Colloque international sur l'étude, la restauration et la gestion de l'alose
International symposium on restoration and conservation of shads

Caractéristiques et fonctionnalité des habitats de reproduction sur la Dordogne

Features and functionality of spawning habitats on the Dordogne river

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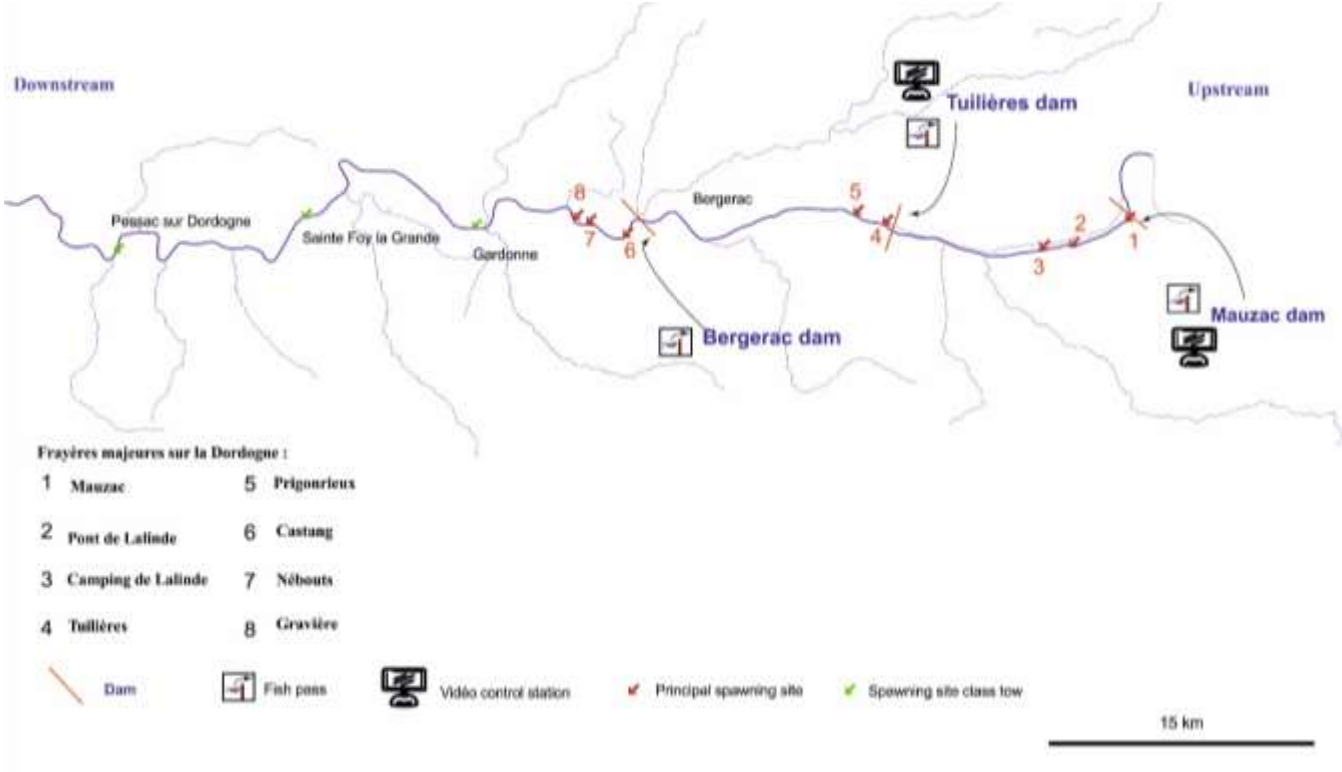
Suivi de l'activité de reproduction
Survey of spawning activity

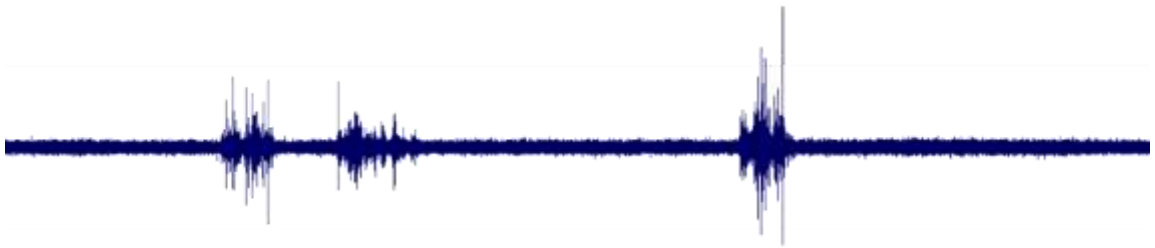


Why ?

- To estimate the spawning stock on the Dordogne river and on the basin Garonne – Dordogne
- To better understand the impacts of dams

How ?

- By direct listening of the activity (« bulls »)
- By audio numeric records
- Considering that 1 bull = 1 male + femelle and 1 femelle = 10 bulls

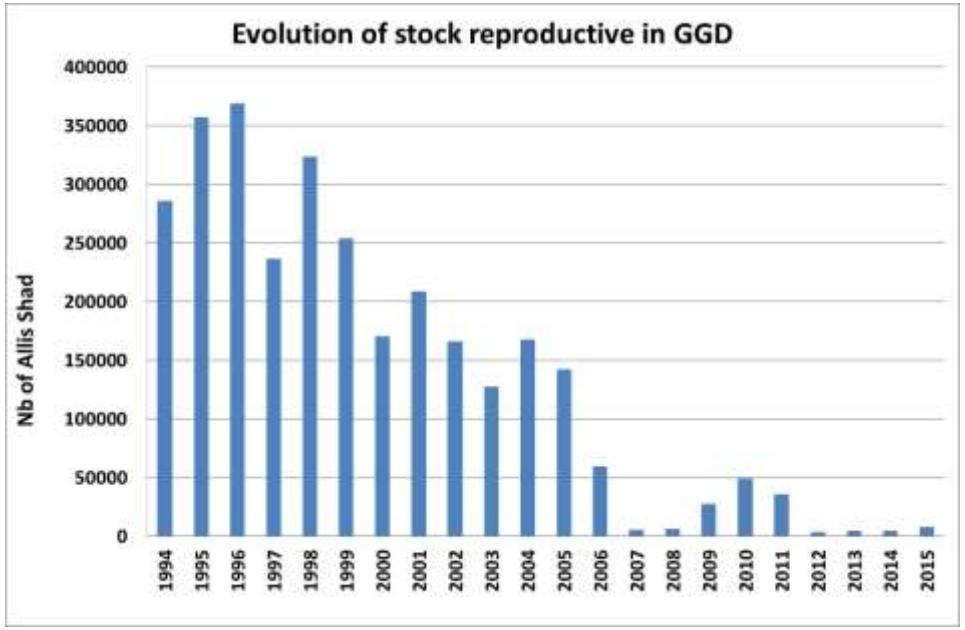


Main results from 2003 to 2015

- Only 8 spawning grounds for 95% of the population located just downstream dams
➔ « forced » sites

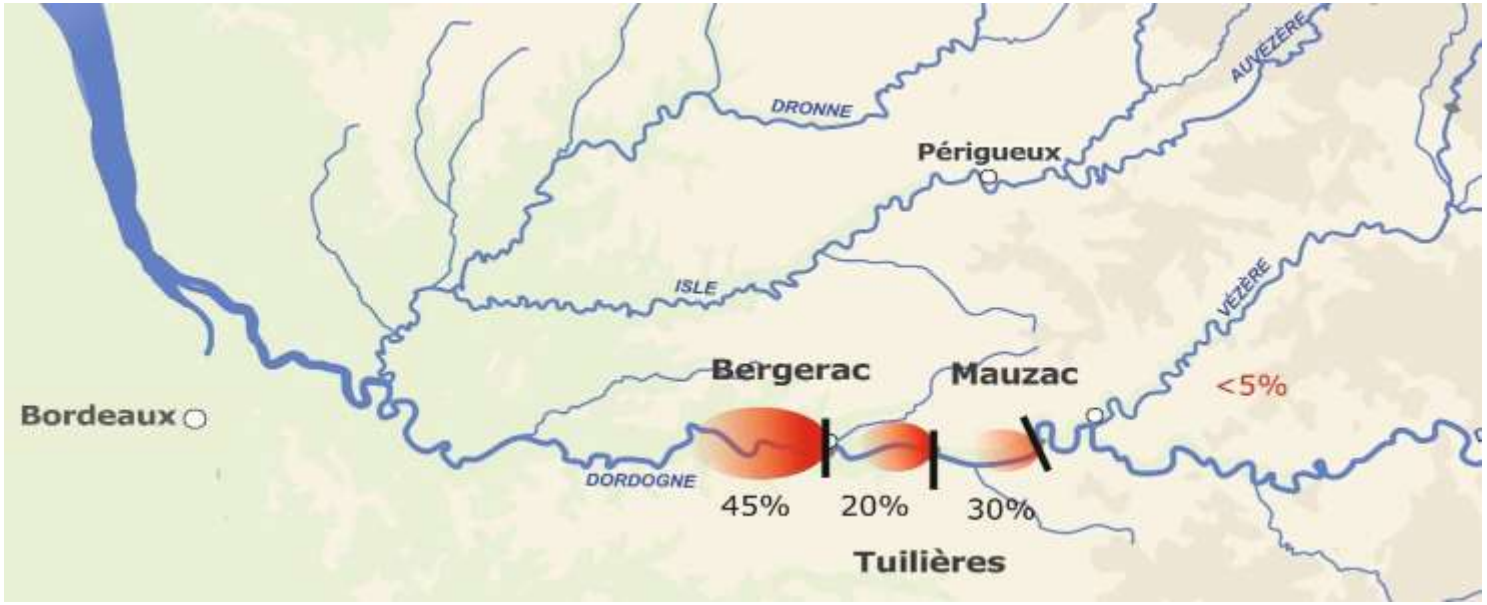
Rq : on the Garonne river, 5 spawning sites

- With Garonne datas : a marked decrease of the spawning stock in 15 years (from 350 000 shads in the 90th to less than 10 000 fish now)

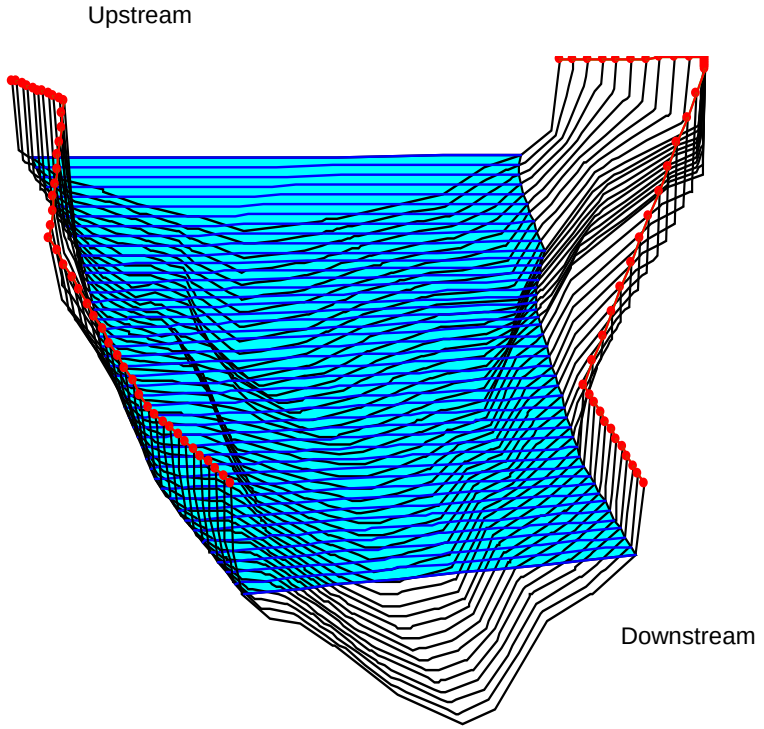


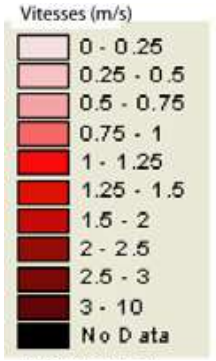
Main results from 2003 to 2015

- Analysis with video counting reveal that 95% of the stock spawn downstream the 3 dams

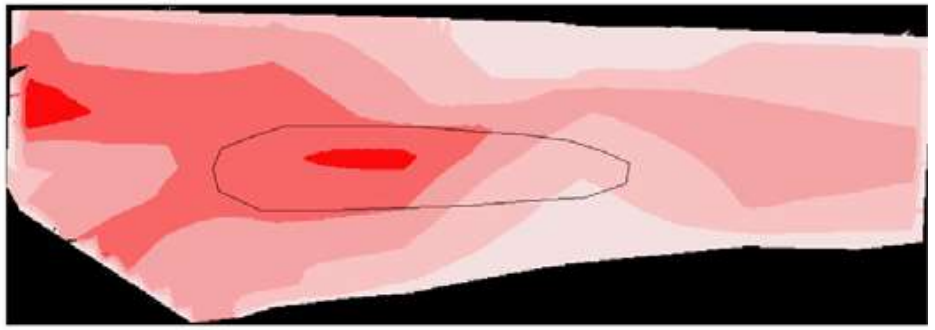


Conditions hydrauliques sur les frayères
Hydraulic conditions on spawning sites





Current velocity for 100 m^3/s



Aims :

- Characterize hydraulic conditions (depth, current velocity) on shad spawning sites
- Better understand selection criteria for shads
- Help to identify potential spawning grounds on others basins (used for Rhine)

Mapping of potential spawning habitats of the Allis shad in the Rhine-System

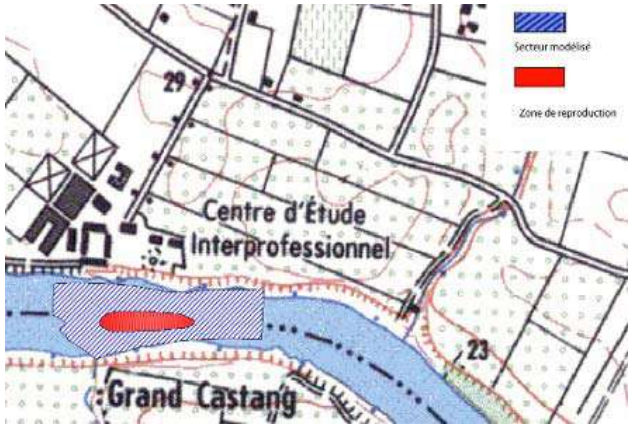
In conjunction with the LIFE project

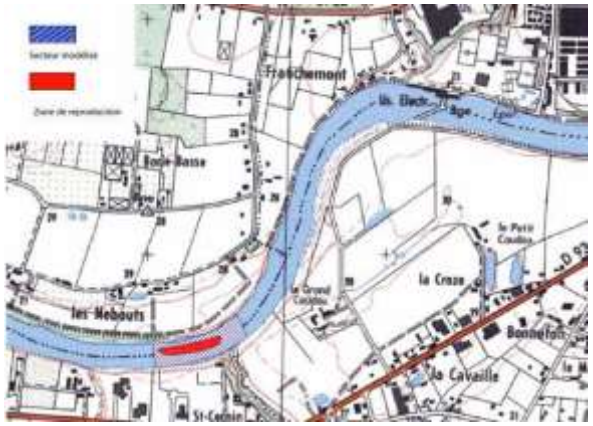
"The re-introduction of the Allis shad (*Alosa alosa*) to the Rhine system"

(LIFE06 NAT/D/000005)

Methods

- Hydraulic models on the 5 spawning grounds downstream Tuilieres dam
- 12 years of monitoring (650 000 bulls)
- Each night, record of water discharge

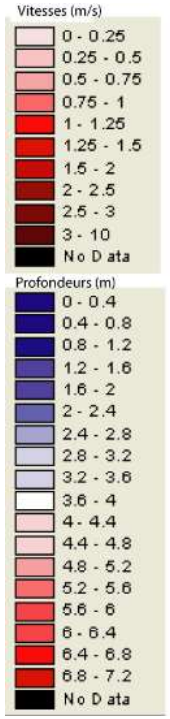


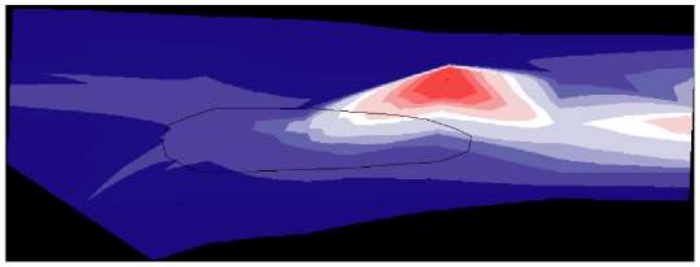


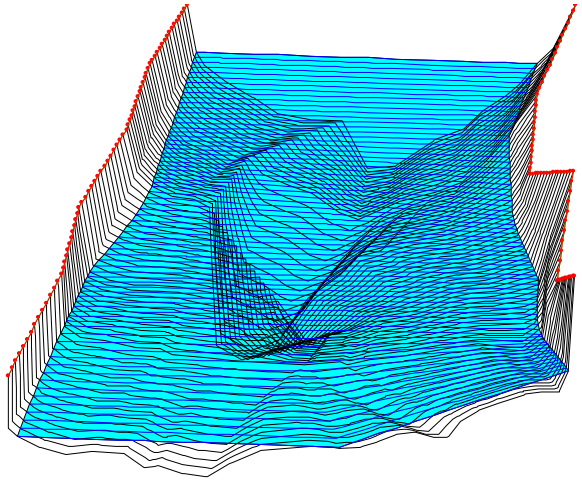
Main results

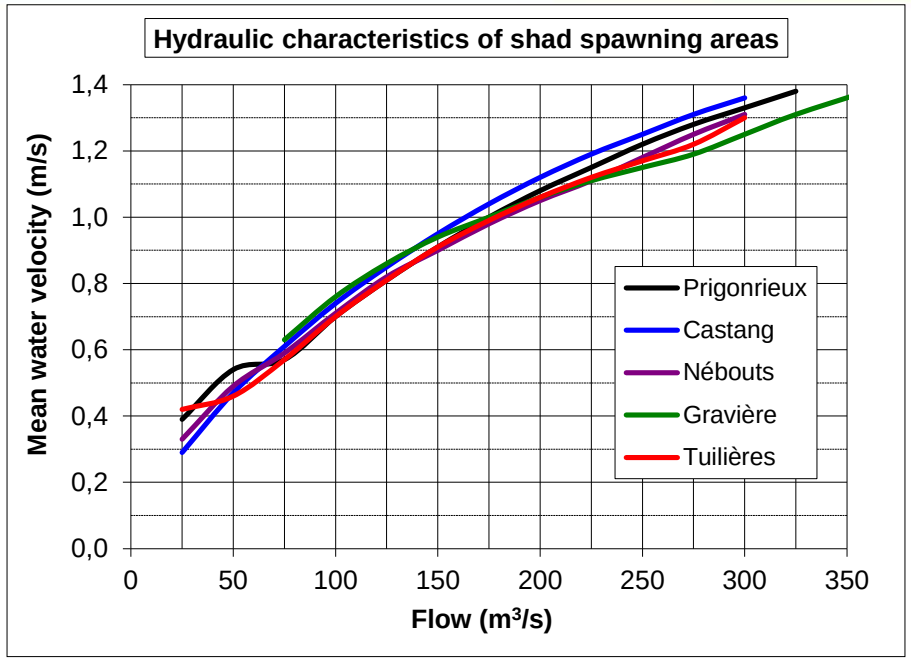
Little influence of bottom sediments

For each spawning sites, current velocities and depth in relation with water discharge





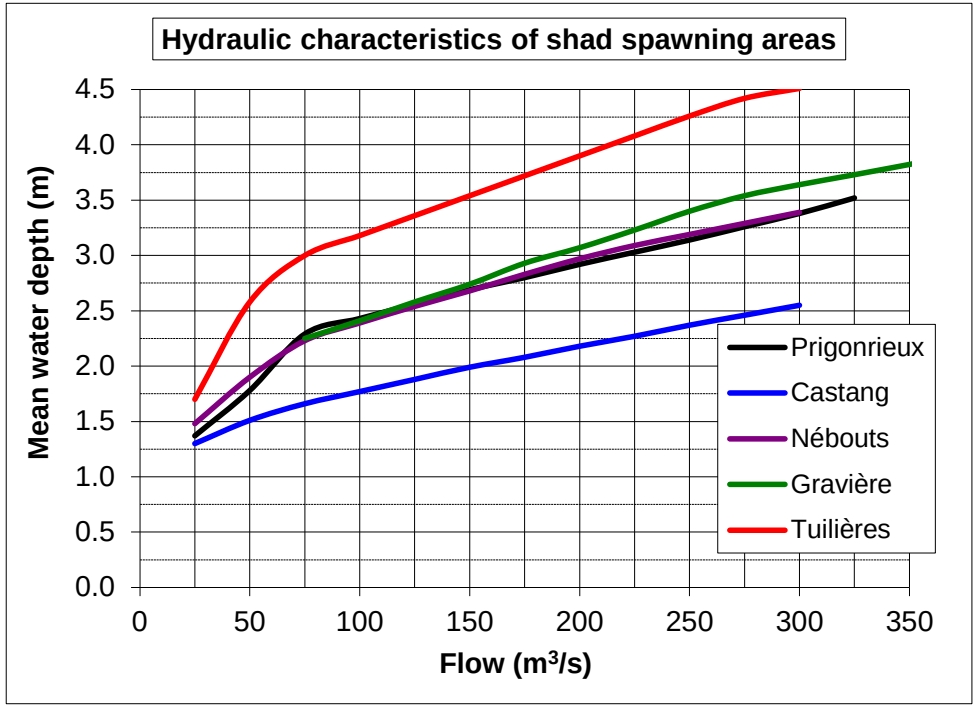




Relation of current velocity and water flow on 5 sites

Current velocities very comparable between sites

➔ important criteria for shad

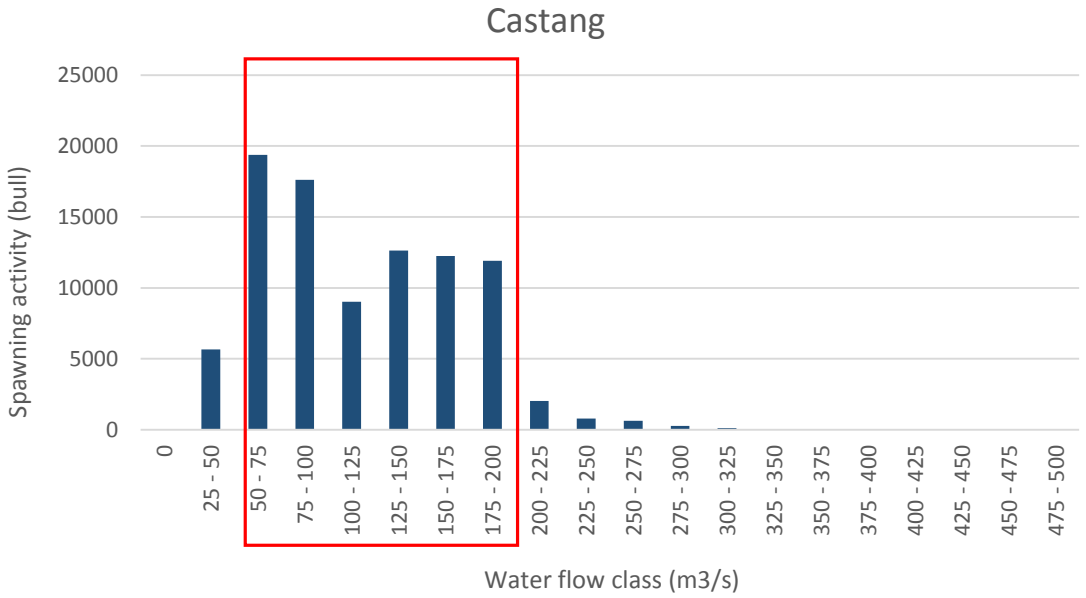


Relation of water depth and water flow on 5 sites

Depth : marked differences between sites

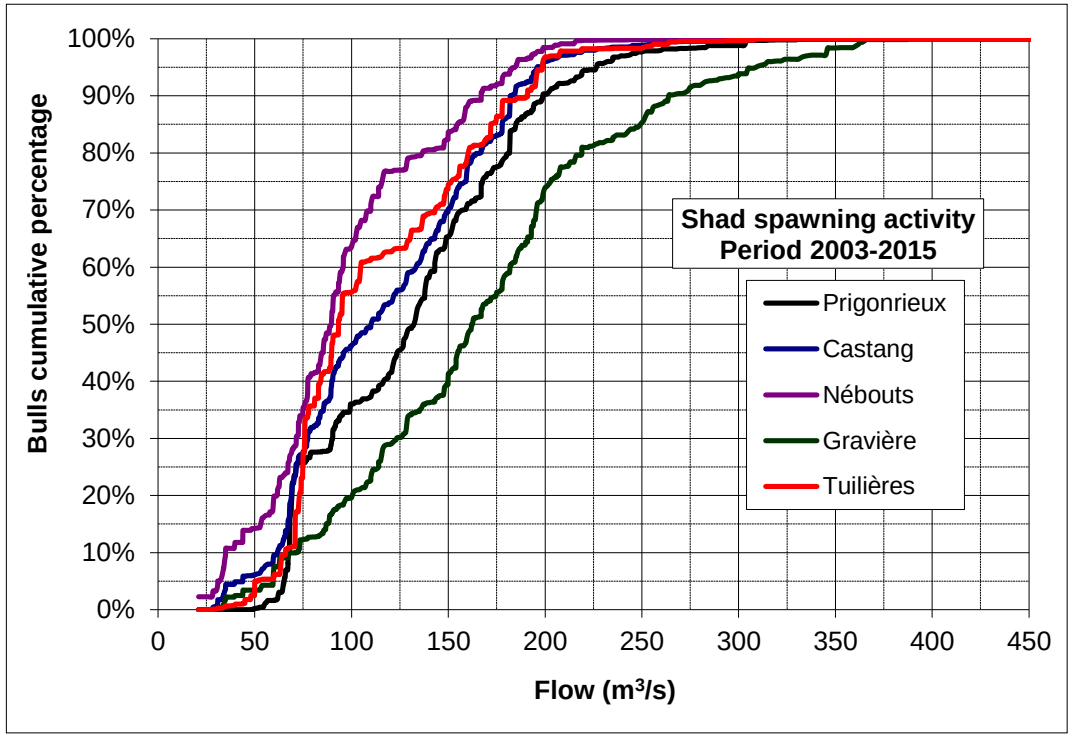
➔ not an important criteria for shad

Water discharge and spawning activity



Relationship between spawning activity and water flow class on Castang spawning ground

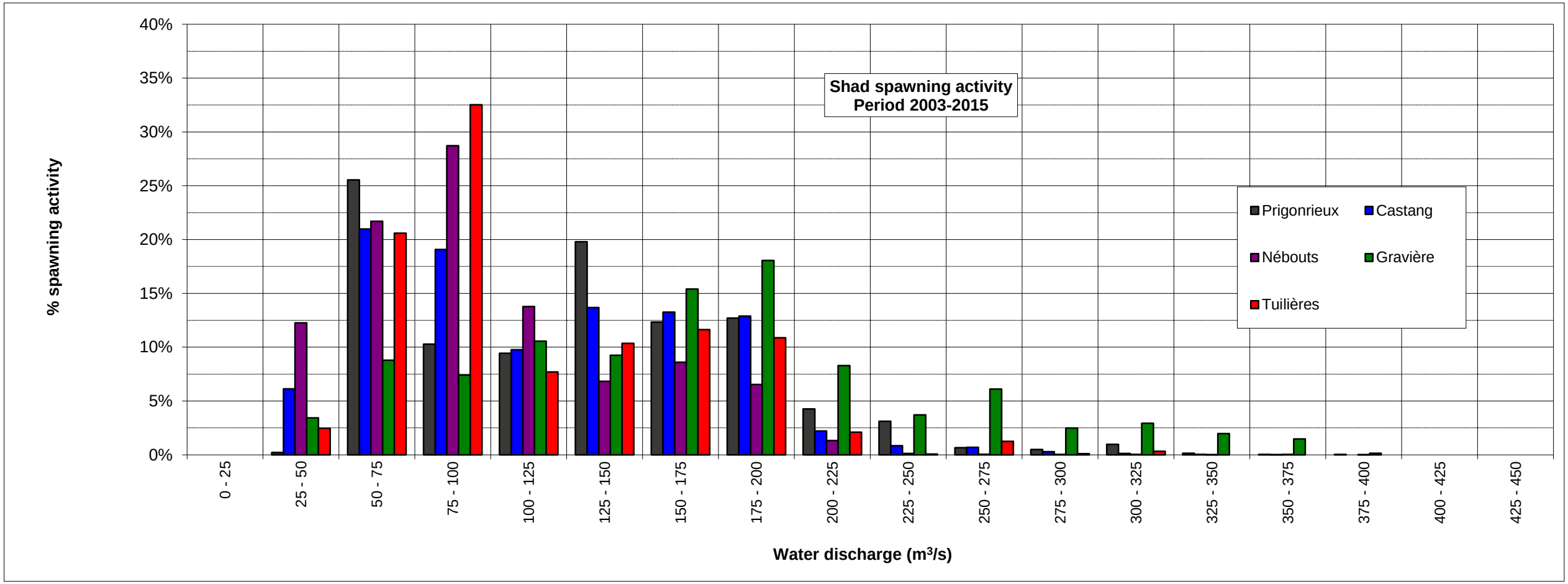
spawning ground	Flow (m^3/s)								
	Q1%	Q10%	Q25%	Q50%	Q75%	Q90%	Q99%	Preferential range water flow	
Tuilières	40	66	75	93	152	191	256	75	100
Gravière	34	71	114	162	203	264	362	175	200
Nébouts	21	35	67	89	116	167	208	75	100
Castang	31	62	72	111	159	182	253	50	75
Prigonrieux	56	68	71	133	168	199	304	50	75



On each site, the range water flow were define to:
- Presence spawning activity (1%-99%)
- 10-90% of spawning activity
- To the preferential range water flow of fishes

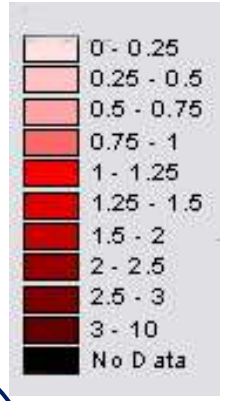
More precisely

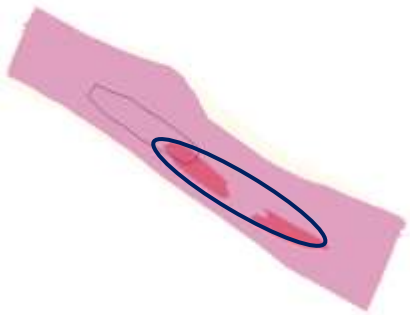
Relation on each site between spawning activity and water discharge



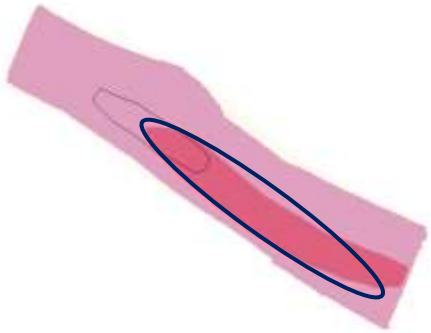
Positioning of the activate areas of reproduction according to the flows

Current velocity classes (m3/s)

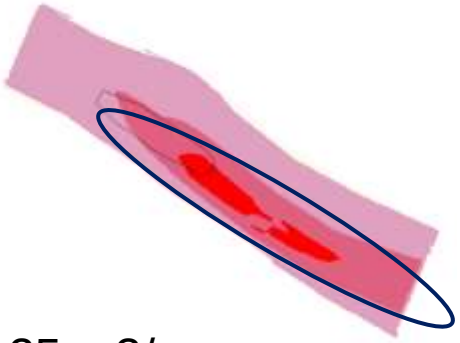




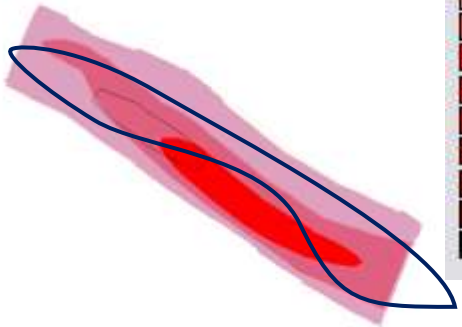
75 m3/s



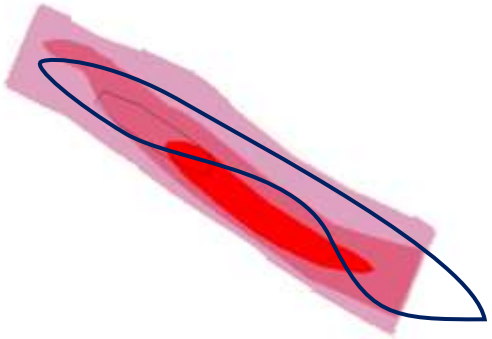
100 m3/s



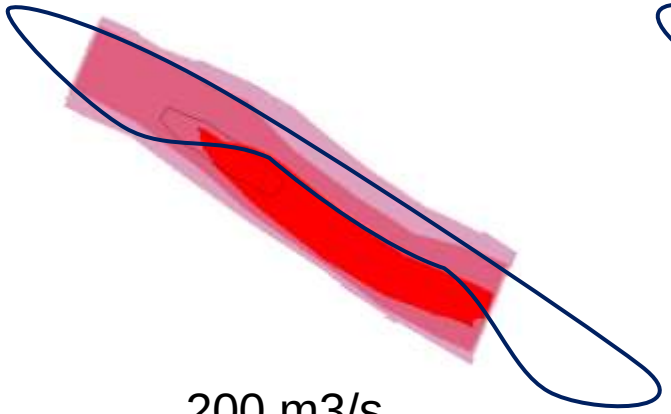
125 m3/s



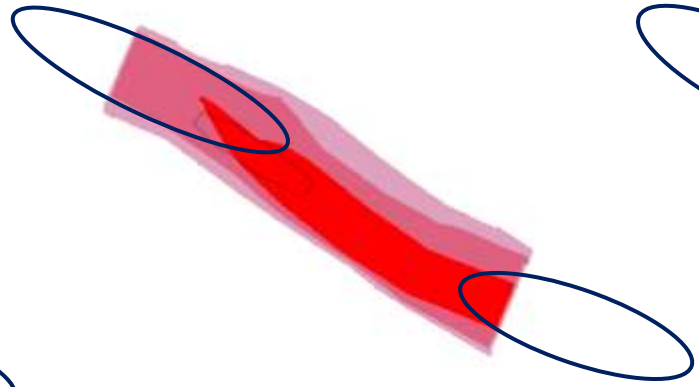
150 m3/s



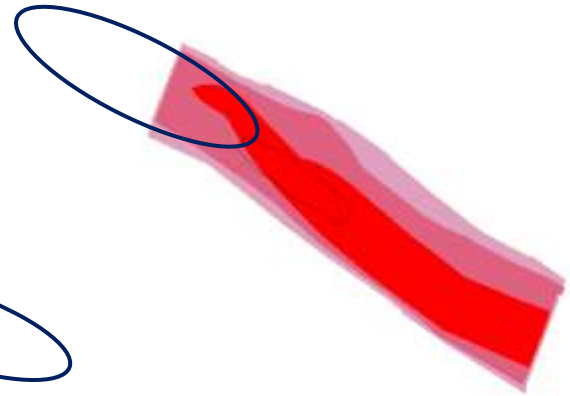
175 m3/s



200 m3/s



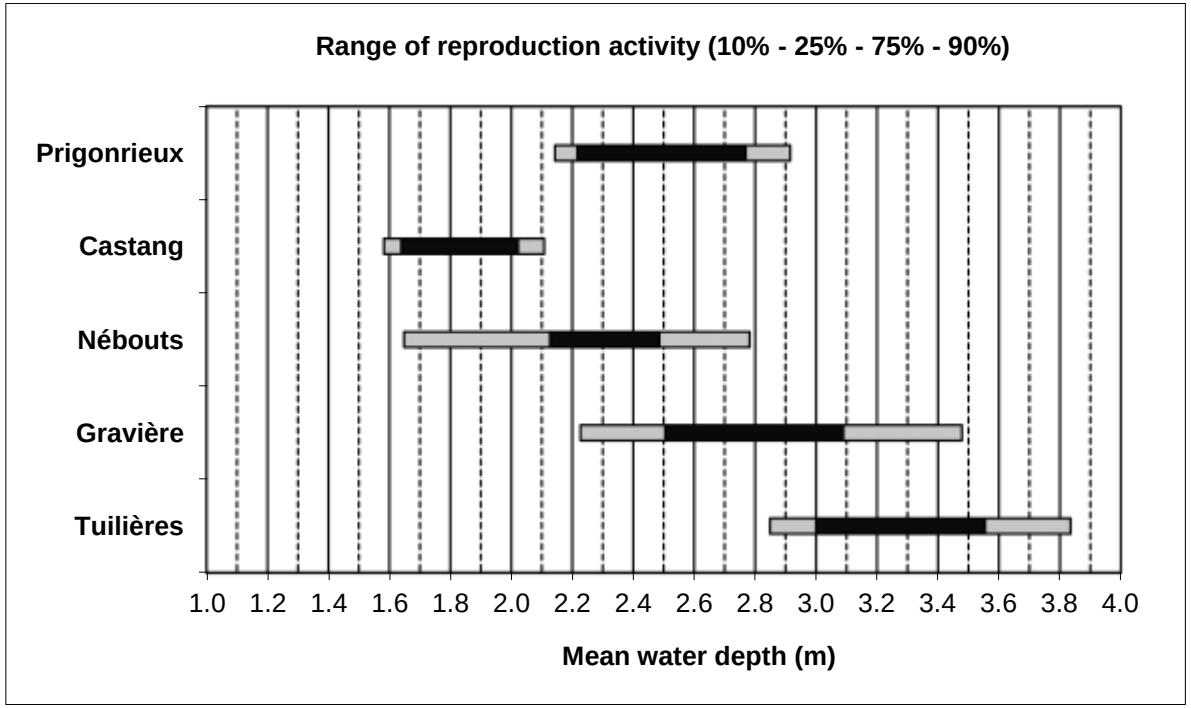
225 m3/s



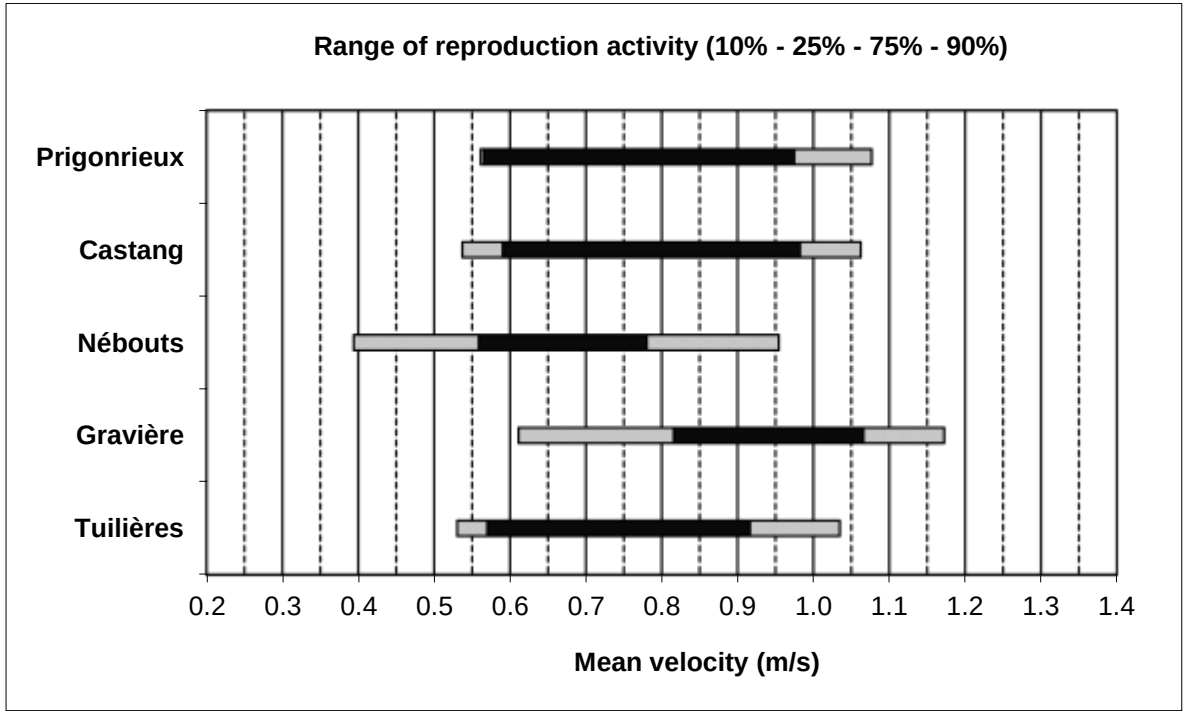
250 m3/s

Relation on each site between spawning activity and hydraulic conditions (10 - 25 – 75 - 90% of activity)

Spawning activity and depth



Spawning activity and current velocity:



Preferential depth on each site are different
Spawning activity observe between 1,6 m et 3.8 m

Spawning activity observe between 0,4 m/s et 1,15 m/s
Maximum observe between 0,6 m/s et 1 m/s

Référence	Profondeur moy. (m)	Vitesse moy. (m/s)
Belaud et al. (2001) Belaud in Baglinière et Elie, 2000	0.9 - 2	0.45 - 1.5
Cassou-Leins et Cassou-Leins (1981)	0.5 - 3	0.9 - 2
Boisneau et al., 1990	0.9 - 2	0.45 - 0.9
Aprahamian (1981) in Baglinière et Elie, 2000	< 3	?
Fiche frayère Onema	0.5 - 3	0.9 - 2
Présente étude	**1.6 – 3.8**	**0.4 – 1.15**

Réflexions sur la fonctionnalité des habitats de reproduction

Functionality of spawning habitats

Trajectory and landing area for eggs

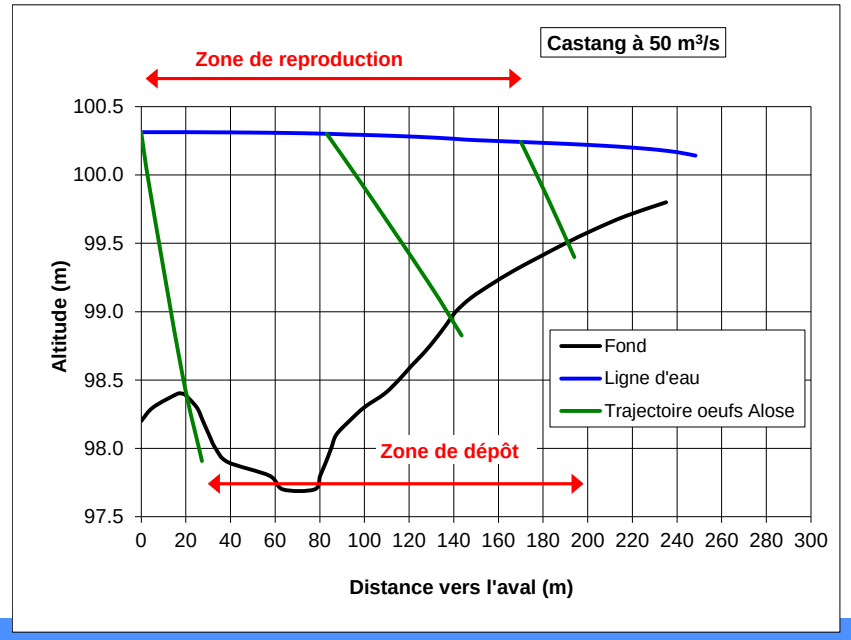
Calculated from the hydraulic models considering:

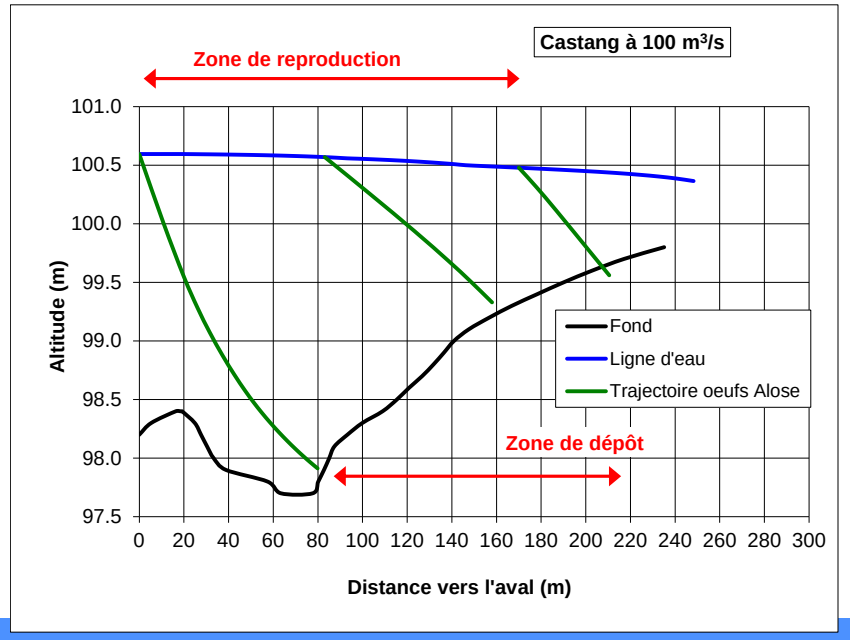
- The surface is the starting point
- The sedimentation velocity is 1.63 cm/s (MIGADO data)
- A downstream transport with the average speed on the vertical line

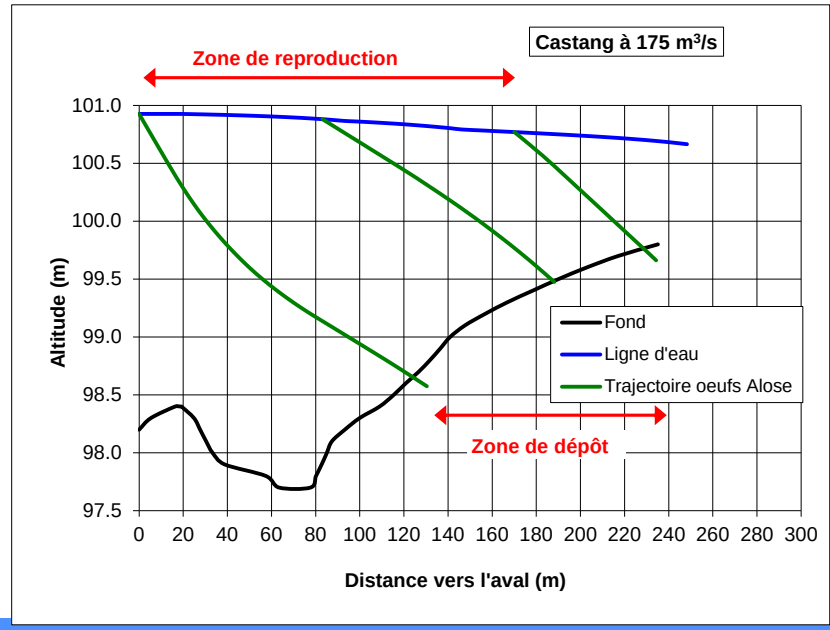
A gap of landing area for eggs in regard to the spawning ground :

- ≈ 20 m à 50m3/s
- 40-80 m à 100m3/s
- 50-120 m à 175m3/s

Castang for 3 values water flow :







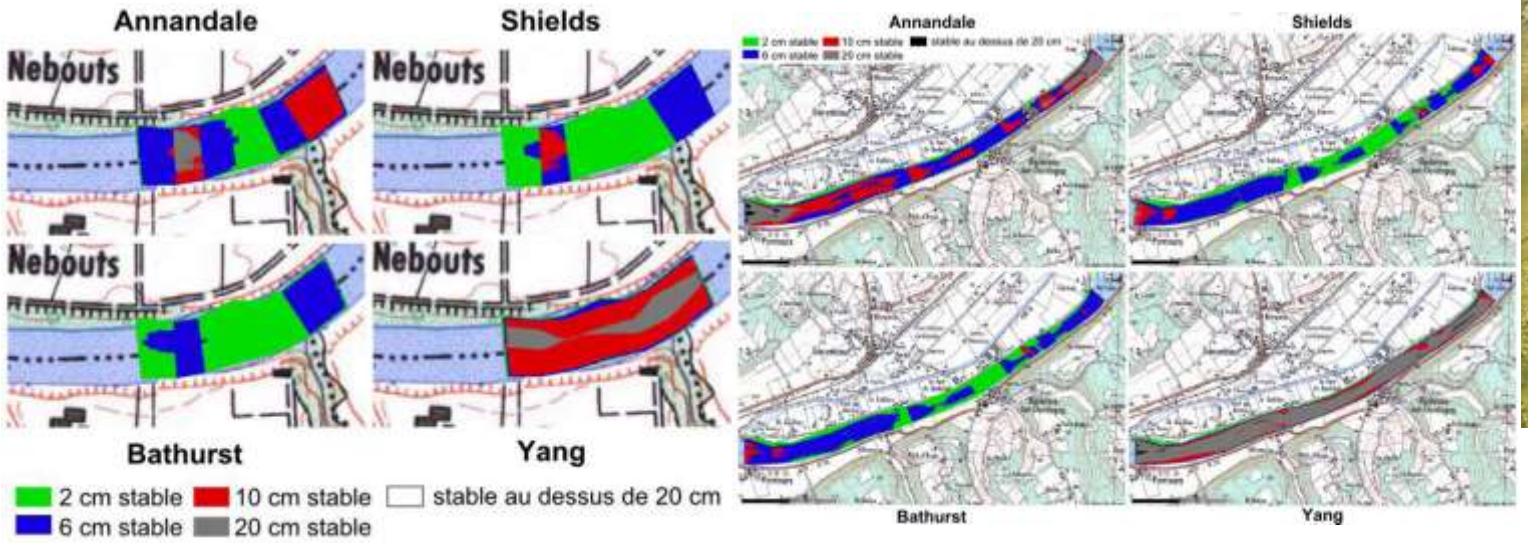
Lack of gravel on the spawning grounds and landing areas, a problem for egg survival

- Risk of predation by other fish (Carlson, 1968 ; Ross et al., 1993 ; Bowman, 2001)

- Reflexions concerning reintroduction of gravel (Epidor - Ecogea study)

  - Determination of deposite site in relation with egg sedimentation speed

  - Stability in relation with the gravel size and water flow



Reflexions concerning the first days of life of larvae

- More than 95% of the population spawn on the lower part of the basin (30 km) which 50% between Bergerac and Mauzac dams.

Layzer (1974) noted that survival rates of shad eggs were highest where gravel and rubble substrates were present. Likewise, Hightower and Sparks (2003) hypothesize that larger substrates are important for American shad reproduction, based on observations of spawning in the Roanoke River, North Carolina

- All the population is submitted to the same environmental conditions

- First days of life of larvae is a critical stage for shad
- Are the zooplankton composition and abundances good for larvae between the dams ?

Nack and al (2015) studies diet composition of larval American shad after the introduction of invasive Mussel Zebra in Hudson river

Binion and al (2012) studies the zooplankton composition and abondances. Models for each alosine species showed that copepod nauplii and rotifers are the most suitable-sized prey for the first feeding after yolk sac absorption.

On the Dordogne river,

- Incubators of ground will be installed on strategic site
- Evaluation study of the food chain state will be propose