Sea Urchins

Red urchin (*Strongylocentrotus franciscanus*).

Status of the Population:

The relative abundance of red urchins has declined since the 1970s (e.g., Carroll et al. 2000). In southern California, the red sea urchin resource now produces about 10 million pounds annually, with harvestable stocks (defined as exceeding the minimum legal size and containing marketable gonads) in decline since 1990 (Leet et al. 2001). Between 1985 and 1995, the percentage of legal-sized red sea urchins at survey sites in the northern Channel Islands declined from 15 percent to 7.2 percent (Leet et al. 2001). Although fishing has significantly reduced density in many areas and catch-per-unit of effort has decreased, localized juvenile recruitment has, thus far, somewhat mitigated fishing pressure (Leet et al. 2001). Consistent recruitment has been noted on artificial settlement substrates and along subtidal transects over the last decade at monitoring stations along the southern California mainland coast and the northern Channel Islands (Leet et al. 2001). This may be partly due to ocean current patterns in the Southern California Bight, where water retention may increase the chances for larvae to encounter habitat suitable for settlement. Continued recruitment at present levels, however, is not guaranteed; in fact, intensive sea urchin take in northern California and Baja California could result in a decrease in sea urchin larvae in southern California in the future.

The northern California fishery has been characterized by rapid growth to 30 million pounds in 1988 and decline to less than five million pounds in the late 1990s (Leet et al. 2001). Fishery dependent modeling of the sea urchin fishery during the period of rapid decline estimated that the 50,800 tons of red urchins taken between 1988 and 1994 represented about 67 percent of the fishable stock available at the start of 1988 (Leet et al. 2001). Effort declined during this period as the 126 divers who had worked exclusively in northern California during 1991 had dwindled to 69 by 1995 (Leet et al. 2001). Annual catch per permittee declined by 57 percent from 1990 to 1995. Densities of fishable stocks continue to be depressed at subtidal survey sites examined in the Fort Bragg area since 1988. From 1988 to 1997, legal-sized red urchins surveyed outside of reserves, declined from 47 percent to 20 percent of the population, and from 0.8 per square meter to 0.2 per square meter surveyed (Leet et al. 2001). In contrast, during this period densities in two area reserves averaged over 3.0 red urchins per square meter (Leet et al. 2001). These patterns were observed to continue during northern California surveys in 1999 and 2000 (Leet et al. 2001). Episodic and infrequent recruitment combined with intensive take on the north coast have had a serious impact upon catches, as the fishery has evolved into a recruitment fishery, with fishermen targeting newly recruited sea urchins (Leet et al. 2001).

Purple urchin (*Strongylocentrotus purpuratus*).

Status of the Population:
Coincident with the decline of competing red urchins, purple urchins populations have increased tremendously at many island sites, creating vast areas denuded of macroalgae (Harold and Reed 1985; Ambrose et al. 1993; Engle 1994; Richards et al. 1997; Carroll et al., 2000, Lafferty and Kushner 2000). A small fishery has existed sporadically for this species which peaked in 1992 at 400,000 pounds and then declined to less than 50,000 pounds in 1999 (Leet et al. 2001). Larval settlement rates monitored at a number of locations in southern and northern California over the past 10 years do not indicate a change in larval production and recruitment patterns, which indicates that the status of this species appears to be stable (Leet et al. 2001).

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Home Range/Migratory Patterns:

Purple and red sea urchins are found all along the west coast, from Mexico to Alaska. Purples are the most abundant on California's coast and occur in large numbers in intertidal regions. Reds inhabit the low intertidal to depths of 125 meters.

Sea urchin movements appear to be primarily in response to food shortages, such as occur during El Niño events when kelp beds can die off; urchins may aggregate and move in front denuding the remaining kelp forests. Sea urchins apparently do not make other movements or migrations.

Current Regulations:

The dive fishery for sea urchins is restricted access with 385 permittees. The current capacity goal, established in the early 1990s, is 300 divers. There is an annual urchin lottery to allow new participants into the fishery if any permits are available. There are closed days and weeks in April through October when red sea urchins may not be taken. Purple urchins may be taken at any time. In southern California, no red urchin between 1-1/2 and 3-1/4 inches shell diameter may be taken. In northern California no red urchin between 1-1/2 and 3-1/2 inches shell diameter may be taken. Additionally, there is a 20-landing requirement for renewal of the annual permit, and logbooks are required.

Recreational fishermen may take up to 35 urchins (in combination of species) of any size.

In the Master Plan required by the Marine Life Management Act, sea urchins were ranked in the top three fisheries in need of a fishery management plan. The Department is planning to develop research protocols in the coming year, and to proceed with an urchin FMP in the future. The red sea urchin fishery appears to be fully exploited in California, and evidence from a variety of sources suggests overfished conditions in northern and portions of southern California. Various management actions could be applied to improve this situation including increased fishery- dependent and fishery-independent monitoring programs; monitoring of settlement patterns; a review of the capacity goal of the restricted access program; expanded collaboration with industry with research and monitoring; and consideration of MPAs in urchin management. Interim measures could include a size limit, management zones, and annual quotas.

How MPAs May Help:

Reserves in northern California could improve red urchin density which would have two positive effects on the population. Fertilization success would be improved in this broadcast breeder (their sexual products are released into the ocean) because of larger aggregations of red urchins; and juvenile survival would be increased due to protection of the young by the increased availability of adult spine canopy. Reserves could also protect a portion of the large, fecund breeders of both sexes. This stable population would help provide insurance against years of poor recruitment and thus provide a stable base of spawning adults.

Red sea urchin densities are known to increase inside MPAs. In a study of red sea urchins in the San Juan Islands, Tuya et al. (2000) found that abundance and size were significantly affected by the presence of established marine reserves. They found 60 times more large urchins than small urchins within marine reserves in the San Juan Islands that have been closed to take since 1970.

In northern California red urchin populations are significantly denser inside MPAs compared with fished sites (Rogers-Bennett et al. In Prep.). Densities outside the reserves in some areas in the north are far below that needed for fertilization success (less than 0.2 per square meter at Fort Ross) which has been estimated to be 4 per square meter (Levitan et al. 1992). These low densities were measured in 1999 and 2000 despite a major red sea urchin recruitment event which resulted in high densities of legal size urchin inside the MPAs (greater than 5 urchins per square meter) (Rogers-Bennett et al. In Prep.).

In southern California reserves could protect the stability of the ecosystem by not allowing purple urchins to proliferate when their larger relative, the red urchin, was

removed by the fishery. Fertilization success and juvenile survival could also be affected positively. Reserves could protect large, fecund urchins of both sexes.