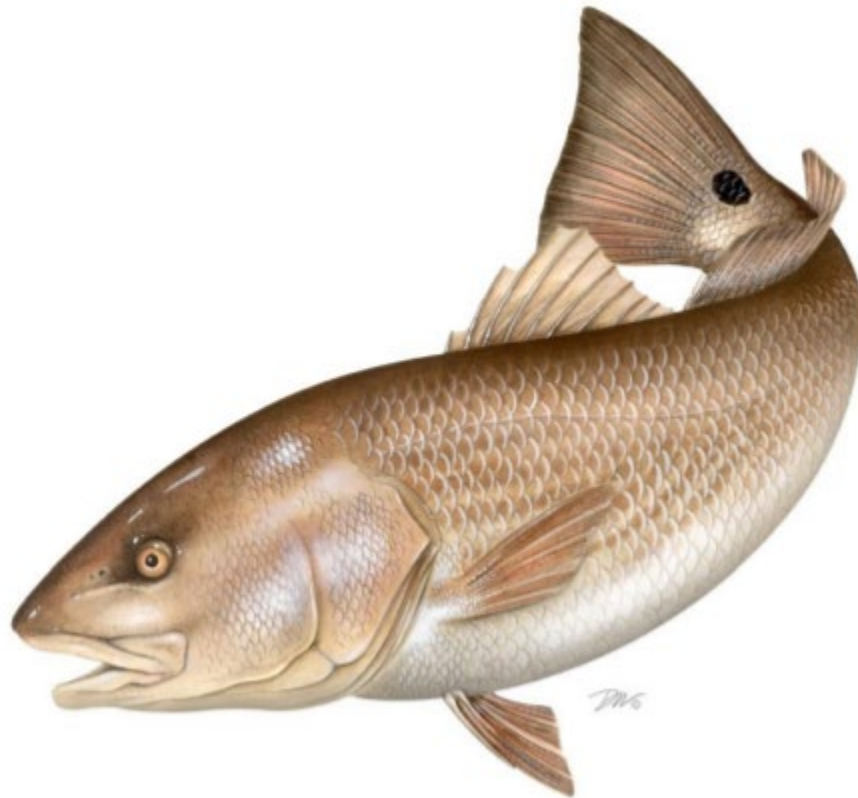


# ATLANTIC STATES MARINE FISHERIES COMMISSION

## REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR RED DRUM  
*(Sciaenops ocellatus)*

2005 FISHING YEAR



Prepared by the Plan Review Team

Approved by the South Atlantic Management Board  
Approved October 2006

## **I. Status of the Fishery Management Plan**

|                                  |   |
|----------------------------------|---|
| <u>Date of FMP Approval:</u>     | Original FMP: October 1984, revised 1988  |
| <u>Amendments:</u>               | Amendment 1: October 1991<br>Amendment 2: June 2002   |
| <u>Management Areas:</u>         | The Atlantic coast distribution of the resource from New Jersey through Florida<br>Northern: New Jersey through North Carolina<br>Southern: South Carolina through Florida        |
| <u>Active Boards/Committees:</u> | South Atlantic State/Federal Fisheries Management Board; Red Drum Technical Committee, Stock Assessment Subcommittee, Plan Development Team, Plan Review Team, and Advisory Panel |

The Atlantic States Marine Fisheries Commission (ASMFC) adopted a *Fishery Management Plan (FMP) for Red Drum* in 1984. The original management unit included the states from Florida to Maryland. In 1988, the Interstate Fisheries Management Program (ISFMP) Policy Board requested that all states from Florida to Maine implement plan requirements to prevent development of northern markets for southern fish. All Atlantic coastal states Florida through New Jersey are now required to implement the provisions of the FMP, while New York through Maine (including Pennsylvania) are encouraged to implement consistent provisions to protect the red drum spawning stock.

In 1990, the South Atlantic Fishery Management Council adopted an FMP for red drum that defined overfishing and optimum yield (OY) consistent with the Magnuson Fishery Conservation and Management Act of 1976. Adoption of this plan prohibited the harvest of red drum in the exclusive economic zone (EEZ). The Council FMP, in recognition that all harvest would take place in state waters, recommended that states implement measures necessary to provide the target level of at least 30% escapement. The moratorium on harvest of red drum in the EEZ remains in effect.

The ASMFC updated its FMP to be consistent with the Council plan. The 1991 revision to the plan was Amendment 1, with a goal to attain optimum yield from the fishery over time. Optimum yield was defined as the amount of harvest that could be taken while maintaining the spawning stock biomass per recruit (SSBR) level at or above 30% of the level that would result if fishing mortality were zero. However, the lack of adequate information on the status of the adult stock resulted in the use of a 30% escapement rate of sub-adult red drum into the adult population.

Substantial reductions in fishing mortality were necessary to increase the escapement of sub-adults to the off-shore adult spawning stock. Because of a lack of data on the status of adult red drum along the Atlantic coast, a "phase-in" approach was adopted that required all states to implement or maintain harvest controls necessary to attain at least a 10% SSBR ratio. All states

in the management unit north of Florida modified regulations and/or commercial quotas to reach this goal. Florida maintained its strict regulations that were thought to exceed the target escapement rate. The harvest regulations remained unchanged from 1992-1998, except in Florida where regulations were relaxed somewhat by opening the previously closed March-May period.

These management measures implemented by the states in response to the guidelines of Amendment 1 did lead to increased escapement rates of juvenile red drum. However, the overall exploitation estimates indicated that overfishing was still occurring with SPR values less than 30% for both the northern (North Carolina through New Jersey) and southern regions (South Carolina through the east coast of Florida). These regions were based on stock identity, mark-recapture experiments, life history, habitat preferences, human dimensions of the fisheries, and management goals (Ross and Stevens 1992, Pafford et al. 1990, Wenner et al. 1990).

The Council then adopted new definitions of OY and overfishing for red drum in 1998. Optimum yield was redefined as the harvest associated with a 40% static spawning potential ratio (SPR), and overfishing was an SPR less than 30%, with a threshold overfishing level of 10% SPR. North Carolina, South Carolina, and Georgia implemented substantive changes to their regulations from 1998-2001 that restricted the harvest of red drum and increase the escapement rate.

In 1999, the Council recommended that management authority for red drum be transferred to the states, through the Commission's Interstate Fishery Management Program (ISFMP) process. One of the reasons the Council recommended this transfer to the ASMFC was the inability to accurately determine an overfished status and therefore, stock rebuilding targets and schedules as required under the revised Sustainable Fisheries Act (1996). With no estimate of the adult population's size as well as what a rebuilt or healthy stock looks like, it is virtually impossible to determine a rebuilding schedule. However, the duration of a rebuilding schedule should include the generation time of the species. For a long-lived species with an age of maturity at 3-5 years, such as red drum, mean generation time would be on the order of 15-20 years based on age-specific egg production (Vaughan and Carmichael 2000). Maximum age is 50-60 years for the northern region and about 40 years for the southern region. Given these factors, only a considerable period of time will result in noticeable increases in the age structure of the adult population.

The ASFMC adopted Amendment 2 to the Red Drum FMP in June 2002. Its primary objective is to achieve and maintain SPR at or above 40 percent. Atlantic coast states from Florida through New Jersey were required to meet appropriate bag and size limit combinations needed to attain the 40 percent SPR. Amendment 2 also required all states to maintain their current or implement more restrictive commercial fishery regulations. The states implemented the provisions of Amendment 2 by January 1, 2003.

## **II. Status of the Stocks**

It is important to remember that the population models used in the coast wide assessments (specifically yield per recruit and static SPR) are based on equilibrium assumptions. Previous estimates of escapement rates (relative survival of red drum from age at entry to fishery to age 4) for 1992-94 ranged from 10.4% for the northern region and 17.2% for the southern region

(Vaughan 1996). Escapement rate estimates for Florida Atlantic coast red drum (through age 4) during 1992-94 ranged from 51-69% assuming the size structure of released fish was the same then as it is now (Murphy 2005). This may mean that rates in Georgia and South Carolina are lower than the regional estimate. Estimates of static SPR (the ratio of spawning stock biomass per recruit with and without fishing mortality) ranged from 9% for the northern region to 14% for the southern region. This may be an overestimate because during this period most states north of North Carolina allowed a fishery for adults and the analysis assumes no adult fishing mortality or any discard mortality from commercial fishing operations and recreational use of commercial (gillnet) gear.

Based on the most recent full assessment (Vaughan and Carmichael 2000), results for the northern region indicated that escapement rates were on the order of 18%, but may be overestimated due to the lack of discard data from both the commercial fishery and recreational netting practices. Also, the estimate for the southern region (15%) may not be reflective of escapement rates throughout the region, where there appears to be significant regional differences between Florida and Georgia/South Carolina. Estimates of escapement rates on Florida's Atlantic coast have shown a slow decline since peaking during 1988 at 94% following two years of near-complete moratoria on fishing (Murphy 2005). After fishing for red drum reopened in 1989, escapement began to decline reaching 51-69% during 1992-1994 and 32-43% during 2001-2003.

The next stock assessment is scheduled for the spring of 2009 through the full Southeast Data Assessment and Review (SEDAR) process.

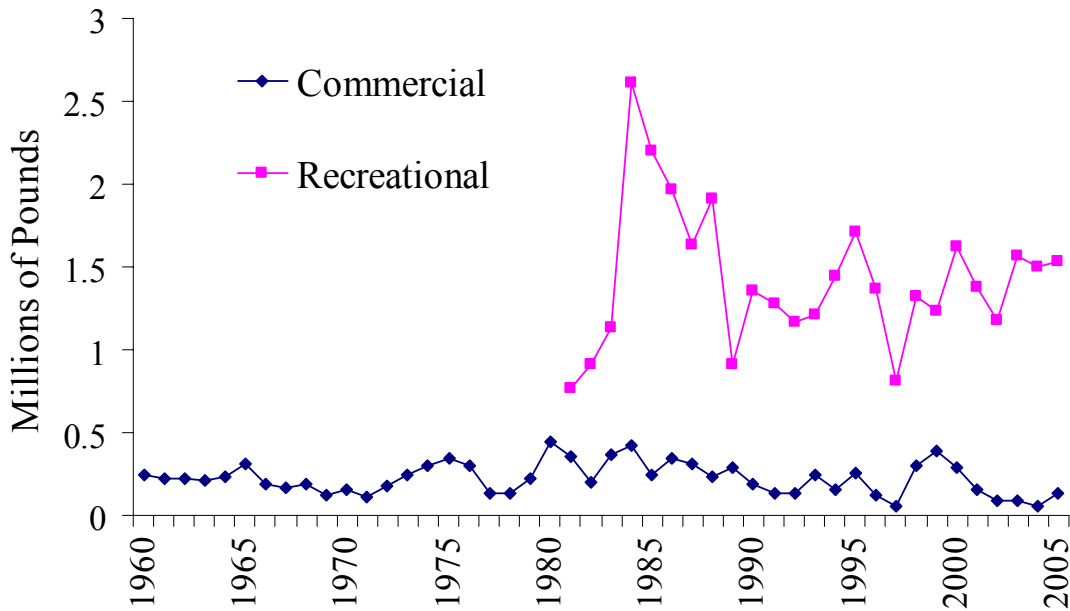
### **III. Status of the Fishery**

Few commercial landings of red drum have been recorded in states north of Maryland since 1960 (Table 2). Only Rhode Island, New York, and New Jersey have reported any commercial landings since 1980. Coastwide commercial landings show no particular temporal trends, ranging from approximately 55,000 to 422,000 pounds annually between 1960 and 2005 (Figure 1). The greatest harvest was reached in 1980, while the lowest was reached in 2004. In 2005, coastwide commercial harvest increased to 129,980 pounds, the majority (~99%) from North Carolina (Table 1). Landings in Georgia (<500 lbs), Virginia (656 lbs), Maryland (37 lbs), and New Jersey (517 lbs) comprise the remaining 1% of the commercial landings for red drum.

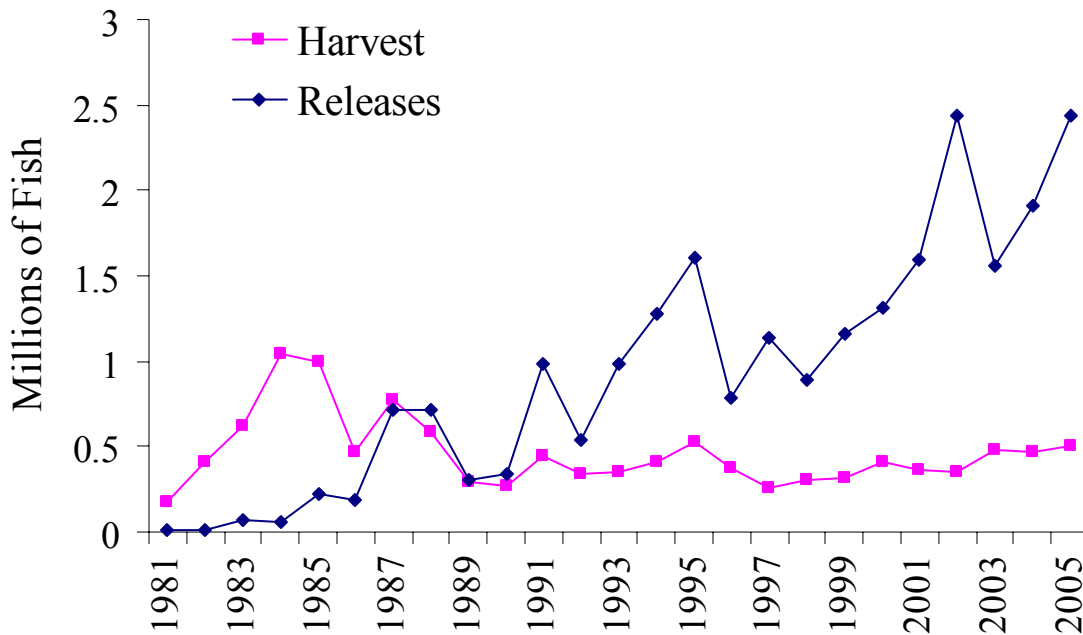
Historically, the major commercial harvesters were North Carolina and Florida. However, commercial harvest has been prohibited in Florida under state regulations, since January 1988. South Carolina has also banned the commercial harvest or sale of native caught red drum since 1987. In North Carolina, an annual cap of 250,000 pounds limits the commercial harvest of red drum. In 1999, the North Carolina Marine Fisheries Commission implemented rules through the development of a state red drum FMP that: prohibited the possession or sale of red drum larger than 27 inches; reduced the recreational bag limit to 1 fish per day between 18-27 inches; imposed a commercial daily trip limit of seven (7) fish with a 250,000 pound annual cap; and required fishermen to attend gill nets less than five-inch stretched mesh from May 1-October 31 in order to reduce regulatory discards. In 2003, the South Atlantic State/Federal Fisheries Management Board approved a motion to allow the North Carolina Fisheries Director to raise or lower the seven fish commercial trip limit while maintaining the 250,000 pound harvest cap.

The number of red drum harvested by recreational fishermen ranged between approximately 175,000 and 1,000,000 fish from 1981 to 1988; since then, the number has been in the 250-530,000 range (Figure 2). Over a million fish were taken in both 1984 and 1985, but this was exceptional. The recreational harvest for 2005 was 498,761 fish (~1.5 million pounds) (Tables 3 and 4). By number of fish, Florida takes approximately 38% of the catch, but takes over 50% by weight. South Carolina, Georgia, and Florida are responsible for 88% of the catch by number of fish (Tables 4). The number of red drum released by recreational fishermen was approximately 2.4 million in 2005, an increase from the previous year, and the second highest for the time series (Table 5).

**Figure 1. Red Drum Commercial and Recreational Harvest (pounds)**  
 (NMFS Office of Science and Technology, 2006; state compliance reports, 2006)



**Figure 2. Recreational harvest of red drum in number of fish (A + B1 fish)**  
(NMFS Office of Science and Technology, 2006)



#### IV. Status of Research and Monitoring

In cooperation with the states, the NMFS laboratory in Beaufort has compiled information and performed analyses on status of the stocks periodically since 1989. Fishery-independent data collected by the states (North Carolina, South Carolina, Georgia, and Florida) have been utilized in coastwide stock assessment. Virtual population analyses utilize the MRFSS as the primary fishery dependent data source.

#### Summary of Fishery-Independent and Fishery Dependent Monitoring Carried out in 2005

##### *Fishery-Dependent*

- North Carolina: NCDMF has conducted commercial fishery-dependent monitoring since 1982 to characterize the size and age distribution of fish by gear/fishery. In 2005, 811 red drum caught primarily by gill net were measured.
- South Carolina: SCDNR has conducted charterboat trip reporting since 1992 to determine CPUE, and a cooperative public tagging program since 1974 to study movement patterns, growth rates, and release-mortality rates. In 2005, 1,430 red drum were tagged, with 211 recaptures documented. SCDNR also collects data from a carcass collection program and measuring fish from tournaments.
- Georgia: The Marine Sportfish Carcass Recovery Project collects in designated bins at ports the carcasses of filleted recreationally caught fish. In 2005, 281 red drum were recovered and measured.
- Florida: MRFSS samplers conducted 16,705 intercepts at Florida Atlantic coast sites in 2005. A FWC program produced an additional 28 reports on angler catch.

### *Fishery-Independent*

- North Carolina: Since 1991, NCDMF has conducted a seine survey to produce a juvenile (age-0) abundance index. Results of the survey are incorporated into current stock assessments. In 2005, 1,082 red drum were caught. Since 2001, a gill net survey to characterize the size and age distribution in the Pamlico Sound has been conducted. In 2005, 658 red drum were caught.
- South Carolina: SCDNR conducts inshore trammel net surveys and electrofishing to assist in tagging efforts and measure sub-adult relative abundance. Tagging data is used, in part, to estimate escapement and stock mixing rates. SCDNR has also conducted 1,395 individual bottom longline sets from 1994 to 2005 to estimate adult relative abundance and other data. SCDNR developed and had approved a plan in 2002 for experimental red drum stocking; during 2004 and 2005, 51 million genetically marked 1-3 day-old larvae were released into an estuary. In addition to potential stock enhancement, project data will be used to estimate recruitment rates and study life history and population dynamics.
- Georgia: Trammel nets and gill nets were deployed in the estuaries of the Altamaha, Hampton, and Wassaw Rivers to measure relative abundance and size composition. In 2005, 512 red drum were caught. (An adult index of abundance survey via bottom longline was also planned for 2005 but not completed due to funding shortages.)
- Florida: The FWC-FWRI has monitored juvenile fishes and animals, including red drum, abundance in the northern Indian River Lagoon since 1990, in the southern Indian River Lagoon since 1997, and in the lower reaches of the St. Johns, St. Marys, and Nassau rivers since 2001. Beginning in 1997 in the Indian River Lagoon and in 2001 in the lower reaches of the three major rivers in northeast Florida, the programs expanded to include the use of a 183-m haul seine to monitor larger-sized fishes and animals. In 2005, relative juvenile and adult abundance were measured. Additionally, age data are collected from random samples of red drum captured in the 183-m haul seine and the age and length data are used to create age-length keys. In 2005, a total of 173 otoliths were collected.

In 2005, additional ACFCMA funds were provided for North Carolina, South Carolina, and Georgia to develop a study that will develop state specific sampling protocol to provide a fisheries independent index of abundance for adult red drum. This adult index will be used in the red drum assessment process, and will aid managers in determining biological reference points.

A coastwide red drum stock assessment was completed in late 1999, and peer-reviewed by both the Red Drum Technical Committee and the SAFMC Science and Statistics Committee during 2000. A revised bag and size limit analysis was developed for each region using the new overfishing definitions and standards as benchmarks (Vaughan and Carmichael 2001).

### **V. Status of Management Measures**

Discussions between the Council's Red Drum Management Committee and the South Atlantic Board led the Council to recommend in December 2000 the transfer of management authority to the states. This necessitated the development of Amendment 2 to the current Interstate FMP. The Board's intent had been to initiate the development of Amendment 2 after the update and review of the stock assessment. This occurred in 2000-01 and Amendment 2 was developed (2001-2002) and approved by the Board (May 2002).

The approval of Amendment 2 in 2002, required states to implement appropriate bag and size limits to attain the management goal of 40% SPR (Table 1). All states in the management unit also implemented a 27" total length or smaller maximum size limit for red drum. In order to avoid the establishment of any new commercial fisheries for red drum, all states were required to maintain (or make more conservative) their current level of restrictions.

Before the transfer of management authority could occur, the National Environmental Policy Act required the completion of an Environmental Assessment (EA). The EA, completed by staff at the Council's Southeast Regional Office in 2005, is currently under review by the Secretary of Commerce's Office of General Counsel. The transfer of authority is expected to occur by the end of 2006.

#### VI. Implementation of FMP Compliance Requirements as of October 1, 2006

There are three compliance criteria in Amendment 2. For states to be in compliance, they must: 1) implement harvest controls (e.g. bag and size limits) to achieve a minimum 40% Spawning Potential Ratio (SPR); 2) set a maximum size limit of 27 inches or less; and 3) maintain their current or more restrictive commercial fishery regulations for red drum. All states in the management unit have implemented these criteria and have been approved by the Board. The compliance reports are due on July 1<sup>st</sup> of every year. Below is a summary of regulations from each state, the PRT comments, and if that state meets the requirements in the Amendment.

**Table 1. Red Drum Plan Review Team compliance review summary for 2006**

(New Jersey through Florida are required to meet the requirements in the FMP, states north of New Jersey are encouraged but not required to follow these regulations.)

| State | Size Limit           | Possession Limit | Other                       | PRT Comments                               | Meets FMP Requirement |
|-------|----------------------|------------------|-----------------------------|--|-----------------------|
| ME    | None                 | None             |                             |  | N/A                   |
| NH    | 14" - 27"            | 5 fish           |                             |  | N/A                   |
| MA    | 14"                  | None             |                             |  | N/A                   |
| RI    | None                 | None             |                             |  | N/A                   |
| CT    | Not greater than 27" | None             |                             |  | N/A                   |
| NY    | Not greater than 27" | None             |                             |  | N/A                   |
| PA    | None                 | None             |                             |  | N/A                   |
| NJ    | 18" - 27"            | 1 fish           | Requests de minimis status  | PRT recommends granting de minimis status* | Yes                   |
| DE    | 20" - 27"            | 5 fish           | Requests de minimis status  | PRT recommends granting de minimis status* | Yes                   |
| MD    | 18" - 27"            | 1 fish           | Commercial: 18"-25", 5 fish |  | Yes                   |
| PRFC  | 18" - 25"            | 5 fish           |                             |  | Yes                   |



|    |           |        |   |  |     |
|----|-----------|--------|---|--|-----|
| VA | 18" - 26" | 3 fish | No directed commercial fishery  |  | Yes |
| NC | 18" - 27" | 1 fish | No directed commercial fishery. 0 fish > 27" TL. Annual commercial cap = 250,000 lbs. Daily trip limit of 7 fish (NC fisheries director can raise/lower the trip limit) must be less than 50% of catch (pounds). Gill nets < 5" stretch mesh must be tended from 5/1-10/31. |  | Yes |
| SC | 15" - 24" | 2 fish | Gamefish only   |  | Yes |
| GA | 14" - 23" | 5 fish | 0 fish >23"   |  | Yes |
| FL | 18" - 27" | 1 fish | Gamefish only   |  | Yes |

\* The PRT recommends granting New Jersey and Delaware de minimis status because their landings are insignificant when compared to the rest of the coastal harvest. The PRT recommends that these states still be required to meet the regulatory requirements in the FMP and submit an annual compliance report.

## VII. Status of Assessment Advice

The last red drum assessment was conducted in 1999 and reviewed by the Council's Scientific and Statistical Committee in 2000. Recreational and commercial catches were converted to catch in numbers at age using available length-frequency distributions and age-length keys. Separable and tuned virtual population analyses were conducted on the catch in numbers at age to obtain estimates of fishing mortality rates (F). These estimates of F combined with estimates of growth, sex ratios, sexual maturity, and fecundity are used to estimate yield per recruit, escapement to age-4, and static (or equilibrium) spawning potential ratio (static SPR, based on both female biomass and egg production). The Technical Committee chose the FADAPT Virtual Population Analysis methodology as the population modeling approach to determine the status of the stock. Amendment 2 states that the next coastwide assessment should take place five years after implementation; a SEDAR benchmark assessment is scheduled for the spring of 2009. Florida conducted a state wide stock assessment in 2005.

## VIII. Recommendations of FMP Review Team

### Management and Regulatory Recommendations

1. ASMFC and the Regional Fishery Management Councils should continue to collaborate on cooperative review of stock assessments and formulation of management measures.

### **Prioritized Research & Monitoring Recommendations** (H)=High, (M)=Medium, (L)=Low

#### **Stock Assessment and Population Dynamics**

- ▶ Design an appropriate state fishery-independent survey of sub-adult and adult red drum to be implemented in Virginia, North Carolina, South Carolina, Georgia, and Florida. (H) (*in progress for sub-adult and adult surveys*)
- ▶ Each state should develop an on-going red drum tagging program that can be used to estimate both fishing and natural mortality and movements. This should include concurrent evaluations of tag retention, tagging mortality, and angler tag reporting rates. (M)

- ▶ Improve catch/effort estimates and biological sampling from recreational and commercial fisheries for red drum, including increased effort to intercept night fisheries for red drum. This should include significant efforts to determine the size and age structure of regulatory discards of live red drum. (H)
- ▶ States should maintain annual age-length keys. (H)
- ▶ Determine the chronic mortality rate of red drum following regulatory and voluntary discard from commercial and recreational fishing gear, including recreational net fisheries. Evaluate effects of water temperature and depth of capture. (M)
- ▶ Evaluate alternatives to VPA for red drum stock assessment. (M)

### **Biological**

- ▶ Fully evaluate the effects and effectiveness of using cultured red drum to restore native stocks along the Atlantic coast. (H)
- ▶ Explore methods to effectively sample the adult population in estuarine, nearshore, and open ocean waters. (H)
- ▶ Continue tagging studies to determine stock identity, inshore/offshore migration patterns of all life stages (i.e. basic life history info gathering). Specific effort should be given to developing a large-scale program for tagging adult red drum (M) (*in progress*)
- ▶ Determine habitat preferences, environmental conditions, growth rates, and food habits of larval and juvenile red drum throughout the species range along the Atlantic coast. Assess the effects of environmental factors on stock density/yearclass strength. (M)
- ▶ Refine maturity schedules on a geographic basis. Thoroughly examine the influence of size and age on reproductive function. Investigate the possibility of senescence in female red drum. (L)

### **Social**

- ▶ Examine the effectiveness of controlling fishing mortality and minimum size in managing red drum fisheries.
- ▶ Encourage the NMFS to conduct socioeconomic add-on surveys via the MRFSS that are specifically oriented to red drum recreational fishing (Example: the 2000 Northeast Summer Flounder Survey).

### **Economic**

- ▶ Encourage the NMFS to continue funding socioeconomic add-on surveys via the MRFSS that include data elements germane to red drum recreational fisheries management.
- ▶ Where appropriate, encourage member states to conduct studies to evaluate the economic costs and benefits associated with current and future regulatory regimes impacting recreational anglers including anglers oriented toward catch and release fishing trips.
- ▶ Fully evaluate the efficacy of using cultured red drum to restore native stocks along the Atlantic Coast including risk adjusted cost-benefit analyses.
- ▶ Conduct a special survey and related data analysis to determine the economic and operational characteristics of the "for-hire sector" targeting red drum especially fishing guide oriented businesses in the South Atlantic states.
- ▶ Estimate the economic impacts (e.g. sales, jobs, income, etc.) of recreational red drum fisheries at the state and regional level including the "for-hire sector" (e.g. fishing guides). (Note: The economic impact analysis [Southwick Associates 2001] cited in this document is considered preliminary.)

- ▶ Encourage the NMFS to continue funding research on projecting future participation in marine recreational fishing in the Atlantic states with an emphasis on forecasts for major fisheries such as red drum.
- ▶ States with significant fisheries (over 5,000 pounds recorded by MRFSS) should collect socioeconomic data on red drum fisheries through add-ons to the MRFSS or by other means.

### **Habitat**

- ▶ Identify spawning areas of red drum in each state from North Carolina to Florida so these areas may be protected from degradation and/or destruction. (H) (*In progress, NC State University*)
- ▶ Identify changes in freshwater inflow on red drum nursery habitats. Quantify the relationship between freshwater inflows and red drum nursery/sub-adult habitats. (H)
- ▶ Determine the impacts of dredging and beach re-nourishment on red drum spawning and early life history stages. (M)
- ▶ Investigate the concept of estuarine reserves to increase the escapement rate of red drum along the Atlantic coast. (M)
- ▶ Identify the effects of water quality degradation (changes in salinity, DO, turbidity, etc.) on the survival of red drum eggs, larvae, post-larvae, and juveniles. (M)
- ▶ Quantify relationships between red drum production and habitat. (L)
- ▶ Determine methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production. (L)

### **Identified Management Needs/Issues**

- ▶ None at this time

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**Table 2. Commercial landings (in pounds) of red drum along the Atlantic coast, 1960-2005**  
 (1960-2004 Data: NMFS Fish. Stats. & Econ. Division, 2006; 2005 Data: state compliance reports, 2006)

| Year         | RI           | NY           | NJ           | DE           | MD            | VA             | NC               | SC            | GA            | FLEC             | Total   |
|--------------|--------------|--------------|--------------|--------------|---------------|----------------|------------------|---------------|---------------|------------------|---------|
| 1960         |              |              |              |              | 200           | 29,400         | 79,300           | 4,200         | 400           | 129,000          | 242,500 |
| 1961         |              |              |              |              |               | 12,000         | 89,700           | 900           | 1,000         | 114,500          | 218,100 |
| 1962         |              |              |              |              |               | 12,900         | 60,900           |               |               | 149,300          | 223,100 |
| 1963         |              |              |              |              |               | 2,700          | 71,200           |               |               | 134,200          | 208,100 |
| 1964         |              |              |              |              |               | 4,600          | 101,500          | 11,500        |               | 119,000          | 236,600 |
| 1965         |              |              |              |              | 1,200         | 94,900         | 71,400           |               |               | 146,300          | 313,800 |
| 1966         |              |              |              |              | 200           | 3,100          | 35,200           | 200           | 2,700         | 153,000          | 194,400 |
| 1967         |              |              |              |              |               | 1,100          | 12,800           | 900           | 5,800         | 147,100          | 167,700 |
| 1968         |              |              |              |              |               | 100            | 12,500           |               | 5,500         | 167,000          | 185,100 |
| 1969         |              |              |              |              | 400           | 700            | 3,900            | 700           | 2,700         | 119,000          | 127,400 |
| 1970         |              |              |              |              |               | 100            | 7,500            | 400           | 2,200         | 146,800          | 157,000 |
| 1971         |              |              |              |              |               | 700            | 17,200           | 1,300         | 1,200         | 85,200           | 105,600 |
| 1972         |              |              |              |              |               | 5,900          | 42,900           | 1,200         | 3,400         | 128,400          | 181,800 |
| 1973         |              |              |              | 900          |               | 6,200          | 70,300           | 600           | 3,700         | 166,500          | 248,200 |
| 1974         |              |              |              |              |               | 15,700         | 142,000          | 2,300         | 3,100         | 137,300          | 300,400 |
| 1975         |              |              |              | 200          |               | 19,600         | 214,000          | 12,400        | 10,000        | 83,300           | 339,500 |
| 1976         |              |              |              |              |               | 18,600         | 168,200          | 2,600         | 7,300         | 106,000          | 302,700 |
| 1977         |              |              |              | 200          |               | 300            | 19,700           | 800           | 5,000         | 103,500          | 129,500 |
| 1978         |              |              |              | 300          |               | 2,100          | 21,774           | 4,325         | 328           | 104,696          | 133,523 |
| 1979         |              |              |              |              | 100           | 1,900          | 126,517          | 1,767         | 935           | 92,684           | 223,903 |
| 1980         |              |              |              |              |               | 400            | 243,223          | 4,107         | 1,493         | 191,222          | 440,445 |
| 1981         |              |              |              |              |               | 200            | 93,420           |               | 261           | 258,374          | 352,255 |
| 1982         |              |              |              |              |               | 1,700          | 52,561           | 2,228         | 251           | 139,170          | 195,910 |
| 1983         |              |              |              |              | 100           | 41,700         | 219,871          | 2,274         | 1,126         | 105,164          | 370,235 |
| 1984         |              |              |              |              |               | 2,600          | 283,020          | 3,950         | 1,961         | 130,885          | 422,416 |
| 1985         |              |              |              |              |               | 1,100          | 152,676          | 3,512         | 3,541         | 88,929           | 249,758 |
| 1986         |              |              |              |              | 1,000         | 5,400          | 249,076          | 12,429        | 2,939         | 77,070           | 347,914 |
| 1987         |              |              |              |              |               | 2,600          | 249,657          | 14,689        | 4,565         | 42,993           | 314,504 |
| 1988         |              |              |              |              | 8,100         | 4,000          | 220,271          |               | 3,281         | 284              | 235,936 |
| 1989         |              |              |              |              | 1,000         | 8,200          | 274,356          | 165           | 3,963         |                  | 287,684 |
| 1990         |              |              |              |              | 29            | 1,481          | 183,216          |               | 2,763         |                  | 187,489 |
| 1991         |              |              |              |              | 7,533         | 24,771         | 96,045           |               | 1,637         |                  | 129,986 |
| 1992         |              |              |              |              | 1,087         | 2,352          | 128,497          |               | 1,759         |                  | 133,695 |
| 1993         |              |              |              |              | 55            | 8,637          | 238,099          |               | 2,533         |                  | 249,324 |
| 1994         | 5,094        |              |              |              | 859           | 4,080          | 142,160          |               | 2,141         |                  | 154,334 |
| 1995         |              | 668          |              |              | 6             | 2,992          | 248,200          |               | 2,578         |                  | 254,444 |
| 1996         |              | 8            |              |              | 215           | 2,073          | 113,401          |               | 2,271         |                  | 117,968 |
| 1997         | 43           |              |              |              | 22            | 4,049          | 52,548           |               | 1,395         |                  | 58,057  |
| 1998         | 165          | 57           | 311          |              | 336           | 6,436          | 294,415          |               | 672           |                  | 302,392 |
| 1999         |              | 47           | 241          | 6            | 504           | 12,368         | 372,996          |               | 1,115         |                  | 387,277 |
| 2000         |              | 1,215        |              |              | 843           | 11,457         | 271,013          |               | 707           |                  | 285,235 |
| 2001         |              | 58           | 14           |              | 727           | 5,318          | 149,674          |               |               |                  | 155,791 |
| 2002         |              | 116          |              |              | 1,161         | 7,752          | 79,767           |               |               |                  | 88,796  |
| 2003         |              | 43           |              |              | 631           | 2,716          | 81,364           |               |               |                  | 84,754  |
| 2004         |              |              |              |              | 12            | 638            | 54,086           |               |               |                  | 54,736  |
| 2005         |              |              | 517          |              | 37            | 656            | 128,770          |               |               |                  | 129,980 |
| <b>Total</b> | <b>5,302</b> | <b>2,212</b> | <b>1,083</b> | <b>1,606</b> | <b>26,357</b> | <b>398,276</b> | <b>6,040,873</b> | <b>89,446</b> | <b>98,215</b> | <b>3,566,871</b> |         |

**Table 3. Recreational harvest (pounds of A + B1 fish) of red drum along the Atlantic coast, 1981-2005**  
(NMFS Office of Science & Technology, 2006)

| Year         | DE    | MD      | VA        | NC        | SC         | GA        | FLEC       | Total     |
|--------------|-------|---------|-----------|-----------|------------|-----------|------------|-----------|
| 1981         |       | 4,370   | 347,939   | 31,519    | 50,230     | 9,442     | 317,963    | 761,463   |
| 1982         |       |         |           | 37,511    | 340,686    | 52,150    | 480,676    | 911,023   |
| 1983         |       | 3,018   | 51,299    | 109,540   | 222,691    | 67,298    | 675,924    | 1,129,770 |
| 1984         |       |         | 1,285     | 1,160,539 | 183,282    | 294,583   | 976,971    | 2,616,660 |
| 1985         |       |         |           | 70,677    | 1,532,316  | 185,887   | 414,176    | 2,203,056 |
| 1986         |       | 754,161 | 145,517   | 31,594    | 498,586    | 173,837   | 360,725    | 1,964,420 |
| 1987         |       |         | 44,332    | 200,729   | 913,639    | 250,795   | 227,222    | 1,636,717 |
| 1988         |       |         | 9,030     | 451,974   | 1,050,049  | 385,860   | 12,507     | 1,909,420 |
| 1989         |       | 2,348   | 27,236    | 214,849   | 396,771    | 127,245   | 146,064    | 914,513   |
| 1990         |       | 2,679   |           | 302,994   | 631,819    | 161,712   | 258,569    | 1,357,773 |
| 1991         |       | 5,635   | 30,582    | 108,268   | 284,290    | 337,207   | 516,999    | 1,282,981 |
| 1992         |       |         | 55,324    | 109,134   | 411,484    | 198,751   | 396,555    | 1,171,248 |
| 1993         |       |         | 45,505    | 266,459   | 282,614    | 328,245   | 290,930    | 1,213,753 |
| 1994         |       |         | 3,684     | 192,060   | 314,632    | 353,616   | 578,412    | 1,442,404 |
| 1995         |       |         | 66,270    | 405,620   | 417,595    | 300,337   | 525,231    | 1,715,053 |
| 1996         |       |         | 1,512     | 204,556   | 396,394    | 164,756   | 596,483    | 1,363,701 |
| 1997         |       |         | 1,810     | 39,077    | 296,155    | 129,836   | 345,390    | 812,268   |
| 1998         |       |         | 34,861    | 591,428   | 129,619    | 84,348    | 487,091    | 1,327,347 |
| 1999         |       |         | 92,794    | 326,303   | 103,777    | 166,630   | 540,310    | 1,229,814 |
| 2000         |       |         | 95,596    | 316,029   | 93,043     | 228,965   | 885,447    | 1,619,080 |
| 2001         | 860   |         | 51,890    | 132,578   | 188,198    | 155,854   | 853,714    | 1,383,094 |
| 2002         | * 860 | 15,154  | 155,213   | 182,226   | 103,830    | 170,572   | 551,128    | 1,178,123 |
| 2003         |       |         | 57,214    | 118,808   | 449,399    | 234,865   | 729,445    | 1,589,731 |
| 2004         |       |         | 31,748    | 114,434   | 402,789    | 286,486   | 668,179    | 1,503,636 |
| 2005         |       |         | 7,366     | 242,019   | 318,882    | 194,706   | 773,480    | 1,536,453 |
| <b>Total</b> | 1,720 | 787,365 | 1,358,007 | 5,960,925 | 10,012,770 | 5,043,983 | 12,609,591 |           |

\* Weight estimated from same number of fish (275) caught in previous year

**Table 4. Recreational harvest (numbers of A + B1 fish) with percent standard error (PSE) of red drum along the Atlantic coast, 1981-2005**  
(NMFS Office of Science & Technology, 2006)

| Year          |         | DE    | MD     | VA      | NC        | SC        | GA        | FLEC      | Total     |
|---------------|---------|-------|--------|---------|-----------|-----------|-----------|-----------|-----------|
| 1981          | Harvest |       | 601    | 49,630  | 15,054    | 27,319    | 6,323     | 75,244    | 174,171   |
|               | PSE (%) |       | 48     | 60.2    | 38.7      | 45.7      | 37.2      | 36.7      |           |
| 1982          | Harvest |       |        |         | 16,445    | 160,760   | 30,757    | 204,401   | 412,363   |
|               | PSE (%) |       |        |         | 34.7      | 18.2      | 37.2      | 27.5      |           |
| 1983          | Harvest |       | 2,413  | 32,940  | 81,528    | 104,806   | 56,854    | 344,513   | 623,054   |
|               | PSE (%) |       | 51.8   | 48.2    | 55.6      | 37.8      | 27.7      | 19.1      |           |
| 1984          | Harvest |       |        | 1,457   | 108,787   | 129,547   | 258,188   | 549,381   | 1,047,360 |
|               | PSE (%) |       |        | 100     | 67.8      | 30.7      | 21.9      | 16.1      |           |
| 1985          | Harvest |       |        | 0       | 22,077    | 530,110   | 183,837   | 265,185   | 1,001,209 |
|               | PSE (%) |       |        | 0       | 32.7      | 30.6      | 18.6      | 22.2      |           |
| 1986          | Harvest |       | 12,804 | 28,139  | 17,501    | 193,188   | 102,279   | 113,440   | 467,351   |
|               | PSE (%) |       | 67.4   | 22.4    | 65.7      | 19.8      | 18.8      | 19.8      |           |
| 1987          | Harvest |       |        | 2,186   | 61,100    | 522,420   | 138,062   | 51,225    | 774,993   |
|               | PSE (%) |       |        | 58.8    | 19.9      | 17.7      | 18.4      | 30.9      |           |
| 1988          | Harvest |       |        | 4,311   | 142,626   | 287,916   | 147,042   | 9,542     | 591,437   |
|               | PSE (%) |       |        | 70.7    | 18.3      | 20.2      | 28.4      | 72.6      |           |
| 1989          | Harvest |       | 1,014  | 12,007  | 62,359    | 127,492   | 51,557    | 34,748    | 289,177   |
|               | PSE (%) |       | 90.9   | 32.2    | 16.3      | 20.8      | 21.9      | 24.3      |           |
| 1990          | Harvest |       | 1,279  | 0       | 33,149    | 118,666   | 76,304    | 44,280    | 273,678   |
|               | PSE (%) |       | 100    | 0       | 28.2      | 22.4      | 22.5      | 22.7      |           |
| 1991          | Harvest |       | 2,745  | 17,119  | 38,658    | 125,833   | 162,802   | 102,727   | 449,884   |
|               | PSE (%) |       | 51.6   | 39.4    | 15.3      | 22.6      | 23.2      | 15.7      |           |
| 1992          | Harvest |       |        | 13,275  | 23,593    | 112,534   | 83,861    | 104,265   | 337,528   |
|               | PSE (%) |       |        | 38.3    | 19.3      | 15.6      | 16.7      | 14.1      |           |
| 1993          | Harvest |       |        | 14,005  | 49,493    | 119,189   | 105,710   | 65,140    | 353,537   |
|               | PSE (%) |       |        | 50      | 12        | 16.9      | 17.9      | 10.5      |           |
| 1994          | Harvest |       |        | 1,378   | 28,953    | 129,515   | 134,214   | 120,938   | 414,998   |
|               | PSE (%) |       |        | 60.8    | 16.4      | 21.5      | 17.5      | 9.9       |           |
| 1995          | Harvest |       |        | 3,665   | 88,593    | 202,430   | 134,915   | 96,927    | 526,530   |
|               | PSE (%) |       |        | 53.6    | 12.3      | 25.4      | 17.1      | 10.7      |           |
| 1996          | Harvest |       |        | 572     | 36,746    | 130,649   | 60,251    | 146,823   | 375,041   |
|               | PSE (%) |       |        | 99.2    | 15        | 14.9      | 20        | 16.1      |           |
| 1997          | Harvest |       |        | 1,920   | 8,749     | 129,022   | 39,041    | 75,235    | 253,967   |
|               | PSE (%) |       |        | 62.3    | 25.7      | 12.7      | 19.2      | 14.1      |           |
| 1998          | Harvest |       |        | 13,070  | 114,638   | 46,509    | 24,929    | 107,982   | 307,128   |
|               | PSE (%) |       |        | 30.2    | 12.1      | 15.9      | 20.3      | 10.3      |           |
| 1999          | Harvest |       |        | 12,425  | 64,739    | 44,069    | 67,283    | 126,180   | 314,696   |
|               | PSE (%) |       |        | 38.7    | 14.5      | 18.3      | 23.7      | 7.8       |           |
| 2000          | Harvest |       |        | 22,603  | 61,618    | 37,217    | 94,144    | 191,070   | 406,652   |
|               | PSE (%) |       |        | 27.8    | 12.9      | 23.3      | 19.7      | 8.4       |           |
| 2001          | Harvest | 275   |        | 6,967   | 23,142    | 61,420    | 90,376    | 177,633   | 359,813   |
|               | PSE (%) | 100.1 |        | 39.8    | 15.9      | 26.8      | 30.3      | 8.2       |           |
| 2002          | Harvest | 275   | 5,521  | 49,795  | 42,541    | 41,190    | 90,993    | 119,010   | 349,325   |
|               | PSE (%) | 99.8  | 71.2   | 22.8    | 15.4      | 21.6      | 19.1      | 8.7       |           |
| 2003          | Harvest |       |        | 13,607  | 25,481    | 162,484   | 122,259   | 159,331   | 483,162   |
|               | PSE (%) |       |        | 38.1    | 16.5      | 23.1      | 16.9      | 8.5       |           |
| 2004          | Harvest |       |        | 4,975   | 30,165    | 134,079   | 139,074   | 162,016   | 470,309   |
|               | PSE (%) |       |        | 65.6    | 18.9      | 15.2      | 22.2      | 8.5       |           |
| 2005          | Harvest |       |        | 2,673   | 53,154    | 143,769   | 108,286   | 190,879   | 498,761   |
|               | PSE (%) |       |        | 100.1   | 20.5      | 18.7      | 18.6      | 9.0       |           |
| Total Harvest |         | 550   | 26,377 | 308,754 | 1,249,550 | 3,818,598 | 2,506,777 | 3,634,716 |           |

**Table 5. Recreational releases (numbers of B2 fish) with percent standard error (PSE) of red drum by state, 1981-2005**  
(NMFS Office of Science & Technology, 2006)

| Year           |                     | NH           | NJ          | DE            | MD             | VA              | NC              | SC              | GA              | FLEC             | Total     |
|----------------|---------------------|--------------|-------------|---------------|----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------|
| 1981           | Released<br>PSE (%) | 1,334<br>100 |             |               |                |                 | 2,230<br>100    | 417<br>100      | 0<br>0          | 9,042<br>70.8    | 13,023    |
| 1982           | Released<br>PSE (%) |              |             |               |                |                 | 0<br>0          | 2,496<br>80.2   | 3,377<br>65.4   | 10,172<br>66.9   | 16,045    |
| 1983           | Released<br>PSE (%) |              |             |               |                |                 | 1,866<br>100    | 6,751<br>63     | 1,417<br>60     | 54,723<br>40.2   | 64,757    |
| 1984           | Released<br>PSE (%) |              |             |               |                |                 | 2,931<br>100    | 0<br>0          | 4,232<br>52.9   | 47,196<br>38.1   | 54,359    |
| 1985           | Released<br>PSE (%) |              |             |               |                | 1,115<br>73.4   |                 | 16,688<br>31.3  | 6,315<br>31.3   | 193,399<br>29.1  | 217,517   |
| 1986           | Released<br>PSE (%) |              |             |               |                | 7,595<br>68.1   |                 | 24,018<br>32.4  | 56,045<br>23    | 100,095<br>22.4  | 187,753   |
| 1987           | Released<br>PSE (%) |              |             |               |                |                 | 18,499<br>36.7  | 82,595<br>26.6  | 234,676<br>19.7 | 377,959<br>21.1  | 713,729   |
| 1988           | Released<br>PSE (%) |              |             |               |                | 3,958<br>71     | 24,874<br>57.8  | 269,176<br>23.6 | 177,319<br>24.6 | 233,988<br>27.6  | 709,315   |
| 1989           | Released<br>PSE (%) |              |             |               | 2,918<br>75.5  | 7,038<br>57.3   | 7,566<br>34     | 42,824<br>40.8  | 71,162<br>27    | 172,303<br>21.3  | 303,811   |
| 1990           | Released<br>PSE (%) |              |             |               | 0<br>0         | 934<br>100      | 12,452<br>38.2  | 102,611<br>39.2 | 156,263<br>38.9 | 68,667<br>18.3   | 340,927   |
| 1991           | Released<br>PSE (%) |              |             |               | 4,432<br>66.6  | 14,461<br>76.1  | 121,178<br>14.4 | 99,968<br>42    | 92,803<br>31.2  | 645,773<br>23.3  | 978,615   |
| 1992           | Released<br>PSE (%) |              | 301<br>99.9 |               |                | 15,383<br>43.5  | 60,230<br>17.9  | 46,269<br>27.5  | 128,066<br>21.4 | 284,893<br>11.5  | 535,142   |
| 1993           | Released<br>PSE (%) |              |             |               |                | 50,434<br>44    | 182,301<br>20.1 | 146,324<br>27   | 140,386<br>27.7 | 465,656<br>11.8  | 985,101   |
| 1994           | Released<br>PSE (%) |              |             |               |                | 10,684<br>34.7  | 107,662<br>14.3 | 324,706<br>17.2 | 146,039<br>24.6 | 691,261<br>10.4  | 1,280,352 |
| 1995           | Released<br>PSE (%) |              |             |               |                | 33,560<br>40.4  | 164,520<br>10.5 | 362,844<br>14.9 | 356,618<br>23.9 | 683,706<br>9.1   | 1,601,248 |
| 1996           | Released<br>PSE (%) |              |             |               |                | 2,424<br>46.3   | 35,752<br>17.9  | 176,517<br>15.9 | 71,983<br>24.1  | 500,374<br>9.3   | 787,050   |
| 1997           | Released<br>PSE (%) |              |             | 2,571<br>80.6 |                | 109,754<br>36.1 | 259,570<br>10.6 | 175,772<br>25   | 22,736<br>29.7  | 560,559<br>9.7   | 1,130,962 |
| 1998           | Released<br>PSE (%) |              |             |               | 2,768<br>79.7  | 93,660<br>22.3  | 199,701<br>11.3 | 84,274<br>14.6  | 33,882<br>21.3  | 481,009<br>8.7   | 895,294   |
| 1999           | Released<br>PSE (%) |              |             |               | 2,148<br>73.5  | 232,893<br>31.4 | 247,146<br>10.3 | 87,776<br>14.9  | 18,586<br>50    | 565,981<br>8     | 1,154,530 |
| 2000           | Released<br>PSE (%) |              |             |               | 1,458<br>100   | 196,541<br>35.7 | 203,967<br>14.2 | 94,050<br>18.6  | 129,190<br>22.4 | 693,152<br>7.3   | 1,318,358 |
| 2001           | Released<br>PSE (%) |              |             |               |                | 30,365<br>31.1  | 238,552<br>13.7 | 221,045<br>18.5 | 249,892<br>25.2 | 850,044<br>7.5   | 1,589,898 |
| 2002           | Released<br>PSE (%) |              |             | 1,388<br>45.8 | 18,412<br>36.7 | 801,239<br>14.7 | 640,857<br>10.7 | 142,931<br>18.6 | 168,902<br>18.6 | 663,879<br>9.1   | 2,437,608 |
| 2003           | Released<br>PSE (%) |              |             | 731<br>100    | 2,935<br>75.2  | 43,379<br>40.1  | 75,561<br>15    | 430,052<br>17.5 | 272,897<br>16.5 | 732,141<br>8.5   | 1,557,696 |
| 2004           | Released<br>PSE (%) |              |             | 68<br>100     |                | 33,148<br>29.5  | 191,593<br>10.1 | 403,591<br>16.9 | 167,146<br>18   | 1,117,636<br>7.9 | 1,913,182 |
| 2005           | Released<br>PSE (%) |              |             |               |                | 31,146<br>33.2  | 327,859<br>15.1 | 498,537<br>12.7 | 330,193<br>19.9 | 1,247,109<br>7.4 | 2,434,844 |
| Total Released |                     | 1,334        | 301         | 4,758         | 35,071         | 1,719,521       | 3,120,275       | 3,830,066       | 3,034,992       | 11,413,838       |           |