be necessary to normalize data
- Subsampling approaches should be established in advance

Length of study required to determine existing (baseline) densities of aquatic organisms (pre-construction/operation)

- 15-25 yrs is required for many cyclic biological phenomena to become evident; preliminary study of this length is not feasible, though it may be possible to obtain data from historical studies

- 3 years is suggested as a period permitting detection of an exceptional/outlier year, though

3 years also has been criticized for being too short to understand events in the context of long-term trends
- A 1-year study is generally of limited value, but may be acceptable where substantial historical data is available and the intake structure can be represented as having low potential impact, or when it represents the best available data

Sampling Gear

- Sampling gear should have known performance characteristics under the conditions in which it is to be utilized; new gear (or gear that has not been tested under the conditions in which it is to be used) should be tested and compared against standard gear under project-specific conditions; the SEFSC recommended using a bongo net with a mesh size of 0.333 mm to approximate that used to collect SEAMAP samples (Thompson 2004)
- A monitoring plan should consider and account for the fact that no sampling gear is strictly quantitative nor equally efficient in retaining different species/sizes of organisms; correction factors should be developed, along with a description and rationale for how such factors were derived; the SEFSC recommended using a smaller mesh size net (~0.200 mm) for a comparison with the 0.333 mm net to determine extrusion rates (Thompson 2004)
- Rationale for the choice of sampling gear should be provided in the monitoring plan; lacking information to suggest otherwise, adoption of standard gear is advisable to permit comparisons with other investigations

Sample Schedule

- It is important to capture the entire 24-hour cycle of organism presence at the intake structure; it is critical to sample at night, as well as during the day; certain species may be unavailable to standard sampling gear at certain points in the diel cycle because they migrate through the water column during a given 24-hour period
- The monitoring plan should consider and account for differences in expected catch efficiency based on time of day; night tows frequently produce larger catches, which may be due to gear avoidance abilities in relation to light level as well as diel differences in abundance
- The monitoring plan should consider and account for differences in expected catch efficiency based on lunar cycles (Hernandez and Shaw 2003); studies have shown that larval abundance is often higher during the new moon (Rooker 1996; Victor 1986), possibly due to increases in spawning and settlement success by minimizing mortality from visual predators (Thresher 1984); in addition, gear avoidance capabilities may be lower during the new moon (Rooker 1996)
- The monitoring plan should capture the entire seasonal cycle of organism presence at the intake structure, as densities of different species and life stages will fluctuate throughout the year
- The SEFSC recommended sampling covering a 24-hour period be conducted on a monthly basis (Thompson 2004)

Entrainment Monitoring

Source Water (Tenera 2001)

- Source water surveys should be collected to estimate the abundance of organisms at risk of entrainment
- The rationale used to calculate the source water volume should be included in the monitoring plan
- A comparison of density estimates between the source water samples and the actual entrainment samples can be used to calculate fractional losses; these numbers can be translated into potential impacts on local fisheries
- Source water surveys covering a 24-hour period should be collected at multiple stations to capture the entire diel cycle; source water samples should be collected a minimum of once a month

Fish eggs and larvae

- A pump system is acceptable as the primary sampling method unless:
    - It damages fragile organisms
    - It is harder to automate and less accurately quantifiable than placing sampling nets over the intake flow
- Sampling to capture the diel variations in density of eggs and larvae (i.e., coverage for an entire 24-hour period) should be conducted at a frequency of no less than every 4 days
- The volume of water sufficient for each sample is dependent on the actual densities of eggs and larvae in the area surrounding the intake; sample volume should be determined based on the least dense species/life stage of concern; initially, as large a sample as can be handled should be collected; the SEFSC recommended a minimum of 1000 m^3 of water be filtered per tow (Thompson 2004); volumes can be adjusted accordingly once information on the least detectable densities has been developed; the use of a sample volume that is too small will bias the study and may lead to rejection of the data
- Sample locations in the intake system should be immediately ahead of the intake screens
- Sampling points should be located throughout the water; at a minimum, samples should be collected near-surface, mid-depth, and near-bottom.
- Potential for re-entrainment should be factored into entrainment impact calculations; dye surveys can be used to experimentally determine the potential for re-entrainment (EPA 2002b)

Zooplankton[1]

- Pumped samples are acceptable as long as pumping does not damage fragile organisms

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[1][NOTE: EPA guidance states that intake effects on zooplankton are of relatively short duration and confined to a relatively small portion of the water body segment because of their short life span and regenerative capacity. However, zooplankton should not be dismissed from consideration without a preliminary assessment of the importance or uniqueness of the species' assemblage at the site. The SEFSC recommended some measure of overall zooplankton abundance or biomass be collected (Thompson 2004)]

- Non-toxic material should be used in all sampling gear
- The volume of water filtered to obtain sample should be determined and recorded
- Samples should be taken in duplicate
- Sampling points should be located throughout the water column to measure any vertical stratification
- Sampling locations should be established immediately ahead of the intake screens and as close as possible to the discharge
- Samples should be concentrated in non-toxic containers and inspected for mortality and damage as soon as possible after collection
- Samples covering a 24-hour period should be collected at least monthly; duplicate samples should be collected every 3-4 hours during the 24-hour survey

***Phytoplankton*[2]**

- Chlorophyll concentrations should be measured
- Rates of primary production should be measured

Impingement Monitoring

- Total daily counts of impinged organisms should be obtained over a 12-month cycle
- Complete daily counts of impinged organisms are easily obtained by collecting organisms contained in the intake screen backwash in collection baskets placed over intakes; collection baskets with mesh sizes equal to or smaller than the intake screen mesh should be utilized
- If less than complete daily counts must be utilized, daily sampling every 4 days is the lowest acceptable effort for allowing reliable loss projections
- The sampling scheme must account for diel and seasonal differences in impingement impacts
- More or less intensive sampling schemes may be justified based on apparent impact, intake data, spawning periods, and other site-specific or seasonal considerations; e.g., at the Pilgrim Nuclear Power Plant in MA, samples were taken 3 times per week every other week Oct. through Feb.; March through Sept., samples were taken 3 times a week every week; a standard collection mesh size of 0.333 mm was used except March through late May, when a 0.202 mm mesh was used (EPA 2003c)
- Estimates of numbers of naturally occurring dead fish in the area ahead of the intake screening system
- Tests should be conducted periodically to determine the recovery rate of fish impinged on the screen by spiking the screen with tagged dead fish and determining the proportion that are recovered in the screen backwash
- Monitoring should include quantification of mortality of eggs and larvae that are impinged on material clogging the intake screens by also collecting debris contained in the screen

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[2][NOTE: EPA guidance states that intake effects on phytoplankton are of relatively short duration and confined to a relatively small portion of the water body segment because of their short life span and regenerative capacity. However, phytoplankton should not be dismissed from consideration without a preliminary assessment of the importance or uniqueness of the species' assemblage at the site.]

backwash; attempts should be made to screen debris for impinged organisms
- Monitoring should attempt to account for predation on impinged organisms
- Uncertainty should be figured into entrainment estimates as ranges with maximum and minimum levels

Entrainment and Impingement Mortality

- It is appropriate to assume 100% mortality due to impingement and entrainment unless valid field and/or laboratory data are conducted to support a lower loss estimate; e.g., some specimens apparently surviving impingement on screens or entrainment in the regasification system may initially appear to be healthy, however species-specific experiments with controls should be conducted to assess delayed mortality, impaired physiological functions, etc., if less than 100% mortality is to be assumed
- When conducting mortality experiments, samples at intakes and discharge should be from the same water mass; samples should not be combined if they were collected under different environmental conditions (EPA 2002a)
- Control samples should be taken as far from the intake as possible to insure mortality/injury is not from increased velocity and turbulence near the intake
- Organisms should be sorted by species, life stage, and size
- An organisms condition should be recorded (live, dead, injured)
- Initial mortality, and extended/latent (96 hour) mortality should be reported
- Surveys should cover a 24-hour period to determine the time of day entrainment survival will most likely occur; survival should be calculated separately for each life stage and species
- The physical and operating conditions of the facility need to be recorded to determine their associated impact on the three fundamental stressors (thermal, mechanical, chemical) that affect survival
- The results of entrainment and impingement survival studies are only applicable for similar operating conditions (flow rates, transit times, thermal regimes, and biocide regimes)

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Fisheries Science Center
75 Virginia Beach Drive
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July 30, 2004July 30, 2004

MEMORANDUM FOR: Miles Croom

FROM: Alex Chester

SUBJECT: SEFSCs comments on the Gulf Landing Liquefied Natural Gas(LNG) Draft Environmental Impact Statement(EIS) for LLC Deepwater Port License Application

SEFSC staff have reviewed the Draft Environmental Impact Statement(EIS) for the LLC Deepwater Port License Application Gulf Landing Liquefied Natural Gas(LNG) and comments are provided below:

The Gulf Landing facility proposes to use an open-rack vaporizer (ORV) system to regassify the Liquid Natural Gas (LNG), the operation of this system will have a number of negative impacts on the habitats and organisms in the vicinity of the facility. These impacts include direct mortality of planktonic organisms from entrainment, mortality of some organisms from impingement, discharge of cooled water into the area, and discharge of antifouling chlorine and its byproducts. Almost all of these impacts can be avoided by using a closed loop system of some type, as proposed for the majority of LNG facilities in the Gulf of Mexico.

The DEIS indicates that SEAMAP plankton data were used to calculate densities of fish eggs and larvae in the vicinity of the proposed site (WC-213); in Table 3-6, fish egg densities were calculated to be 2.87 per m^3 (SE=0.938) and fish larvae were 1.12 per m^3 (SE=0.075). These densities for fish larvae are likely in error, because the densities for Port Pelican (just offshore of Gulf Landing) were 6.21 per m^3, and the general pattern is for densities to increase as sites get closer to the coast. Dr. Joanne Lyczkowski-Shultz indicates that fish larvae densities from SEAMAP samples in the area of Gulf Landing should be about 5.6 per m^3. The standard error estimates also appear low for fish larvae. If we use 5.6 larvae per m^3, the number of fish larvae in a million gallons of seawater (Table 3-7) for WC-213 would be 21,198 (mean) and 63,594 (adjusted mean; multiplying by 3 for a net extrusion adjustment). After multiplying by the proposed seawater intake of 136 MGD, the daily mortality of fish larvae would be 2.88 million larvae (using the mean value) or 8.65 million (using the adjusted mean). Extrapolating to a year, it is estimated that the annual mortality to be 1.05 billion larvae using the unadjusted mean, which is about 5 times the 210 million larvae estimated in the DEIS (line 31, pg 4-34). Using the adjusted mean from their data for a net extrusion, the annual mortality rate would be 8.65 billion larvae.

The age-1 equivalency analysis used in the DEIS appears to be one of the one of the methods to estimate the impacts of this larval and egg entrainment mortality on fish stocks, because it accounts for mortality during early life stages and estimates how many of these organisms are likely to survive to reproductive maturity. The model results, however, should be adjusted for the density corrections noted above. As an example, one can estimate the age-1 equivalent loss of red drum. In Table 4-3 of the DEIS, an annual adjusted mean entrainment mortality of 80.2 million red drum larvae is estimated. The above density corrections indicate that this value should more correctly be 401 million larvae (80.2 x 5), and the age-1 equivalent losses for red drum shown in Table 4-3 should range between 39,990 and 115,285 fish. Red drum are currently. An annual loss of over 100,000 adults has potential for negative impacts on this stock.

An important consideration in any such analysis is an assessment of the potential impact of error in calculations. The DEIS correctly notes that the SE around the mean density of eggs and larvae is useful in determining variability around estimates of entrainment mortality. In addition, some recognition is needed of the inherent variability present in the age-1 equivalency model parameters. For example. one of our staff used the information from one of Dr. Shannon Cass-Calay's charts, one could calculate the the age-1 equivalency of red drum in the Gulf of Mexico based on entrainment and mortality of 2.1 million eggs and 23.2 million larvae. In a sensitivity analysis, she included a range of daily survival rates for larvae (0.72 to 0.90) and a range of larval stage durations (18 – 30 days) from estimates found in the literature. The results were highly variable, but the most reasonable age-1 equivalencies were between 5,000 and 20,000 adult red drum. If one were to use the above estimate of 401 million larvae (and a proportional number of eggs) in this modeling exercise, the annual entrainment mortality of age-1 equivalent red drum would range between 86,000 and 432,000. These calculations show that the extent of possible entrainment mortality that has been greatly underestimated in the DEIS.

The DEIS also indicates that impacts of entrainment mortality will be mitigated by placing the intake structures in the lower half of the water column. Although this is a recommended location, there is substantial uncertainty as to the benefits of this placement. The vertical distribution of plankton in the water column is affected by water stratification, the species examined, and by daily changes in light. Some plankters are attracted to light and some repelled. The possible effect of a constant artificial light field at the structure should be examined.

Throughout the DEIS, conclusions are made that the facility will have no significant impacts on EFH, fishery stocks, and the coastal environment due to entrainment, impingement, and the plume of cold chlorinated water to be discharged. These conclusions are not supported by hard scientific data and rely on much speculation. An unbiased view of the limited data available indicates that inherent variability in the parameters being measured is high and supports the possibility that impacts will be significant. A risk-averse approach to resource management requires us to recommend an alternative to the proposed ORV system that does not sterilize 50 billion gallons of seawater each year.

In addition our review of the DEIS showed that limitations were identified:

1. Inherent high variability (patchiness) in these abundance estimates,

2. Sampling gear relative to vertical distribution (oblique tows vs stratified tows),

3. Sampling gear selectivity (mesh size),

4. Temporal pattern over entire year (June _ Nov for SEAMAP),

5. Identification to species level,

6. Further refining age of eggs and larvae to better determine survival to age 1 (or any other marker),

7. Survival through early life stages (eggs, yok_sac larvae, post yolk_sac larvae, juveniles) until age 1,

8. Availability of stock assessment with population estimates of age 1 (at stock level), and

9. Relevance of local depletion and potential cumulative impacts of multiple LNG facilities.

SEFSC staff feel that the draft EIS refer to many of these problems (but not 8 & 9). The select 4 species to consider in greater depth (bay anchovy, (gulf) menhaden red drum, red snapper) for which they attempted to use the age_1 equivalent loss approach (Table 4_3, has croaker but no red drum?). With high abundance and fecundity for gulf menhaden (and probably bay anchovy), the age_1 equivalent losses probably suggested minimal likely effect at the stock level for this one facility.

Inappropriate formatting of citations: Within the Gulf Landing application and appendices, there are numerous citations of the format (Author, 1999) that refer to written and verbal correspondence. This format is properly used for peer-reviewed, published literature, although it is often used for gray literature including technical reports and unpublished manuscripts. Verbal and written correspondence, including email, should not be cited in this manner. Instead, the citation should be listed as a "personal communication", and appear in the footnotes (e.g., [1]Cass-Calay, S.L. pers.comm. NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami FL 33149).

Age-1 Equivalency approach:

The results estimated using Age-1 Equivalency methods are subject to enormous uncertainty given small, ecologically realistic variations in the input parameters (stage durations and stage mortalities). Estimating uncertainty using the upper and lower confidence intervals of the adjusted mean egg density will greatly underestimate the possible impacts on marine resources, although the most extreme impacts may be unlikely. Sensitivity analyses varying the egg and larval densities, stage mortalities and stage durations within realistic ranges will more adequately describe the potential impact on marine resources.

For example, consider the following scenarios:

Case 1:
Eggs entrained: 1,000,000 $year^{-1}$
Larvae entrained: 80,000,000 $year^{-1}$
Egg stage duration: 1 day
Egg mortality rate (50% day^{-1})
Larval stage duration: 20 days
Larval mortality rate (20% day^{-1})
Juvenile stage duration: 365-1-20=344 days
Juvenile mortality rate (1% day^{-1})

Age 1 Equivalent Losses: 58,149.5 fish

Case 2:
Eggs entrained: 1,000,000 $year^{-1}$
Larvae entrained: 80,000,000 $year^{-1}$
Egg stage duration: 1 day
Egg mortality rate (50% day^{-1})
Larval stage duration: 30 days
Larval mortality rate (30% day^{-1})
Juvenile stage duration: 365-1-30= 334 days
Juvenile mortality rate (2% day^{-1})

Age 1 Equivalent Losses: 4.3 fish

The examples use the method:

$$AE1_{(egg)} = N_{(egg)} * S_{(egg,1)}$$

$$AE1_{(larva)} = N_{(larva)} * S_{(larva,1)}$$

where

$$S_{(egg,1)} = 2 * S_{(egg)} e^{-\log(1+S_{(egg)})} * S_{(larva)} * S_{(juvenile)}$$

$$S_{(larva,1)} = 2 * S_{(larva)} e^{-\log(1+S_{(larva)})} * S_{(juvenile)}$$

Life Table Assumptions:

Red Drum ***(Sciaenops ocellatus):*** Age-1 equivalent losses of red drum were estimated using Atlantic croaker (*Micropogonias undulatus*) life history parameters (Appendix F, page F-44). This is not necessary as many red drum life history parameters are described in the literature.

Egg duration (Vetter et al. 1983)
Egg mortality (lab) (Holt et al. 1981)
Larval Duration/Mortality (Comyns 1998; Rooker et al. 1999)
Post settlement Mortality (Rooker et al. 1999)

Many of the parameter values described in the literature differ from those presented in Appendix F Table F-8. For example, red drum egg duration is ~24 hours (Vetter et al. 1983) rather than 2 days. Therefore, egg mortality is likely to be overestimated in Table F-8. Also, durations of the larval stages appear high. The planktonic period for red drum larvae is ~20 days (Rooker et al. 1999) and the larval mortality rate (Z) averages 0.31 or 27% day^{-1} (Comyns 1998). Thereafter, the larvae settle in estuarine seagrass meadows. Early postsettlement mortality rates were 0.134 (12.5% day^{-1}) and 0.139 (13% day^{-1}) in 1994 and 1995, respectively. Postsettlement mortality rates likely apply to larvae 20-50 days old and 6-30 mm in length.

Red drum is currently overfished, and under a strict management plan. Estimated age-1 losses should be compared to the most recent landings and biomass estimates.

Red Snapper (Lutjanus campechanus): Age-1 equivalent losses of red snapper were estimated using many bay anchovy (*Anchoa mitchilli*) life history parameters (Appendix F, page F-44). Some attributes of the early life history of red snapper are described in the literature:

Egg Duration 1 day (Rabalais et al. 1980)
Larval Duration (including yolk-sac stage) ~26 days (Szedlmayer and Conti 1999; Rooker et. al 2004)
Early postsettlement mortality rate 0.099 (9.3% day^{-1}) applicable to age 47-57 days. (Rooker et al. 2004)

Other life history parameter estimates are available for vermilion snapper, a closely related species in the Gulf of Mexico (For example, Comyns et al. 2003, vermilion snapper larval Z = 0.19 – 0.29). Life history parameters might also be obtained for other snapper species that occur within the Gulf of Mexico, for example gray, yellowtail and lane.

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ADDITIONAL COMMENTS

It might serve as a useful reminder that this proposed facility would be located in the region known as the 'Fertile Fisheries Crescent'. The name is fitting as the region is the most biologically productive area in the Gulf of Mexico marine ecosystem. This contention is supported by satellite images of chlorophyll a concentrations to shellfish and finfish landing statistics. Each LNG facility using an open-cycle system adds to the cumulative impact on NOAA trust resources directly through the mortality of early life history stages (eggs to early juveniles) by entrainment, impingement, temperature shock and chemical toxicity. It would seem from this that the most appropriate course of action would be to follow the risk-averse principle and eliminate those sources of mortality entirely by employing closed-loop technology.

Specific Comments:

1. We noticed that mean larval fish abundances and standard errors listed in Table 3-7 were low compared to values we obtained from SEAMAP data in the vicinity of the Port Pelican LNG. The mean abundance we calculated using the same source SEAMAP data files as the applicant and the same SEAMAP stations as listed by the applicant in Appendix D of document #270363, Environmental Review (December 2003) was an order of magnitude greater (11.7± 4.7 vs. 1.12±0.075 larvae per m^3). We are not sure how the applicant arrived at their values but a likely reason was an erroneous data merge

2. The applicant presumes to minimize the intake of larval fishes by centering seawater intakes at ~ 11 m below mean sea level or ~ 5 m off the bottom. On page 5-7 of the draft EIS it is stated (without supporting evidence or data) that locating the intake in the lower half of the water column is a mitigation measure that will reduce entrainment by at least 50 percent. Data that conflict with this assertion are presented in papers by Lyczkowski-Shultz et al. (1991) and Comyns et al. (2004). The larvae of red drum and Atlantic croaker (the only species considered in the two studies) were found to be significantly more abundant at 11-16 m in the water column than at 1 and 5 m especially during nighttime hours in an area east of the Mississippi River that resembles the proposed site of Gulf Landing in depth and bottom composition. Vertical distribution of fishes can change during ontogeny and settlement to juvenile bottom habitats is not an all or nothing proposition. Individuals nearing settlement may descend deeper in the water column, become concentrated there before taking up permanent residence; and thus, become more susceptible to entrainment and/or impingement at LNG seawater intakes.

3. Another point which has not been addressed is the relationship between intake velocity and larval swimming speeds. The applicant states that entrainment is minimized by intake velocities of 0.10 to 0.15 m/sec. In units more relevant to fish larvae intake velocities are 100 to 150 mm/sec. It has been observed that fish larvae can sustain swimming speeds of 2 to 3 body lengths per sec (Blaxter 1969; Hunter 1981). Therefore, even at their maximum size during the planktonic phase (< 16-20 mm) red snapper larvae would not be able to effectively swim away from the intake screens. Whether they are entrained at that point or remain impinged on the screens is moot. The effective

maximum opening of the 6.35 mm intake screens is ~ 9 mm. Cross sectional area and not length is than the dimension that will determine whether an organism is entrained or excluded from intake water.

4. My major criticism of the Age I equivalency analyses is the use of only single values for mortality and stage duration. Given that small differences in these vital rates can make huge differences in numbers of survivors. Comyns et al. (2003) provided a range of observed values of Z for vermilion snapper larvae. The applicant would be advised to use those values for red snapper instead of the values (specifically the mortality coefficient) for bay anchovy. As it turns out the value of Z used (0.196) in the DEIS was at the low end of the vermilion snapper mortality estimates but values as high as 0.29 were estimated for vermilion snapper. The mortality rate for juvenile red snapper used in these analyses may be as much as an order magnitude low compared to the estimates of Rooker et al. (2004) for newly settled juvenile red snapper. And finally I am puzzled by the use of information on Atlantic croaker life history to estimate age I equivalents for red drum when there is certainly enough data available for red drum larvae on which to base a life history table.

The applicants conclusion of 'no significant impact' based on apparently flawed initial data summaries and Age I equivalent analyses using only low end estimates of natural mortality is untenable.

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