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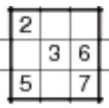
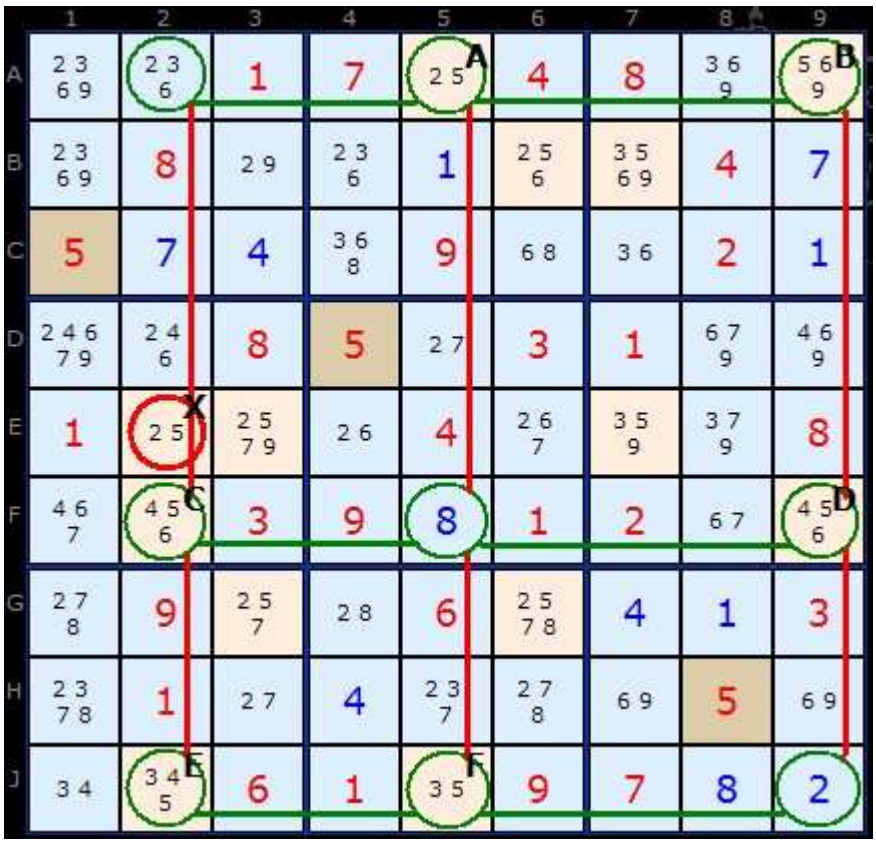
Sword-Fish Strategy

From sudokuwiki.com, the puzzle solver's site



With X-Wing we looked at a rectangle formed by four numbers at the corners. This allowed us to exclude other occurrences of that number in either the row or column. We can extend this pattern to nine cells connected by locked pairs. In the example below (concentrating on the number 5) we have three sets of locked pairs at AB, CD and EF.
They are all horizontal pairs but they also lock each vertically in a staircase fashion (I guess this inspired the name).



The vertical pairing is between AF, BD and CE.
Now, in this example we can clearly see that the green horizontal lines connect pairs of 5. Because 5 is also locked vertically the red lines represent columns where if a 5 is not on our grid of nice nodes it can be excluded. There is one such 5 on cell X (E2).

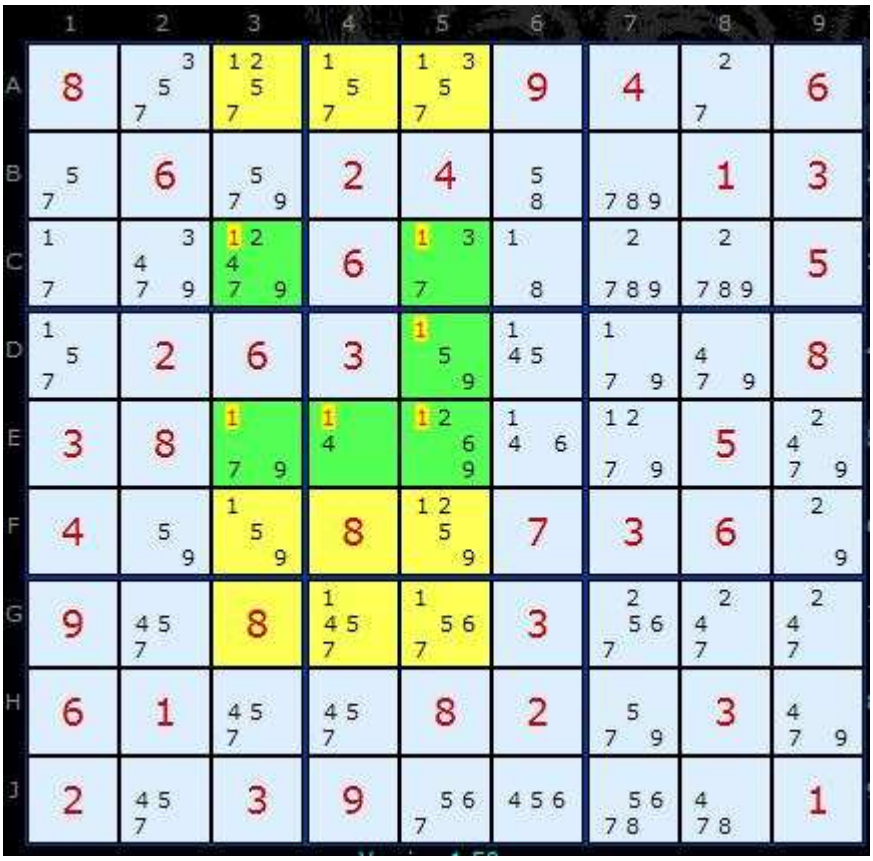
Another way of looking at it is to consider any 5 on the Sword-Fish grid. Pretending for a moment it's a real 5 the others in the row and column are repressed. What we're left with is an X-Wing. X-Wing logic then applies to exclude the 5s it can see.

Swordfishes come in a number of variations depending on the number of X present in the nine cells that make up a Swordfish. With an X-Wing you need candidate X in all four cells of the 2 by 2 formation, but with the 3 by 3 Swordfish formation you don't need X in every cell. The above example has 5 twice in each row and is called a 2-2-2 Swordfish. 3-3-3 Swordfis would be the fullest kind but it can be as skimpy as 2-1-2 or even 1-2-1 and other variations although 1-1-1 is probably not realistic.

The next example was recently submitted by Stephen Hotchkis and the graphic is from the solver. It is a 3-2-2 Swordfish since you can see Candidate 1 present three times in the top row and twice in rows F and G. The alignment is vertical since the eliminations are in the columns.

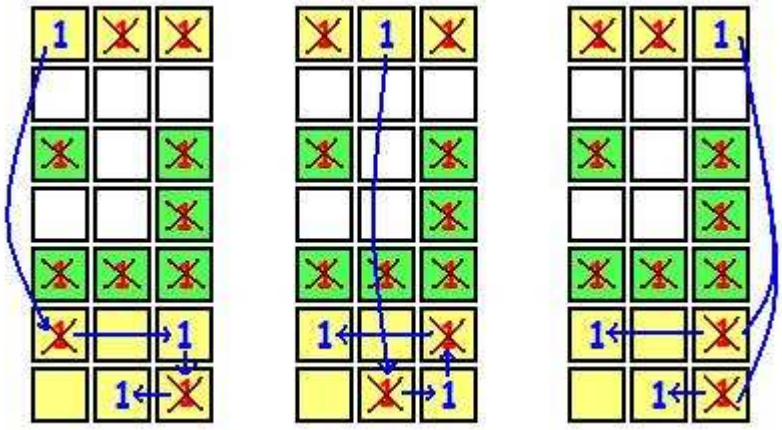
The yellow cells are the Swordfish cells. The green cells are those cells where 1 can be removed, which makes this an excellent example since we have six 1s that can go.

The rule for Swordfish is as follows:
When there are 1) only three possible cells for a value in each of three different rows, and 2) these cells also lie in the same columns, then all other candidates for this value in the columns can be eliminated. The reverse is true for columns instead of rows.



Swordfish Example 2: Load Example

A final way of considering this example is to take some cells in the formation and see what happens if you place a 1 in them. I've done this in the illustration on the right with the top row. I've placed 1 in each of the cells in the top row and because of the locked pairs they force a solution that in no instance requires the 1s in the green cells.



Three possible outcomes

In the first instance a 1 in A3 removes the 1 in F3 which obliges F5 to be 1 and then G4.

In the second instance A4 removes 1 in G4 forcing 1 in F4, which through eliminations makes F3 a 1 also.

Lastly a 1 in A5 sets both F3 and G4 to be 1.

Onc can pick any cell in the Swordfish and trace the chain of consequences round and in no cases does a green cell1 become a required cell. We don't know which of the three instances is correct - that will be revealed later, but it does help us whittle down the candidates.

Here is a very perfect 3-3-3 Swordfish, so called because all three candidates in each column are present (that is, no solved 8s in the pattern).

Provided by Klaus Brenner who found it in the newspaper *La Libre Belgique*.

	1	2	3	4	5	6	7	8	9
A	5	2	9	4	1	6 8	7	6 8	3
B	4 7 8	1 4 8	6	5 9	7 8 9	3	1 8	1 4 5 8 9	2
C	4 7 8	1 4 8	3	2	7 8 9	5 6	1 8 9	5 6	1 4 8 9
D	4 8	5	2	3	8 9	1 4 8	1 8 9	7	6
E	6	3	7	1 9	5	1 4 8	2	1 4 8 9	1 4 8 9
F	1	9	4 8	6	2	7	5	3	4 8
G	3	7 8	1 5 8	1 5	6	9	4	2	1 7 8
H	2	4 7	1 4 5	8	3	1 5	6	1 9	1 7 9
J	9	6	1 8	7	4	2	3	1 8	5

Perfect 3-3-3 Swordfish: Load Example or : From the Start

Comments...

Thursday 9-Apr-2009

... by: jef

A Swordfish is not limited to rows and columns, also boxes can be involved:

```
. . x|x x .|. . .
. . .|. . .|. . .
. . .|. . .|. . .
-----+-----+-----
. . .|x . .|. . .
. . .|. x .|. . .
. . .|. . .|. . .
-----+-----+-----
. . .|. . .|. . .
. . .|. . .|. . .
. . x|x . .|. . .
```

Swordfish row 1, box[2,2] and row 9.
Is your solver finding this pattern?
Have you examples of this pattern?

Kind regards,
Jef

PS I totally agree with your remarks on J.F. Crook's paper, nothing new and not a real solution.

http://users.telenet.be/vandenberghe.jef/sudoku/

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