Paddlewheel Water Mixing in Split-Ponds Used for Catfish Production

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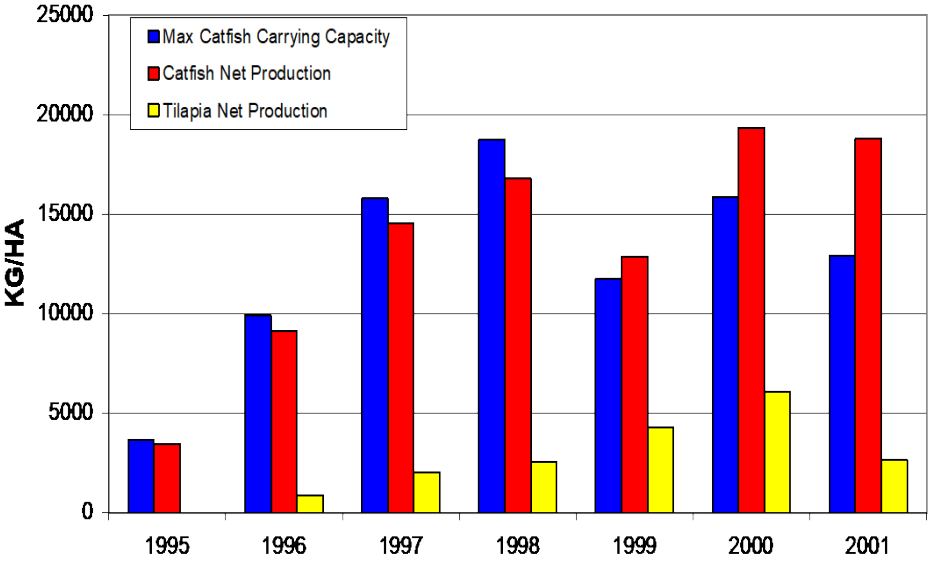
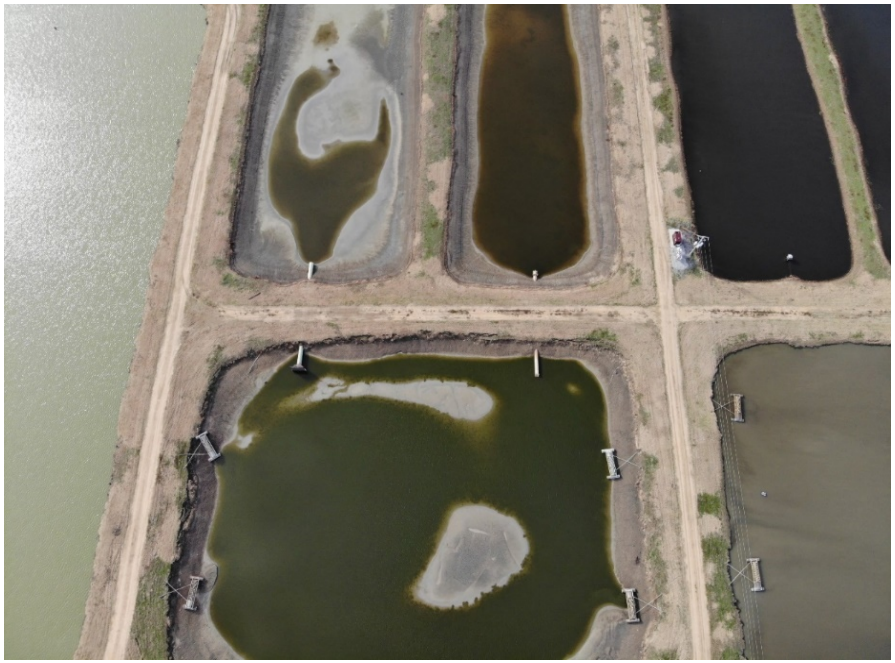
Partitioned Aquaculture System (PAS) uses paddlewheels providing uniform water mixing and increased photosynthesis (in treatment zone) with cultured fish in high-density raceways.

Clemson University Two-Acre PAS averaging 2.3 hrs cycle-time in waste treatment zone



Catfish Yields in PAS Approaching 18,000 lbs/acre

To take advantage of the enhanced algal treatment of the PAS, a lower cost version of the PAS, entitled the Split-Pond (SP), was installed at the Warm Water Aquaculture Center in Stoneville Mississippi in 2001.



Seven-Acre Split-Pond with Levee in Five-Acre Waste Treatment Zone using Culvert Pumps Delivering 8,000 gpm (11.8 hrs cycle time)

Seven-Acre Split-Pond without Levee in Five-Acre Waste Treatment Zone using Paddlewheel Delivering 10,000 to 15,000 gpm Water Flow (9.4-6.3 hrs cycle time)

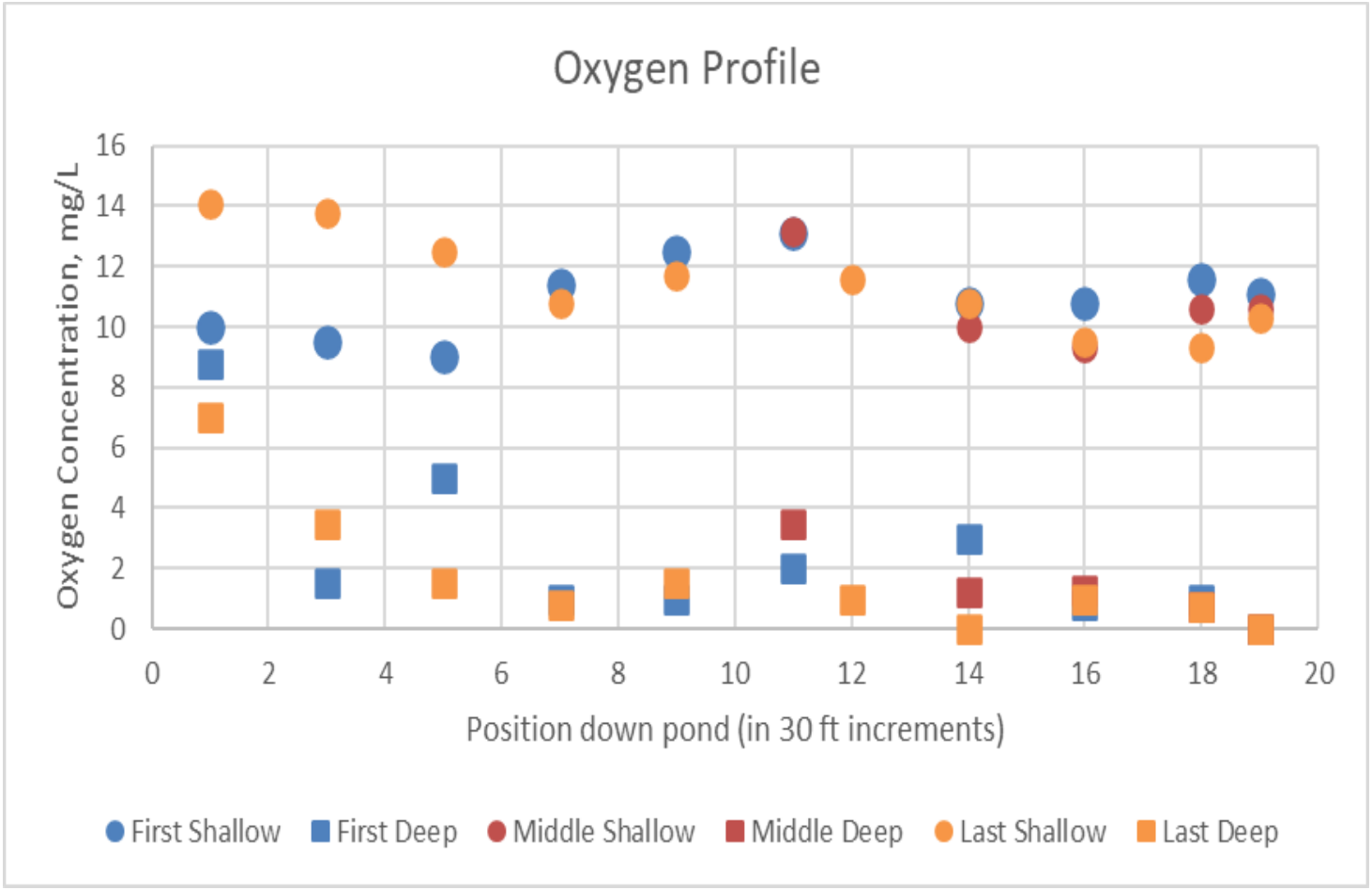
This study was undertaken to compare mixing effectiveness of paddlewheels vs culvert pumps in SPs with, and without, internal levees dividing water-flow

Oxygen (lbs/acre-day)

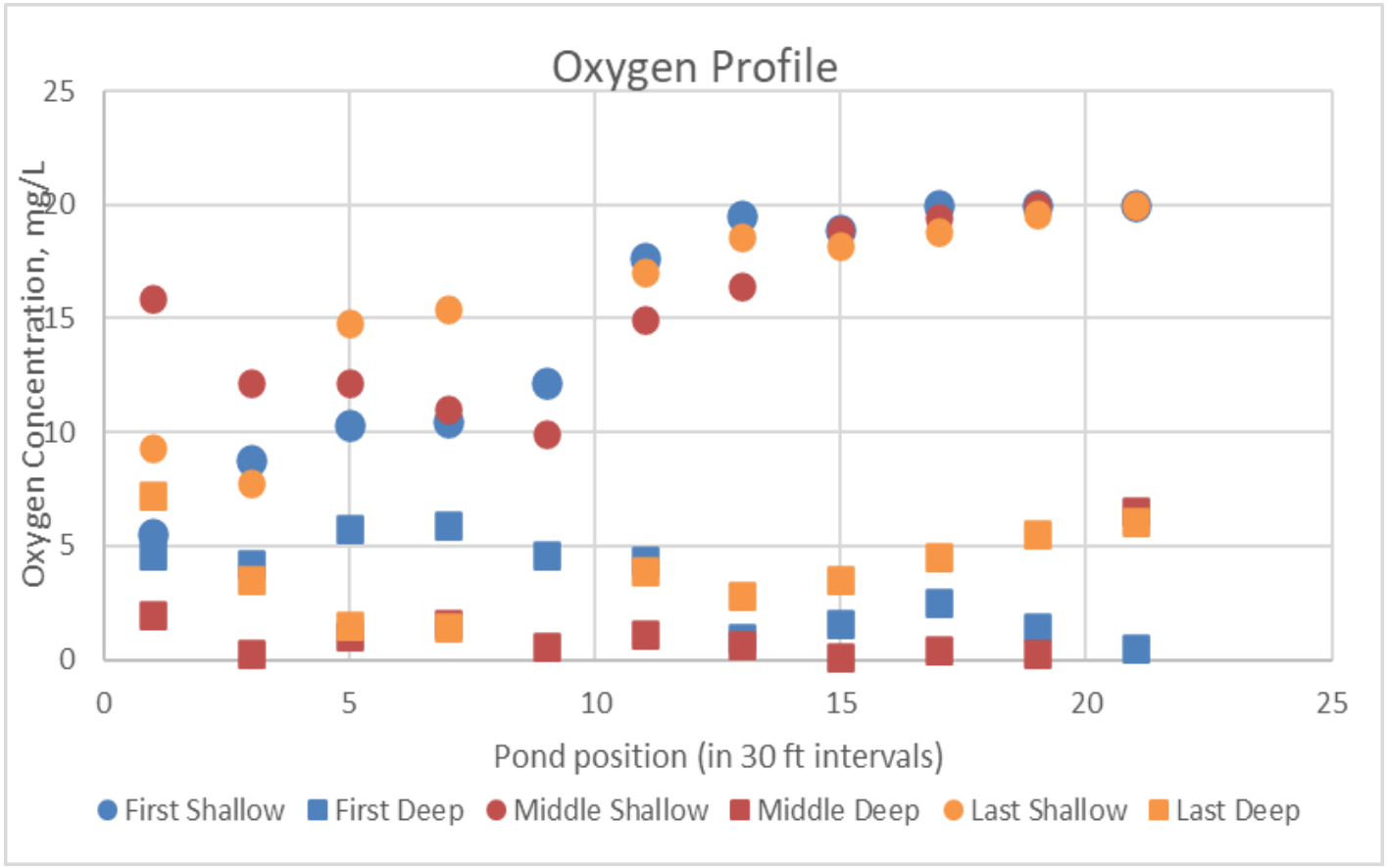
System	Surface	Fish	Photosynthesis	Deep	Photo % of Fish
Clemson PAS	+72	-150	+180	-102	120 %
Conventional Pond	+40	-50	+32	-22	64 %
MS Split Pond	+40	-180	+140	-76	78 %
MS High-HP Pond	+80	-237	+157	-78	66 %

Comparison of Oxygen Dynamics in PAS, Splits Ponds, High-Rate Ponds and Conventional Catfish Ponds.

Paddlewheel Used to Move Water in Split-Pond Without Central Levee.



Oxygen Concentration 1 ft Below Water Surface and 1 ft Above Pond Bottom in First-Section (Along Discharge Line from Culvert Pump), Middle-Section, and Last-Section in 5.0-Acre Split-Pond Treatment Zone with Central Levee (Increment = 30 ft).



Oxygen Concentration at 1 ft Below Water Surface and 1 ft Above Pond Bottom in First-Section (Aligned with Discharge from Paddlewheel), Middle-Section, and Last-Section in 5.0-Acre Split-Pond Waste Treatment Zone without Central Levee (Increment = 30 ft

Type	Max capacity lbs-fish/acre	Feed loading (lbs/acre-day)	FCR feed/fish
		1995-2008 (2 acre)	
PAS	15,000-18,000	160/250	1.4-1.6
CP	5,000-7,500	100/150	~2.0
		2014 -2015 (2 acre)	
SP	12,800 -14,032	110/280	1.7- 1.9
IP	9,200- 18,245	84/270	1.8 -1.9
		2015- 2020 (7 acre)	
SP open	12,330-19,872	190/210	1.8-2.6
SP channel	9,830-15,600	105/164	1.9-2.6

Catfish Production and Feed Application in PAS, Conventional Ponds, (CP), Intensively Aerated Ponds, (IP), and Split Ponds (SP) of Seven Total Acres with/without Dividing Levee within Treatment Zone

SUMMARY

1) Split-ponds offer potential for expansion of aquaculture production at reduced environmental impact with cost ~50% of PAS cost, capturing 65% to 110% of PAS production.
2) Performance of split-pond is dependent on degree of water mixing
3) Culvert pumps at 8,000 gpm in split-ponds with levee (cycle time of 11.8 hrs), mixes 33-50% of treatment zone, with fish yield of 9,800 to 15,600 lbs/acre.
4) Paddlewheel at 10,000 gpm in split-pond without levee (cycle time of 9.4 hrs) mixes 50% of treatment zone.
5) Paddlewheel at 15,000 gpm in five-acre split-pond without internal levees (cycle time of 6.3 hrs) with fish yield of 12,330 to 19,872 lbs/acre
6) Two-acre PAS prototypes with paddlewheels (cycle time averaging of 2.3 hrs) with fish yield of 15,000 to 18,000 lbs/acre