Tolerances to salinity and air exposure of *Dormitator latifrons* (Pisces: Eleotridae)

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Resumen En su ambiente natural y en acuacultura en el Ecuador *Dormitator latifrons* puede experimentar grandes variaciones de salinidad y desecación. Para peces capturados en agua dulce y transferidos al agua de alta salinidad, la salinidad letal para el 50% de los peces esperimentales fue 42°/oo. Para peces capturados en agua de 36°/oo a 48°/oo y transferidos a agua dulce, la mortalidad fue cero. El tiempo fuera del agua para que el 50% de los peces experimentales muera fue 18 h sin una cobertura de plantas húmedas y cerca de 54 h con una cobertura de plantas húmedas.

Dormitator latifrons (Richardson) is a popular food fish in the central Pacific coast of Ecuador, where it occurs in the rivers, floodplains, mangrove swamps, and shrimp farms. Previous studies have indicated that *D. latifrons* can tolerate wide variations in salinity and can survive long periods of air exposure, although the experimental conditions were not controlled or specified (Fitch, 1962; Ancieta Calderón and Landa Cannon, 1977). Observations of fishery and aquaculture practices in the Chone River basin in Ecuador also indicate such tolerances. In the upper mangrove zone, *D. latifrons* can be exposed to salinities from 0% to more than 50% during the year.

In aquaculture practice, freshwater ponds are often seeded with young *D. latifrons* captured in high salinity conditions, without gradual acclimation to the new salinity conditions. The ability to tolerate air exposure is indicated by the apparent high survival of *D. latifrons* after being transported in journeys of up to 10 h in bamboo crates without water; both young seed fish for ponds and adults for market are transported this way.

The present study was designed to determine if *D. latifrons* can survive the salinity variations and air exposure experienced in nature and in the current fishery and aquaculture practices in Ecuador.

Experimental fish of 6 to 20 cm total length were caught with cast-nets or fish traps from various sites in the Chone River basin in the central Pacific coast of Ecuador. The fish were transported to the laboratory in water from the collecting site. Experiments were performed in plastic trays (30 x 36 x 19 cm deep) with 5 test fish per tray. In the salinity tolerance experiments, fish were transferred abruptly from water of the collecting site to a tray containing *ca.* 10 cm depth of water of the experimental salinity, with aeration; survival was recorded after 24 h. Two series of salinity tolerance experiments were performed: fish caught in freshwater were transferred to high salinity water, and fish caught in high salinity water were transferred to freshwater.

In the air exposure experiments, test fish caught in freshwater were placed in trays (as above) without water for a determined length of time, after which freshwater (*ca.* 10 cm depth, with aeration) was added; survival was recorded after 24 h.

These experiments were performed with and without a covering of moist aquatic plants (*Eichhornia crassipes*); when used, the plant covering was replaced every 24 h.

Experiments were performed out of direct sunlight. Temperature was not controlled; daily ambient temperatures were 20-22°C minimum and 30-32° C maximum.

TABLE 1

Survival of D. latifrons *captured in freshwater and abruptly transferred to high salinity, 24 h after exposure to the experimental salinity*

Initial salinity (°/oo)	Experimental salinity (°/oo)	n	Survival (°/oo)
0	35	40	97.5
0	40	40	95
0	42	40	50
0	45	40	0
0	50	40	0

TABLE 2

Survival of D. latifrons *captured in high salinity and abruptly transferred to freshwater, 24 h after exposure to the experimental salinity*

Initial salinity (°/oo)	Experimental salinity (°/oo)	n	Survival (°/oo)
36	0	40	100
45	0	40	100
48	0	40	100

TABLE 3

Survival of D. latifrons *after air exposure, with and without a covering of moist plants. Following air exposure, freshwater was added to the experimental containers. The survival rate was observed 24 h after the addition of freshwater*

Hours of air exposure	Without covering of plants		With covering of plants	
	n	Survival (%)	n	Survival (%)
12	20	100	20	100
18	20	50	20	100
24	20	25	20	95
30	20	0	20	80
48	–	–	20	55
72	–	–	20	35
96	–	–	20	0

Salinity tolerances: The survival of *D. latifrons* after abrupt transfer from freshwater to high salinity is shown in Table 1; the salinity required to kill 50%of the test fish after 24 h exposure (LD_{50}-24 h; see Kinne, 1971) was 42% Survival after abrupt transfer from high salinity to freshwater is shown in Table 2; survival was 100% for test fish caught in 36-48% salinity water.

Air exposure tolerance: the survival of *D. latifrons* after air exposure, with and without a covering of moist plants, is shown in Table 3. Survival was greater when the test fish were covered by plants. The exposure time required to kill 50% of the test fish (LT_{50}) was *ca.* 54 h with and 18 h without a covering of plants, respectively.

These results confirm that *D. latifrons* has a wide tolerance of salinity variations and can tolerate long periods of air exposure. It thus appears that the current aquaculture practices of transferring fish abruptly from high salinity conditions to freshwater and the transport of fish without water result in little or no mortality. In the present study, survival was 95% or more after air exposure of 12 h without a covering of moist plants or 24 h with a covering of plants. Transport using a covering of plants, or other means of maintaining humid conditions, are recommended in journeys of more than 12 h, and air exposure of more than 24 h should be avoided. The tolerance to air exposure in the present study was less than the 120 h survival out-of-water in humid conditions reported by Ancieta Calderón and Landa Cannon (1977); this may be due to different temperature and humidity conditions, which were not specified in the latter study.

Kinne (1971) indicated that since the stress of air exposure involves body water loss (desiccation), which affets the water and salt balances of organisms, the tolerance of an organism to air exposure is related to its salinity tolerances. Thus, an animal such as *D. latifrons*, which can tolerate long periods of air exposure, might be expected to show a wide tolerance to salinity variations. In order to tolerate air exposure, in addition to a tolerance of desiccation, a means of air respiration is also required. *D. latifrons* is able to absorb oxygen from the air through its highly vascularized, broad forehead (Todd, 1973).

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