

calf died immediately post-partum.) In all samples, P4 was well above the 2000 ng/g pregnancy threshold by 2.5 months gestation, and remained so for the next 15.5 months until parturition. One sample collected on a confirmed pregnant female during her first month of gestation had P4 levels below the 2000 ng/g threshold (Fig 2A). By contrast, no male, or immature, non-cycling, lactating or post-reproductive female whale ever approached that P4 threshold (Table 3). The majority of samples from confirmed pregnant females were well above 18,000 ng by 10 months gestation. All samples from confirmed pregnant females exhibited a precipitous decline below 2000 ng/g P4 immediately following parturition (Fig 2A).

T concentrations of all samples from confirmed pregnant females clearly remained below 50 ng/g until mid-gestation (Fig 2B). Thus, pregnancy samples (i.e., samples above the 2000 ng/g P4 threshold) were divided into low (≤ 50 ng/g) and high (> 50 ng/g) T groups, respectively, corresponding to early, and mid-to-late stages of gestation (Fig 2A and 2B). The only other age-sex class that showed significantly elevated T concentrations, above the 50 ng/g threshold, was adult males, but their P4 concentrations never approached 2000 ng/g (see Table 3). T was above the 20 ng/g by 2.5 months gestation in all confirmed pregnant females, with the majority above 100 ng/g by 10 months gestation (Fig 2B). Low T confirmed pregnant females had a mean fecal P4 of $6206 \text{ ng/g} \pm 2565$ and a mean T concentration of $21 \text{ ng/g} \pm 5.8$, whereas High T confirmed pregnant females had a mean fecal P4 $> 25587 \text{ ng/g} \pm 5116$ and a mean T concentration of $215 \text{ ng/g} \pm 43$ (Table 3). With the exception of one early lactation sample, testosterone concentrations declined well below the 50 ng/g threshold after parturition (Fig 2B). Multiple scat samples were obtained from the same pregnancy event in 4 of the 11 pregnancies and three lactation events; all multiple samples exhibited these same P4 and T patterns over time.

None of the post-reproductive females were ever recorded to be pregnant nor did they show any sign of ovarian activity (Table 3). These results support the assertion that the “post-reproductive” adult females (>40 years of age) in this population have undergone reproductive senescence [42].

Samples from genotyped reproductive age adult females with P4 concentrations above the 2000 ng/g pregnancy threshold that were not followed by a live calf within the 18-month gestation period were assumed to be from females that experienced a spontaneous abortion (in utero mortality), or early perinatal death prior to calf's first observation, collectively termed an unsuccessful pregnancy (UPg). Among the females classified as reproductive adults, we characterized 24 unique unsuccessful pregnancy (UPg) events from 12 different females with genotyped samples collected between 2008–2014—up to 69% of all confirmed pregnancies (Table 2). All samples from the 22 apparent UPg's had significantly elevated progesterone concentrations well above 2000 ng/g. Yet, no observations of those females over the next 18 months included a new calf. As with confirmed pregnancies, the presumed UPg samples were separated into two distinct groups: one with T concentrations above 50 ng/g feces (mean $T = 198.6 \pm 40$; $P4 = 37,425 \pm 12,820$), hereafter termed “high T UPg” samples (7 unique females, 7 presumed late spontaneous abortions and one early perinatal loss), and the other with T concentrations below 50 ng/g feces (mean $T = 11.3 \pm 3.2$; $P4 = 6618 \pm 2014$), termed “low T UPg” samples (4 females, 16 presumed early spontaneous abortions; Table 2; Fig 3A). Multiple samples from 6 of the 24 unsuccessful pregnancy samples (4 low T, 2 high T, plus 1 low T that transitioned to high T) were all within the pregnancy range (i.e., $P4 < 2000$ ng/g). Thirty three percent of the UPg samples (8 out of 24) identified here were high T UPg (up to 23% of all recorded pregnancies). The high T UPg samples were likely from the second half of gestation, based on their high P4 and T concentrations relative to temporal profiles for those hormones in whales with a confirmed pregnancy (see Fig 2).